



## **Differentials in Returns of Water Melon (*Citrullus lanatus*) and Sweet Melon (*Cucumis melon*) Production among Farmers in Gombe and Bauchi States, Nigeria**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author YA designed the study, supervised the work, prepared the interview schedule and protocol of the study, carried out field survey, interaction with stakeholders and performed the statistical analysis. All authors managed the analyses of the study. Author YA wrote the first draft of the manuscript and managed the literature searches and edited the manuscript. All authors read and approved the final manuscript.*

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### **ABSTRACT**

The study analysed the differentials in returns of water melon and sweet melon production among farmers in Gombe and Bauchi States, Nigeria. A multistage sampling technique was used to collect information from one hundred and twenty eight (128) and one hundred and twenty two (122) water melon and sweet melon farmers respectively. Primary data was collected through the use of questionnaire. Data were analyzed by the use of descriptive statistics, gross margin model and Z test statistics. The results of the descriptive statistics show that the study area is male dominated,

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majority of the respondents are still in their productive age within a mean of between 39 to 44 years; married with large family size and not well experienced in water melon and sweet melon farming respectively. The results from the gross margin model show that both water melon and sweet melon production is profitable as indicated by a positive gross margin (GM) of ₦103,635 and ₦100,113 respectively. Moreover, the results from Z-test revealed that water melon farmers performed better than the sweet melon farmers in terms of yield and income indicating a highly significant difference at 1% level of probability. The results therefore call for relevant policies aimed at encouraging the farmers to increased their production and income through adoption of improved technologies. There is also the need for provision of free and affordable education to enable the farmer's access and process information on improved production technologies available to them. Finally, the provision of loans and basic farm inputs could jointly contribute to an improvement of production output so that farmers can get more returns.

*Keywords: Differentials; returns; water melon; sweet melon; production.*

## 1. INTRODUCTION

Fruit vegetables are edible plant products that are good for health. They are nutritionally important to man as they provide the much needed vitamin, minerals and fibre [1]. They form important component of diet in our nutrition as a source of adequate energy, nutrients, vitamins and other dietary factors where they play a key role in neutralizing the acids produced during food digestion and helps in reducing constipation [2]. In Nigeria, the production and consumption level of these exotic fruits vegetable like water melon, sweet melon, cucumber and pumpkin is gradually increasing annually owing to greater appreciation of their food values and as alternate crop that brings in the needed income for improved livelihood [3,4,5]. For instance, Water melon (*Citrullus lanatus* L) as a fresh fruit is relished by many people across the world (Fig. 1). The fruit is 93% water, with small amounts of protein, fat, minerals, and vitamins C and A [6]. The differential in return from water melon production varies with location and variety. For example, a Gross margin of ₦253,850/ha was realized in Kwara State as against ₦93,030/ha in Bauchi State. Also, problems like poor yield, pests and diseases, storage facilities, ready markets and non-availability of credit were identified as major challenges to all year round production [3,7].

Similarly, Sweet melon (*Cucumis melo* L) fruit is a fleshy pepo which can be eaten raw and often used as a refreshing dessert after main meals and used to produce juice (Fig. 2). Mature fruits of sweet melon are usually consumed fresh for the sweet and juicy pulp which is mixed with water, sugar and sometimes with milk and serve as a refreshing drink or made into ice cream. Thus, it is also rich in water, sugar, protein, fat,

minerals, and vitamins A and C [5]. The production and consumption of both the two fruits is becoming attractive due to its increasing importance as a dessert/appetizer and a source of income to many households in Nigerian towns and cities in North-eastern zone especially Bauchi and Gombe States [3,4,5]. Their average productivity is put at 15- 20 Mt. per ha and 2-3 Mt. per ha for water melon and sweet melon respectively depending on the variety; even though there is no specific data about the country's production level.



**Fig. 1. Water melon fruits**



**Fig. 2. Sweet melon fruits**

Despite the nutritional and commercial value of both the water melon and sweet melon fruits, their production is low in Nigeria [3,5,8]. Thus, their overall productivity and potential gains has not been brought to fore. Therefore, investigating the relative profitability of the existing potentials of the two (2) enterprises among the farming households is vital as it will provide guidance and stimulating impact on production and distribution of the commodities. It is against this background that this study was initiated to ascertain the differential in returns of water melon and sweet melon production in Gombe and Bauchi States, Nigeria.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The study was carried out in Gombe and Bauchi States, North Eastern- Nigeria. Gombe State lies between Latitude 10° 16' and 11° 00' N and Longitude 11°00' E and 11°11' E of the Greenwich meridian above sea level. It shares boundary with Bauchi in the west, Taraba and Adamawa in the south west, Borno in the east and Yobe to the North. Similarly, Bauchi State lies between Latitude 10° 17' and 11° 00' N and Longitude 9° 45' E and 11°12' E. It shares boundary with Plateau State in the south west, Jigawa State in the North West, Gombe State in the east and Yobe State to the north east. The study areas experienced two distinct seasons in a year that is, wet and dry. The vegetation is characterized by Northern Guinea to Sudan savannah which is endowed with good climatic conditions, sizable expanse of arable and rich fertile soils is well suited for the production of a wide variety of staples like maize, millet, rice, sorghum, groundnut, cowpea, fruits and vegetables. Thus, the major occupations of the people in the area are farming, livestock rearing, crafts and trading [9,10]. The choice of study area was based on their prominence and intensity in the production and marketing of water melon and sweet melon in Northern, Nigeria.

### 2.2 Sampling Procedure and Data Collection

Multi stage sampling technique involving purposive and proportionate random sampling was used to select a sample size of one hundred and forty nine (149) and one hundred and fifty one (151) fruits vegetable farmers which gave a total of 300 respondents, though only 250 questionnaires were dully filled and used for the analysis with 128 and 122 respondents each

from water melon and sweet melon farmers respectively. Data for the study was obtained from primary source through the use of structured questionnaire and personal interview with the help of well-trained enumerators under the supervision of the researcher. Data were analyzed using descriptive statistics such as tables and percentages were used to describe socio-economic variables of the respondents, while profitability was analyzed by the use of gross margin model. The z- test statistics was used to compare the yield and differentials in returns between water melon and sweet melon farmers.

### 2.3 Method of Data Analysis

Descriptive statistics such as frequency counts, percentages and means were used to describe the socio-economic characteristics and the constraints to the respondents' productivity.

#### 2.3.1 Model specifications

##### 2.3.1.1 Gross margin analysis

Gross margin analysis involves evaluating the efficiency of an individual enterprise or farm plan so that comparison can be made between enterprises or different farm plans. It is a useful planning tool in situation where fixed capital is a negligible portion of the farming enterprise as in the case with small scale agriculture [11]. It helps the manager to critically examine the variable cost components. Gross margins give the difference between gross income and the total variable cost of production [12]. The gross margin analysis was used to capture the profitability level of the business in the area of study. The model is given thus:

$$GM = \sum(Q_{yi}P_{yi}) - \sum(X_{xi}P_{xi}) \quad (1)$$

$$\text{Benefit Cost Ratio (BCR)} = \frac{\sum(Q_{yi}P_{yi})}{\sum(X_{xi}P_{xi})} \quad (2)$$

Where:

GM = Gross Margin (₦/ha)

$Q_{yi}$  = Output of water melon and sweet melon by  $i^{\text{th}}$  farmer (Kg)

$P_{yi}$  = Unit price of watermelon and sweet melon by  $i^{\text{th}}$  farmer (₦/ball/kg)

$X_{xi}$  = Quantity of inputs used by  $i^{\text{th}}$  farmer

$P_{xi}$  = Unit price of inputs used by  $i^{\text{th}}$  farmer (₦)

$\Sigma$  = Summation sign

$\Sigma(QyiPyi)$  = Total revenue

$\Sigma(Xxi Pxi)$  = Total variable cost

### 2.3.1.2 Z-test model

Similarly, z -test statistics was used; to test for differentials in the mean output and returns between water melon and sweet melon farmers. The model is specified thus:

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\delta^2_1}{n_1} + \frac{s\delta^2_2}{n_2}}} \quad (3)$$

Where:

$\bar{X}_1$  = mean output/ returns of water melon farmers

$\bar{X}_2$  = mean output/ returns of sweet melon farmers

$\delta^2_1$  = standard error of water melon output and returns

$\delta^2_2$  = standard error of sweet melon output and returns

$n_1$  = number of water melon farmers

$n_2$  = number of sweet melon farmers

## 3. RESULTS AND DISCUSSION

### 3.1 Socio-economic Characteristics of Water Melon and Sweet Melon Farmers

The result in Table 1 shows the frequency distribution of the respondents according to the socio-economic characteristics. The result show that majority (97.7% of water melon and 100% of sweet melon) of the fruit vegetable farmers interviewed were males while 2.3% and 0% were females respectively. Gender issues in agricultural production have been investigated for a long time and mostly showed mixed evidence regarding the different roles men and women play in production [13], and [3] in their study reported that males dominated the farming aspect of agricultural production which may be attributed to the common cultural norms in the area. There were no significant differences between the number of male or female between water melon and sweet melon farmers. In both

groups, men dominated the number of respondents interviewed and few women.

The age distribution from the results show that sweet melon farmers were younger with mean age of 39 years than the water melon farmers with mean age of 45 years and the difference in age was found to be significant at 5% probability level between the two groups. Both groups were however, in their active age. The implication of this is that most of the respondents were of middle age to make positive contribution to agricultural production. This category of people is believed to be more flexible in their decision making and adopt new ideas more readily, and the aged are risk-averse. This is in agreement with the views of [14], that age is a major socio-economic factor that significantly affects the performance of farmers.

The results on educational level of the respondent's shows that 29.7% of the water melon farmers and 65.6% of the sweet melon farmers had no form of formal education while 30.5% of the water melon and 13.9% of the sweet melon farmers attained primary level of education respectively. About 31.2% and 16.4% of the water melon and sweet melon farmers attained secondary level of education; with only 8.5% and 4.1% that attained tertiary level of education respectively. Results from the study also indicate that there is significant difference in the education levels between the two groups. Thus, educated farmers are expected to be more receptive to improved farming techniques, while farmers with low level of education or without education would be receptive to improved farming techniques [15].

Majority (57.0% and 60.7%) of the water melon and sweet melon farmers had household size of between 11-20 and 1-10 persons respectively while only about 19.5% and 11.5% of the water melon and sweet melon farmers had household size of between 21-30 persons. This shows that the study area is dominated by farmers with large family size with an average of 15 and 10 persons for water melon and sweet melon farmers respectively; having significant difference between the two groups. This implies that the respondents' large household size will likely influence the availability of family labour especially at the peak of the season, during second weeding and harvesting. The findings of [16], reported that large household size ease labour constraints leading to increase in production.

**Table 1. Distribution of respondents according to socio- economic characteristics**

Variables	Water melon		Sweet melon		Z- statistics
	Frequency	Percentage	Frequency	Percentage	
<b>Gender</b>					
Male	125	97.7	122	100	1.740 <sup>NS</sup>
Female	3	2.3	0	0.0	
<b>Age (years)</b>					
25-30	11	8.6	32	26.2	3.682 <sup>***</sup>
31-49	91	71.1	87	71.3	
50 and above	26	20.3	3	2.5	
<b>Mean</b>	<b>44.5</b>		<b>39.2</b>		
<b>Educational level</b>					
Qur'anic education	38	29.7	80	65.6	5.406 <sup>***</sup>
Primary education	39	30.5	17	13.9	
Secondary education	40	31.2	20	16.4	
Tertiary education	11	8.5	4	4.1	
<b>Household size (persons)</b>					
1-10	30	23.5	74	60.7	5.503 <sup>***</sup>
11-20	73	57.0	34	27.8	
21-30	25	19.5	14	11.5	
<b>Mean</b>	<b>15</b>		<b>10</b>		
<b>Years of experience</b>					
1-5	66	51.6	99	81.1	5.185 <sup>***</sup>
6-10	42	32.8	23	18.9	
11 and above	20	15.6	0	0.0	
<b>Mean</b>	<b>6</b>		<b>2</b>		
<b>Access to extension</b>					
Yes	48	37.5	97	79.5	0.479 <sup>NS</sup>
No	80	62.5	25	20.5	
<b>Total</b>	<b>128</b>	<b>100</b>	<b>122</b>	<b>100</b>	<b>250</b>

Source: Field survey, 2013

NS = Non-significant; \*\*\* P &lt; 0.001 = Significant at 1 percent level of probability

The results also show that water melon farmers on average had more years (6) of experience compared with sweet melon farmers who had 2 years of experience. The difference in years of experience is significant at 5% level of probability. The years of experience afford farmers the opportunity to master the skills required in production for positive and better yields since the farmer may know more methods of reducing production risks.

Moreover, the results on access to extension services indicate that 62.5 percent of the water melon farmers had no contact with extension workers. While, up to 79.5 percent of sweet melon farmers had contact with extension workers. The overall result of the farmers shows that 58 percent had no contact with extension workers at all. Also, there were no significant differences in the frequency of visit and access to extension services between water melon and sweet melon farmers in the area. In both groups,

this shows that the fruit vegetables growers in the area may not have been benefiting from extension services; this may explain in part why the respondents operated below the production level of 11.8 Mt. per ha and 3.2 Mt. per ha as against the 15- 20 Mt. per ha and 2-3 Mt. per ha for water melon and sweet melon respectively. This is similar to findings of other scholars like [3,7,17].

### 3.2 Comparative Gross Margin Analysis of Water Melon and Sweet Melon Farmers

The estimate of the gross margin of water melon and sweet melon production is presented in Table 2. The total variable cost was found to be ₦54,661 with a gross margin of ₦103,635 for water melon compared to a total variable cost of ₦42,779 and the gross margin of ₦100,113 per hectare was realized for sweet melon respectively. This implies that water melon

farmers seemed to earn more average profits (₦103,635) compared with sweet melon who were making (₦100,113) on average. This is similar to the findings of Adamu et al. (2011), who reported a net revenue of ₦12,632 / (100 balls) and ₦34,098/Ha for both marketing and production of water melon respectively. The cost of labour constituted an average 53.9 percent of the total variable cost in water melon production compared to 44.5 percent in sweet melon production among the respondents. This may be as a result of the high labour requirement in both water melon and sweet melon production while, 26.0 percent and 35.9 percent is made up of the cost of other inputs. The remaining 20.1 and 19.6 percent accounted for the cost of rent on land.

The results further showed that both the water melon and sweet melon production enterprises in the study area is profitable from the positive gross margin values. This is similar to the findings of [18], that labour constituted the highest component of total variable cost, representing about 50% and 43% of the cost expended by male and female farmers respectively. Also, significant difference was found to exist between the average labour cost for males (₦22, 700) and females (₦9, 700) at the 5% level.

Similarly, the benefit – cost ratio (BCR) is greater than one. The BCR revealed a value of 2.89 and 3.34 for water melon and sweet melon production respectively. This study agrees with the findings of [3,5,19,20] who reported that

water melon and sweet melon production is a profitable venture.

### 3.3 Comparative Analyses between Water Melon and Sweet Melon Productivity and Returns

#### 3.3.1 Comparative analysis of water melon and sweet melon farmers' yield and productivity

Z-test analysis was used to compare the productivity and yield of water melon and sweet melon farmers. The results in Table 3 showed a mean output of 13580.88 kg and 4906.54 kg for both water melon and sweet melon with the z-value of 6810.80 indicating that there is significant difference between the mean outputs at 1 percent level of probability. This is possibly due to the difference in the output of water melon been almost three to four -times than that of the sweet melon. Furthermore, the good performance of water melon farmers in terms of yields has translated into more gross profits per hectare compared with sweet melon indicating that there was a significant difference in the output at 1% level of probability.

#### 3.3.2 Comparative analysis of water melon and sweet melon farmers' returns

Similarly, Z-test analysis was used to compare the returns of water melon and sweet melon farmers. Returns of both water melon and sweet melon farmers' were subjected to z- test analysis

**Table 2. Comparative cost and returns for water melon and sweet melon production per Ha**

Category Variables	Water melon		Sweet melon	
	Value (₦/Ha)	(%)	Value (₦ /Ha)	(%)
Rent on land	₦11,000	20.1	₦8,400	19.6
Cost of fertilizer	₦5,446	10.0	₦11,080	25.9
Cost of seeds	₦3,052	5.6	₦2,200	5.2
Cost of agro- chemicals	₦5,650	10.4	₦2,129	4.8
Land clearing and preparation	₦6,393	11.8	₦4,415	10.4
Planting	₦3,634	6.6	₦2,127	9.6
Weeding	₦4,795	8.8	₦4,087	3.1
Fertilizer application	₦2,312	4.2	₦1,296	2.9
Agro-chemicals application	₦3,567	6.5	₦1,276	8.2
Harvesting	₦3,356	6.1	₦3,451	5.4
Transportation	₦5,456	9.9	₦2,318	9.6
Total Variable Cost (TVC)	₦54,661	100	₦42,779	100
Price / Kg	₦13.33		₦45.00	
Output (kg)	11876		3175	
Total Revenue (Py.Y)	₦158,296		₦142,892	
Gross Margin (GM = TR - TVC)	₦103,635		₦100,113	
Benefit Cost Ratio (BCR=TR/TC)	2.89		3.34	

Source: Field survey, 2013



**Table 3. Z-test analysis of water melon and sweet melon yield**

Variables	Mean output (Kg)	Mean difference	Standard error	Z statistics	Pr>t
Sweet melon	4906.54	8674.34	453.10	6810.8***	<0.0001
Water melon	13580.88		1649.04		

Source: Computer print out of SPSS, 2014

\*\*\*  $P < 0.001$  = Significant at 1 percent level of probability

to find if significant difference exists between water melon and sweet melon respondents. The mean analysis of the returns showed an average returns of N214,657.50 and N198,493.44 from both water melon and sweet melon enterprise with a z- value of 4869.43 indicating that there was a significant difference in their returns at 1% level of probability.

The results further indicated that there was a significant difference in gross margins earned at 1% level. Thus, water melon farmers seemed to earn more average profits of N214,657.50 compared to sweet melon farmers who were making a profit of N198,493.44 on the average. The use of improved seeds and fertilizers may be the reason as to why farmers in water melon groups had a significantly higher return than the sweet melon farmer groups. This is similar to the findings of [19] who reported that cooperative member farmers seemed to earn

more average profits compared with non-members who were making less profit on the average.

### 3.4 Constraints Associated with Water Melon and Sweet Melon Production

The constraints to water melon and sweet melon production are shown in Table 5. The table indicates the major constraints of water melon farmers were identified and ranked in order of their importance. High cost and shortage of labour, low prices, inadequate credit facilities, storage facilities problems and poor marketing arrangement and information in their order of their severity. While, the problems identified to be associated with sweet melon farmers includes shortage and high cost of labour which ranked first among the problems listed by the respondents followed by, pest and disease attack, inadequate credit facilities, storage

**Table 4. Z test analysis of water melon and sweet melon returns**

Variables	Mean returns (N)	Mean difference (N)	Standard error (N)	Z statistics	Pr >t
Water melon	214657.50	16164.06	50632.24	4869.43***	<0.0001
Sweet melon	198493.44		36811.64		

Source: Computer print out of SPSS, 2014

\*\*\*  $P < 0.001$  = Significant at 1 percent level of probability

**Table 5. Constraints to water melon and sweet melon production**

Category S/No	Constraint	Water melon		Sweet melon	
		Mean score	Rank order	Mean score	Rank order
1	High cost of labour	2.80	1 <sup>st</sup>	2.68	1 <sup>st</sup>
2	Low prices of melon	2.79	2 <sup>nd</sup>	2.58	6 <sup>th</sup>
3	Inadequate credit facilities	2.64	3 <sup>rd</sup>	2.51	3 <sup>rd</sup>
4	Storage facilities problem	2.60	4 <sup>th</sup>	2.39	4 <sup>th</sup>
5	Poor marketing arrangement and information	2.56	5 <sup>th</sup>	2.28	7 <sup>th</sup>
6	Pests and disease attack	2.53	6 <sup>th</sup>	2.17	2 <sup>nd</sup>
7	Inaccessibility to cheap farm inputs	2.43	7 <sup>th</sup>	2.09	5 <sup>th</sup>
8	Pilfering and theft	2.09	8 <sup>th</sup>	2.03	8 <sup>th</sup>
9	Inadequate extension support services	1.95	9 <sup>th</sup>	1.75	9 <sup>th</sup>
10	Land tenure problem	1.93	10 <sup>th</sup>	1.54	10 <sup>th</sup>

Source: Field survey, 2013

facilities problems and inaccessibility to cheap farm inputs as well as land tenure problems as the least of their problems. This is similar to the findings of [3,7] that identified poor and low extension visit to the farmers.

#### 4. CONCLUSION

The findings from the study show differentials in returns among water melon and sweet melon farmers in Gombe and Bauchi States, Nigeria. The results show that males dominated fruits vegetable production, married with mean age of 44 and 39 years and mean household size of 15 and 10 persons respectively. In conclusion, both water melon and sweet melon production is profitable as indicated by a positive gross margin (GM) of ₦103,635 and ₦100,113; depicting a returns differential of ₦3,522 between the two enterprises with water melon having more income than their counterparts whom are sweet melon farmers. This implies that there is the need for an upward shift in the production function of both the water melon and sweet melon farmers for improved productivity. Thus, the provision of improved production (*biological, chemical and mechanical*) technologies as measures for increased production and income among farmers is vital. There is also the need for intensification of training and educational programs for potential producers and investors. Finally, the provision of loans and basic farm inputs could jointly contribute to improvement in production output and the farmers will be more efficient to get more returns.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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