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Income and Factor Analysis of Watermelon Production in Ekiti State, Nigeria

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Abstract
This study examined the income and factor productivity in watermelon production in Ekiti State, Nigeria. A multi stage sampling technique was used to select a total of 90 respondents for the study. Data were obtained with the aid of a pre tested structured questionnaire. Descriptive statistics was used to describe and categorize the socio-economic characteristics of the respondents, Gross margin analysis was used to analyze the cost and returns to watermelon production and Cobb Douglas production function was used to evaluate the input factor productivity. Results showed that the farmers are relatively young with average age of 33.16 years with a sizable number of the respondents (33.33%) having passed through tertiary education. It was also observed that the farmers are typically smallholders with average farm size of 1.11ha. The result of the gross margin analysis showed that watermelon production is profitable with a gross margin of ₦138, 044:22 per hectare. The result of the Cobb Douglas production function shows that the coefficients of cost of fertilizer (0.7081) and cost of agrochemicals (0.5117) were positively significant at 5%, while the coefficient of labour was negative (-0.2041) and significant at 10%. The overall factor productivity index is 1.14 implying an increasing return to scale in water melon production in the study area. However, lack of capital was identified as a major production constraint.
Keywords: Income, factor productivity, gross margin, Cobb Douglas function, smallholders and return to scale

1.0 Introduction

Watermelon is a warm season crop that is cultivated worldwide because of its numerous nutritional benefits. It thrives very well in most well drained soils whether clayey or sandy but preferably sandy loams. Although China is reported to be the current world largest producer of the commodity (Huh *et al*., 2008), watermelons are generally believed to have originated from Africa.

In Nigeria, like many other parts of the world watermelon is highly relished as a fresh fruit because of its thirst-quenching attribute in addition to many other identified nutritional values and advantages. Therefore, the consumption of the commodity in the recent times has witnessed remarkable development as it cuts across all socio economic classes. Presently, the largest production of the crop in Nigeria still comes from the northern part. It has however been established that a good crop could also be achieved in other parts of the country. Specifically, the southwestern farmers could take advantage the possibility to grow the crop twice a year to generate additional income and therefore increase their overall annual farm income.

The potentials of watermelon as a cash generating crop is significant for farmers especially those residing near the urban areas. According to Oguntola, (2006), watermelon is the most preferred among five other exotic vegetables examined in Ibadan Metropolis of Oyo State, Nigeria. This was coupled with recent report which indicated that exotic vegetables production generally generate higher profit, provided more employment and income to the farmers than those of indigenous vegetables. Equally, the crop could be cultivated successfully twice a year in the southern part of the country. The first crop could be planted with the first or second rain which mostly occurs around February or early March. The crop sown at this time will hit the market between May and June when the supply from the northern part of the country must have diminished completely. While the second crop could be planted in September to be harvested around December when there will be no supply from the north therefore, the farmers could cash in on the opportunity to increase their farm income appreciably. Like the cultivation of many other crops the basic inputs in watermelon cultivation are land, labour, capital, and management.

According to Olayide and Heady, (1982) and Ezeh, (1998) the primary objectives of every producer include the maximization of satisfaction, profit maximization, cost minimization or combination of all these. However, the objective of profit maximization is commonly assumed for a typical entrepreneur in the farm – firm sector, subject to resource constraints. A profit maximizing entrepreneur will not use a given resource beyond the point where the resource adds just as much to his revenue as it adds to its cost, because this might lead to a loss. However, the farmer can increase profit below such a point by using more of the resource. In general, resources are said to be efficiently allocated when the value of marginal product of each resource equals its price.

Watermelon production is a recent phenomenon in Ekiti State as the crop was hitherto believed to thrive

well only in the northern part of the country. Notwithstanding, Bamidele, *et al* (2008) noted that productivity differences over time and farming types can result from variety of factors including variation in scale or level of production, farmer's rationality in resource use, and management practices at the plot levels. Various attempts have been made to document the issue of factor productivity and resource use efficiency in arable crop production in Nigeria (Okoye, *et al* 2008; Bamidele *et al*, 2008). However, technologies, systems, ecologies and cost factors are diverse and dynamic and these make it difficult to attain a comprehensive up-to-date analysis both in terms of time and location (Nwakpu, 2008). It is therefore necessary to carry out a location specific evaluation of crop performance in order to determine the profitability of the production and producers resource use rationality. Therefore, this study specifically examined the costs and returns and efficiency of resource use in watermelon production in Ekiti State to serve as a guide to prospective investors on watermelon production investment decisions.

1.1 Methodology

1.1.1 The Study Area

This study was conducted in Ekiti State, Nigeria. The state which lies entirely within the tropics is located between latitude 7^{o} $15^{'}$ to 8^{o} $5^{'}$ North of the equator and Longitude 4^{o} 45' to 5^{o} $45^{'}$ East of the Greenwich meridian. It enjoys a typical tropical climate with two distinct seasons, the rainy season which last roughly from April to October and the dry season which prevails for the remaining months of the year. Ekiti is basically an agrarian society with a land area of about 5,307 square kilometers of which over 90% is available for farming and agricultural related enterprises. Equally the state is endowed with favorable agro climatic conditions suitable for agricultural productions of tree crops such as oil palm, citrus, mango, kola nut and guava and arable crops such as maize, rice, plantain, tomato, okro, melon and water melon. Ekiti State has about 70% of her population engaged in farming (NAERLS and NPAFS 2010). The state is bounded in the North by Kwara and Kogi States, in the West by Osun State. It is bounded in the East and South by Ondo State.

1.1.2 Sampling technique

Emure, Ikole and Ise/Orun Local Government Areas (LGA)s of the State were purposively selected for the study due to the dominance of watermelon farmers in communities within the stated LGAs. Simple random sampling was then used to select 30 farmers each from the three selected LGAs to make a total of 90 respondents from which primary data were obtained through the administration of a pre tested structured questionnaire. Information was collected on the respondents' socioeconomic characteristics such as age, education level, farm size, farming experience, cost and revenue in water melon production etc.

1.1.3Analytical techniques

Descriptive statistics which included frequencies, percentages, mean and standard deviation were used to describe and categorize the socioeconomic characteristics of the respondents. The Gross Margin analysis which is the difference between total revenue and total variable costs was used to determine the costs and returns to watermelon production in the study area while the Cobb Douglas function was used in input factor analysis in watermelon production. The choice of Cobb Douglas was based on its widely acknowledged fitness to agricultural production (Barman and Chaudhury 2000; Barman *et al.,* 2002; Onyenweaku and Nwaru, 2005, Ogbonna *et al* 2009).

1.1.4 Gross Margin Analysis

The costs and returns to water melon production was estimated using the gross margin analysis as follows;

GM = TR-TVC

Where:

GM = Gross margin in naira/ha

TR = Total revenue in naira/ ha (i.e Unit Price x Quantity)

TVC = Total variable cost in Naira/ha

TR = Total Revenue = Price x Quantity i.e. PQ

1.1.5 Cobb Douglas function

The Cobb Douglas function used in the factor analysis in watermelon production in the study area is specified in the logarithmic form as:

$InY_i = \ln \beta_o + \beta_1 InX_1 + \beta_2 InX_2 + \beta_3 InX_3 + \beta_4 InX_4 + \varepsilon_i$

Where;

Y = Gross return, measured in ₦/ ha

X_1 = Cost of planting material, measured in ₦/ha

X_2 = Cost of fertilizer (NPK 15:15:15), measured in ₦ /ha

X_3 = Cost of agrochemicals, measured in ₦/ha

X_4 = Cost of labour, measured in ₦/ha

β = constant

ε_i = Error terms.

These variables were expected to positively influence the increase in gross returns of watermelon farmers in the study area.

1.2 Results and Discussion

1.2.1Socio - Economic Characteristics of the Respondents

The socio economics characteristics of the respondents are presented in Table 1.

Table 1: Socioeconomic Characteristics of the Respondents

Characteristics	Frequency	Percentage	Mean	SD
Age group				
≤30	13	14.45	33.16	10.05
31-40	46	51.11		
41-50	29	32.22		
>50	02	2.20		
Sex				
Male	78	86.67		
Female	12	13.33		
Educational qualification				
Never been to School	04	4.44		
Primary school	26	28.89		
Secondary	30	33.33		
NCE/OND	21	23.33		
BSC/HND	09	10.00		
Extension officer visits				
Yes	35	38.89		
No	55	61.11		
Farm Size				
< 0.5	15	16.70	1.10	0.72
0.51 – 1.00	23	25.60		
1.01 – 1.50	46	51.10		
1.51 – 2.00	02	2.20		
>2.00	04	4.40		
Household size				
<4	24	26.67	6.15	1.55
4-8	35	38.89		
>8	31	34.44		
Formal training in watermelon production				
Yes	53	58.89		
No	37	41.11		
Mode of Sale				
Wholesale	44	48.89		
Retailer only	15	16.67		
Both	21	23.33		
Watermelon farming experience				
<5	38	42.22	7.12	1.25
6-10	26	28.89		
11- 15	18	20.00		
> 15	08	8.89		

Source: Field Survey, 2014.

From Table 1, the average age of the sampled farmers is 33.16years with a standard deviation of 10.05. This clearly shows that watermelon farmers in Ekiti state are very young. This could be attributed to the state government sponsored Youth Commercial Agricultural development Programme (YCAD) which focuses watermelon production as one of the commercial crop under the program. A total of 78 respondents representing 86.67% are male while the remaining 12 respondents representing 13.33% are female farmers, obviously, watermelon farming in the study area is dominated by male gender. A total of 30 respondents representing 33.33% had secondary education and 26 respondents representing 28.89% had primary education. A sizable number of the respondents 33.33% had tertiary education, the high level of literacy among watermelon farmers in the study

area could equally be attributed to the YCAD project in the state in which unemployed young University and other tertiary institution graduates are given various incentives to embrace farming as a commercial venture. The majority of the respondents 55 representing 61.11% did not receive any extension visit during the cropping season. This shows that there is a need for improved extension service delivery in the study area to assist the farmers in modern and improved agricultural practices.

The average farm size of the respondents is 1.11 ha with a standard deviation of 0.72. The majority of the farmers (46 representing 51.10%) cultivated between 1.01 and 1.50 ha while only 4 respondents, representing 4.40% cultivated above 2ha. This shows that watermelon production in the study area is practiced mainly by small-scale farmers. Also the average household size of the respondents is about 6, with a standard deviation of 1.15. The small average family size may be because the majority of the farmers are relatively young. A total of 53 respondents representing 58.89% have formal training in watermelon production. This is expected to increase both resource use efficiency and productivity of the farmers. The majority of the farmers (44, representing 48.89%) engaged in wholesale marketing of their produce probably because water melon is a highly perishable good. Therefore there is need to dispose of it at the shortest time possible after harvest, while 15 respondents (representing 16.67%) do retail marketing and 21 respondents (representing 23.33%) combine both wholesale and retail marketing. The average years of water melon production experience was 7.57 years. This further shows that water melon production is a relative new enterprise in the study area.

1.2.2Cost and Return Analysis of Water melon production per hectare

The result of cost and benefit analysis associated with water melon production in the study area is presented in Table 2.

Table 2: Gross margin analysis of water melon production

Items	Value
A Gross Benefit ₦ / ha	
1. Average Yield /ha	5290.34kg
2. Average Cost N / kg	56.81
3 Gross Benefit N / ha (1 x 2)	300544.22
B. Variable Input Cost ₦ / ha	
1. Planting material	5000:00
2. Fertilizer	7500:00
3. Agrochemicals	300544:00
4 Labour	
(i) Land clearing	25,000:00
(ii) Ridging	47000:00
(iii) Planting	5000:00
(iv) weeding	15000:00
(v) Fertilizer application	6000:00
(vi) Agrochemical application	6000:00
(vii) Harvesting	15000:00
5 Total Variable Cost	162,500:00
C Gross margin ₦/ha (5-3)	**138,044:22**

Source: Data analysis, 2014

Exchange rate: ₦165 = $1

From Table 2 the farmers recorded an average yield of 5290.34kg per hectare Gross return from watermelon production was ₦300544.22. The total variable cost (TVC) amounted to ₦162,500 .This indicates that watermelon production is profitable in the study area with a gross margin of ₦138,044.22 per hectare. This is, however, lower that ₦229,585:06 recorded in Oyo State by Adeoye *et al* (2011) but it is higher than ₦105,002:95 recorded by Ibrahim (2011) in Borno State

1.2.3 Factor Productivity in watermelon production

The result of the Cobb Douglas production function used in evaluating the input factor productivity in water melon production in the study area is as presented in Table 3.

Table 3: Summary of Regression Results.

Factor inputs	Coefficients	t – values
Cost of planting (X_1)	0.1263	1.03
Cost of fertilizer (X_2)	0.7081	0.262**
Cost of agrochemicals (X_3)	0.5117	0.053**
Cost of Labour (X_4)	-0.2041	0.138*
Return to scale	1.14	
R^2	0.627	
F- value	4.90***	
Number of observation	90	

Data Analysis, 2014
** Significant at 5%
*Significant at 10%

From Table 3 the coefficients of cost of planting, cost of fertilizer and cost of agrochemicals are all positive indicating that any increase in the cost of these factors through employment of more of these resources will increase the gross revenue in watermelon production in the study area. However, it was the coefficients of cost of fertilizer and cost of agrochemicals values of 0.7081 and 0.5117 respectively that were significant at 5%. This indicated that if the cost of fertilizers is increased by 1%, as indication of more fertilizer usage, the gross revenue in watermelon production will be increased by about 0.71% and if the cost of agrochemicals is increased by 1% by use of more agrochemicals to control pest and diseases the gross revenue in watermelon production will increase by about 0.51%. The coefficient of labour was negative (-0.2041) and significant at 10%. This implies that if the cost of labour was increased in watermelon production, there would be a decrease in gross return by about 0.20%. This suggests excessive use of labour input and, therefore, there is a need to reallocate these inputs to spring more returns in watermelon production.

The sum of factor coefficients was 1.14. This is above unity, which implied that there was increasing return to scale in water melon production in the study area. Therefore, the farmers can still continue to employ more of the productive resources, especially fertilizer and agrochemicals which have significant positive relationship with the gross margin. The coefficient of multiple determinations (R^2) was 0.627. This implies that the explanatory variables used in the model specification accounted for about 63% of variation in gross margin of the watermelon farmers. The F-value was observed to be 4.90 and highly significant at 1%. All these points to the fitness of the model used.

1.2.4 Constraints to water melon production

Constraints to watermelon production in the study area are as shown in Table 4.

Table 4: Distribution of the Respondents by the Problems Encounter during Production.

Problems encountered	Frequency	Percentage
Lack of capital	54	60.00
Planting material	16	45.56
Shortage of labour	41	17.78
Shortage of fertilizer	22	24.44
Lack of extension services	37	41.11
Total	170	

Source: Field Survey, 2014.
*Total > Sample Size: Multiple answers recorded

From Table 4, lack of capital ranked first among the constraints. This is in line with the findings of Adeoye *et al,* (2011). Inadequate capital has consistently been identified as one of the major problems facing small scale farming in Nigeria. Against expectation, this is followed by shortage of labour, and lack of extension services, shortage of fertilizer and availability of improved planting material in that order.

1.3 Conclusion

This study has shown that watermelon production in the study area is profitable. Also, the study revealed that cost of planting, cost of fertilizer and cost of agrochemicals all have positive productivity coefficients indicating that any increase in the use of these variable inputs will increase the gross revenue of the farmers. However, the productivity coefficient of cost of labour was significantly negative indicating excessive use of labour input and therefore there is the need for the farmers to adjust the rate of use of this input for greater returns in watermelon production in the study area. The overall factor coefficient is 1.14 implying an increasing return to scale in water melon production in the study area. Therefore the farmers could still employ more of the resources with positive factor productivity to increase their gross margin. Capital was identified as the major production constraint

among the farmers followed by planting materials. It was also observed that less than half (37) of the sample farmers have access to extension services.

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