Original Research Article

Production Performance and Constraints Associated With Watermelon Farming in Delta State, Nigeria

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Abstract

Watermelon is an emergent crop that farmers in Delta State have been exploring. However, maximizing interventions in this enterprise will require an understanding the characteristics of those engaged in its production. The study thus examined the socio-economic characteristics and constraints of farmers engaged in watermelon production in Delta State. Data were collected from 163 watermelon farmers from 4 local government areas in two agricultural zones using snowball sampling technique. The data collected were analysed using descriptive statistics and Chi-square. Result showed that persons involved in watermelon cultivation were young (average age = 43 years), mostly male (73.01%), generally literate (64.42% had formal education), married (74.14%), and with an average household size of 5. The average cultivator operated a farm size of 1.11 ha, produced 278.3kg of watermelon per hectare, and realized an average income of ₦59,877 per annum. The major constraints faced by respondents were lack of preservative/storage facilities (mean = 3.87), lack of extension services (mean = 3.80), high cost of farm chemicals (mean = 3.67), inadequate credit/finance (mean = 3.58) and pest and disease problems (mean = 3.50). Higher income from the enterprise was significantly associated with respondents' sex (χ^2= 22.81), educational level (χ^2= 41.426), household size (χ^2= 19.118), membership of associations (χ^2= 26.499), age (χ^2= 12.36) and farming experience (χ^2= 10.995). Friedman test result (χ^2 = 683.70) showed that there were significant differences among the production constraints associated with watermelon production in the study area, with the most significant being lack of preservative/storage facilities. It was concluded that watermelon production in Delta State was operating at small-scale level, and that producers were faced with diverse constraints. It was recommended that extension agencies should develop training programmes for watermelon farmers and link them to sources of farm inputs.

Keywords: Income, production, constraints, watermelon farming, Delta State

Introduction

Poverty is prevalent in Nigeria and the highest incident of poverty is recorded among rural households, who happen to be the producers of the nation's foods (Ajayi, 2009). Most rural farm households have farming and farming-related activities as their primary occupation. The rural areas

are largely responsible for meeting the food needs of the country, and this accounts for why the government is naturally concerned with improving the welfare of rural residents as well as enhancing their productive capacity. If these goals of government are to be achieved, it is mandatory for both extension agencies and research institutes, working in partnership, to exploit crops with high economic potentials. Watermelon is one of such crops. A recent report indicates that production of exotic fruits and vegetables such as watermelon generates higher profits, and provide more employment and higher income to farmers than indigenous vegetables do (Ajewole, 2015).

Presently in Delta State, watermelon is considered a new or emergent crop or farm enterprise among crop farmers in Ika South, Ika North and Aniocha South Local Government Areas (LGAs) of Delta North, and Ethiope East LGA of Delta Central. Before now, the crop was brought from the northern part of Nigeria to the State for onwards sales to consumers. But recent trends have seen many farmers becoming interested in the cultivation of the crop. However, rural agricultural production has been characterized by small scale production and low productivity (Oluwalayo *et al*., 2008) from which watermelon is not immune. If the production of the crop is to be maximized, there will be need for the State extension services to focus its activities on this crop, and this requires an understanding of current practices associated with the production of the crop in the State. Presently, watermelon is not a target or mandate crop of the Delta State Agricultural Development Programme (ADP) (the statutory agricultural extension agency in Nigeria). Nevertheless, the importance of, and demand for crop have brought the crop to the attention of extension agency.

Amalu (2004) reported that by understanding the intrinsic features of traditional watermelon farming, it is possible to obtain important information that will be useful in developing appropriate agricultural practices for the crop by research institutes and extension organizations. One way to improve crop production is to identify and address the production challenges faced by producers (Ugboh and Umeri, 2007; Adekoya and Tologbonse, 2011). Watermelon is an emergent crop which farmers in the study area are beginning to embrace. To boost its production will require an understanding of the present challenges faced by its farmers. Unfortunately, there is a dearth of information on the challenges of watermelon production in the State (Onyemekonwu, 2018). Studies on production constraints of watermelon have been conducted by Adeoye *et al.* (2011) in Oyo State and Adojutelegan *et al.* (2015) in Ekiti State. However, these studies were not done in Delta State. Against this backdrop the study seeks to examine the production performance and constraints associated with watermelon farming in Delta State, Nigeria by:

i. profiling farmers engaged in watermelon production in Delta State**,**
ii. determining the output level of watermelon farmers in the study area,
iii. ascertaining the farmers' income derived from watermelon farming, and
iv. identifying possible constraints to watermelon farming in the study area.

Hypotheses of the study

The null hypothesis tested were

- **Ho_1**: There is no significant relationship between farmers' socio-economic characteristics and income derived from watermelon farming.
- **Ho_2**: There is no significant difference among the production constraints associated with watermelon farming in the study area.

Methodology

The study was carried out in Delta State, Nigeria. Delta State is one of the six States in the South – South geopolitical zone of Nigeria and was created from the defunct Bendel State on 27th of August, 1991. It has 25 Local Government Areas (LGAs) with the capital city at Asaba (Delta State Monthly Planner, 2013). The State has a total land area of 17,698 square kilometres and a population of 4,170,214 (based on the 2006 census figures), and with an estimated 3.2% annual growth rate, the population was projected to be 6192950 in 2018.

A multi-stage sampling technique was adopted in the selection of respondents. Stage 1 involved purposive selection of Delta North and Delta Central agricultural zones because of the high intensity of watermelon cultivation in these areas. Stage 2 involved the purposive selection of four local government areas (LGA) identified to be areas of higher intensity of watermelon cultivation (i.e. IkaNorth East, IkaSouth and Aniocha South in Delta North, and Ethiope East in Delta Central). In stage 3, only one community (Abraka) was identified as the area were watermelon farmers were present in Delta Central, while in Delta North, three communities were purposively selected from each of the selected LGAs was based on the high intensity of watermelon cultivation. In stage 4, the snowball sampling technique was used to sample 163 respondents across the selected communities. The research instrument (a structured questionnaire) was validated by experts in agricultural extension and sociology whose assessments, criticisms and suggestion were incorporated into the final instrument. The reliability of the questionnaire was established using the test-retest method applied on pilot survey of two occasions. The reliability coefficient was 0.833, which was considered a good measure of reliability being greater than 0.700 (Okwuokenye and Onemolease, 2011). Data collected were analysed using descriptive statistical tools such as frequency counts, percentages and means. The chi square and Freidman tests were used to analyze the hypotheses.

Data Collected

Data were collected on the socio-economic variables of the respondents, on their average output and income, as well as on constraints associated with production of the crop in the study area.

Results and Discussion

Socio-economic characteristics

The socio-economic characteristics of the respondents are shown in Table 1. The result revealed a modal age of 40-44 years representing 34.36%, and with a mean age of 43 years, thus indicating

that the farmers were young, and in their active economic age where they could effectively carry out farm activities. This result is in line with the report of Alfa-Nla (2014) of a mean age of 44 years for watermelon famers in Kano State, Nigeria.

Table 1: Socio-economic characteristics of respondents

Characteristics	Categories	Frequency (n=163)	%	Mean
Age range	25-29	4	2.45	
	30-34	16	9.82	
	35-39	20	12.27	
	40-44	56	34.36	43
	45-49	41	25.15	
	50-54	22	13.50	
	55 & above	4	2.45	
Sex	Female	44	26.99	
	Male	119	73.01	
Marital status	Married	129	79.14	
	Single	20	12.27	
	Divorced	0	.00	
	Widowed	6	3.68	
	Separated	8	4.91	
Educational level	No formal education	58	35.58	
	Primary education	36	22.09	
	Secondary education	35	21.47	
	Post-secondary education	34	20.86	
Farming experience (years)	<10	47	28.80	
	10-19	70	42.90	15
	20 and above	46	28.30	
Household size	4 & below	72	44.17	
	5-8	81	49.69	
	9-12	10	6.13	5
Farm size (range)	<1	83	50.92	
	1.0-2.0	65	39.88	
	2.1-3.0	11	6.75	1.11
	>3	4	2.45	
Membership of association	No	109	66.87	
	Yes	51	31.29	

Source: Field survey data, 2017.

The modal values indicated that the respondents were mostly male (73.01%), married (79.14%) and educated, with 60.42% of them having formal education. The dominance of male follows the predominant family pattern in the study area where the male assume ownership of the farm enterprise and their wives play a supportive role and also engage in petty trading. The fact that

majority of the respondents were married suggests a good sense of family responsibility. The high literacy level would significantly influence the farmers in decision-making, especially in the adoption of improved farm practices which may directly influence an increase in the production of the crop. Amaza (2000) reported that education has a positive and significant influence on farmers' efficiency in production.

The respondents had a mean watermelon farming experience of 15 years, indicating that the respondents had enough experience to help them in production especially in making useful decisions that would enhance their productivity. Adojutelegan *et al.* (2015) reported a mean farming experience of 10 years for watermelon farmers in Ekiti State. The mean household size of the respondents was 5 members, suggesting that the respondents had a fairly small family which might affect the supply of family labour in their farm activities. It has been reported that there is a positive relationship between household size and farmers' efficiency in production (Bayacag, 2001).

Production Output

The production output of the respondents is shown in , crop yield in Nigeria is low.

Table 2: Production output of respondents

Output (kg)	Frequency	Percent	Mean
<= 200.00	75	46.0	
200.01 - 400.00	45	27.6	
400.01 - 600.00	24	14.7	
600.01+	19	11.7	
Total	163	100.0	309

Source: field survey, 2017.

Income of respondents

The annual income of the respondents, as revealed in **Error! Reference source not found.**, shows that the highest proportion (42%) of the respondents earned an income that was less than ₦50,000, while 32.5% earned ₦50,000 – ₦99,999. The average income was ₦59,877 per annum, which suggests that watermelon farmer's income was low, and this may threaten their future production. An average income of ₦54,604 was reported by Onyemekihan (2016) among arable crop famers in Delta State.

2. The result revealed that 46.0% of the respondents had an output of 200kg/ha and below while 27.6% had an output of 200.01kg -400kg/ha. The mean output was 309kg (or 278.6kg per hectare). A mean output or yield of 1,351.42 kg per hectare has been reported by Alfa-Nla (2014) for watermelon farmers in Kano State, Nigeria. The result suggests that the production output of watermelon farmers in the study area was very low. This result validates the report of Kareem *et al*. (2015) who noted that in spite of favourable climate, good soil condition and availability of irrigation water, crop yield in Nigeria is low.

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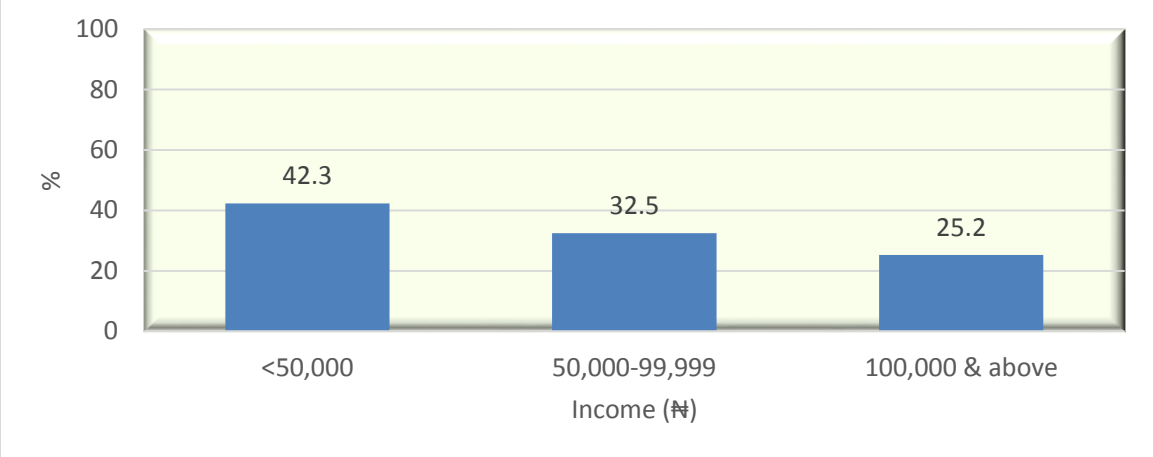

Constraints Associated With Watermelon Production

The constraints faced by respondents in watermelon production are shown in **Error! Reference source not found.** Almost all the constraints listed but one were rated serious by the respondents. The major constraints included inadequate preservative/storage facilities (mean = 3.87), lack of access to extension services (mean = 3.80), high cost of farm chemicals (mean = 3.67), inadequate credit/ finance (mean = 3.58) and pest/disease problems (mean = 3.50). Only the use of crude implements (mean = 2.48) was indicated by the respondents not to be a serious constraint. The result suggests that watermelon production in the study area is faced by several constraints which might affect its production. Alfa-Nla (2014)'s study revealed that lack of improved seeds, lack of

credit facilities, high cost of inputs, transportation problem, prevalence of pests and diseases and problem of storage preservation were major problems affecting watermelon production in Kano State.

The climatic condition determines to a large extent the quality of the watermelon fruit. Watermelon is a warm seasonal crop with optimum growth temperature of 38˚C and above; and requires hot dry climate and plenty of sunshine. Continuous rainfall reduces the sugar content of the watermelon fruit, and when temperatures increase, the sugar content increases (Lilly, 2013; Adojutelegan, 2015). The unavailability of storage facilities was identified by the respondents as a serious constraint; and this situation forced farmers to sell immediately after harvest even at a reduced price. Losses of farm produce due to poor storage and unavailability of market have been reported to have a dysfunctional economic and agronomic effect on the farming population and community (Alakpa and Onemolease, 2014). The lack of extension services and lack of technical know-how will make most adopt practices that might not be the recommended best practices, and this will affect the overall output and profit of the enterprise. Agricultural extension agents have been identified as important stakeholders in improving farmers' socio-cultural and economic conditions (Ugboh, 1999).

Table 3: Constraints faced by respondents in watermelon production

	Very serious		Serious		Slightly serious		Not serious		Total		
Constraints	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Mean***	**SD**	**Rank**
Inadequate preservative/ storage facilities	143	87.73	18	11.04	2	1.23	0	.00	3.87	.38	1
No access to extension services	141	86.50	11	6.75	11	6.75	0	.00	3.80	.55	2
High cost of farm chemicals	113	69.33	47	28.83	3	1.84	0	.00	3.67	.51	3
Inadequate credit/ finance	110	67.48	39	23.93	12	7.36	2	1.23	3.58	.68	4
Pest and disease problems	84	51.53	77	47.24	2	1.23	0	.00	3.50	.53	5
Poor market	92	56.44	42	25.77	23	14.11	6	3.68	3.35	.86	6
Changes in climatic conditions	68	41.72	78	47.85	16	9.82	1	.61	3.31	.67	7
Lack of irrigation facilities	61	37.42	86	52.76	16	9.82	0	.00	3.28	.63	8
Poor access to farm chemicals	68	41.72	75	46.01	18	11.04	2	1.23	3.28	.71	9
Unavailability of improved seeds	57	34.97	91	55.83	15	9.20	0	.00	3.26	.61	10
Inadequate transportation facilities	56	34.36	80	49.08	25	15.34	2	1.23	3.17	.72	11
Land procurement problems	72	44.17	30	18.40	47	28.83	14	8.59	2.98	1.04	12
Unavailability of fertilizers	48	29.45	60	36.81	49	30.06	6	3.68	2.92	.86	13
Seed procurement problems	43	26.38	63	38.65	53	32.52	4	2.45	2.89	.82	14
Poor technical know-how	38	23.31	69	42.33	48	29.45	8	4.91	2.84	.84	15
Labour shortage	26	15.95	63	38.65	59	36.20	15	9.20	2.61	.86	16
Use crude implements	18	11.04	57	34.97	74	45.40	14	8.59	2.48	.80	17

Serious (≥ 2.50)

Source: field survey, 2017

The high cost of farm chemicals reported by respondents is likely to increase their production costs, and this may adversely affect profits. On the issues of inadequate credit/finance, respondents may be compelled to utilize their little available resources; and since this is limited, it may constrain them to keep their production scale small. The seriousness of pest and disease infestation, as identified by the respondents, will compel farmers to seek for available means of controlling

them, and this will increase their production costs and in the long run affect their profits. The problem of poor markets and inadequate transport facilities will affect the sale of the farmers' produce.

Relationship between farmers' socio-economic characteristics and their income

The Chi-square result (Table 4) revealed that a significant association existed between respondents' income and their sex (χ^2= 22.81), educational level (χ^2= 41.426) household size (χ^2= 19.118), membership of association (χ^2 = 26.499), age (χ^2= 12.36) and farming experience (χ^2= 10.995). Marital status (χ^2= 0.739) and farm size (χ^2= 4.152) had no significant association with the respondents' income. The significant variables are discussed as follows:

Table 4: Independence of respondents' income and their socio-economic characteristics

	Annual Income (₦)								
	<50,000		**50,000 -99,999**		**100,000 & above**				
Characteristics and Categories	Freq (n=41)	%	Freq (n=41)	%	Freq (n=41)	%	**Chi-square**	**df**	**Critical Chi-square**
Sex									
Female	21	47.73	23	52.27	0	0	22.81	2	5.991*
Male	48	40.34	30	25.21	41	34.45			
Educational level									
No formal education	38	65.52	16	27.59	4	6.9	41.426	6	12.592*
Primary education	16	44.44	11	30.56	9	25			
Secondary education	11	31.43	16	45.71	8	22.86			
Post-secondary education	4	11.76	10	29.41	20	58.82			
Household size									
4 & below	19	26.39	26	36.11	27	37.5	19.118	4	9.488*
5- 8	42	51.85	25	30.86	14	17.28			
9- 12	8	80	2	20	0	0			
Membership of associations									
No	56	50	41	36.61	15	13.39	26.499	8	15.507*
Yes	13	25.49	12	23.53	26	50.98			
Age (Years)									
35 & below	8	40	7	35	5	25	12.36	4	9.488*
35 – 44	42	55.26	22	28.95	12	15.79			
45 & above	19	28.36	24	35.82	24	35.82			
Marital Status									
Married	53	41.09	44	34.11	32	24.81	0.739	2	5.991ns
Single	16	47.06	9	26.47	9	26.47			
Farming experience									
<10	15	31.91	13	27.66	19	40.43	10.995	4	9.488*
10 – 19	30	42.86	23	32.86	17	24.29			
20 & above	24	52.17	17	36.96	5	10.87			
Farm size (ha)									
2.0 & below	64	43.24	50	33.78	34	22.97	4.152	2	5.991ns
>2.0	5	33.33	3	20	7	46.67			

Source: Field survey, 2017

Sex: The contingency table (Table 4) revealed that more female (47.73%) than male (40.34%) belonged to the lowest income class of less than ₦50,000. It equally revealed that more male farmers (34.45%) belonged to the highest income class of ₦100,000 and above, and no woman fell in this class. This result suggests that the male farmers earned significantly higher income than the female farmers. Onyemekihian (2016) reported that male farmers earned higher income than their female counterparts. This may be attributed to the fact that most farming women do not engage in full-time farming and/or cultivate small farms, as they are also known for petty trading.

Education: The contingency table result on education revealed that more educated farmers (58.82%) belonged to the highest income class of ₦100,000 and above compared to the less educated farmers (22.86%). It equally revealed that majority of the non-educated farmers (65.52%) belonged to the lowest income class. This result suggests that more educated farmers earned significantly higher income than the less educated farmers. Education has been reported to facilitate farmers' capacity to work with improved technologies to improve their income (Oriakhi, and Okoedo-Okojie, 2013).

Household size: Table 4 revealed that farmers with smaller households (37.5%) belonged to the highest income class (₦100,000 and above) relative to respondents with larger households (17.28%). It equally revealed that more farmers with larger households (51.82%) belonged to the lowest income class (less than ₦50,000). This result suggests that farmers with smaller households earned significantly higher income than farmers with larger households.

Association membership: Table 4 revealed that farmers who belonged to associations (50.98%) fell under the highest income class (₦100,000 and above) compared to farmers who did not belong to associations (25.25%).. This result suggests that farmers who belonged to associations earned significantly higher income than those who did not. Group formation and membership by farmers have been identified to support livelihood improvement among the rural poor (Akpantaku *et al.*, 2002; Ayinde *et al.*, 2008).

Age: Table 4 revealed that younger (55.26%) farmers belonged to the lowest income class (less than ₦50,000) compared to the older farmers (28.36%). It equally revealed that a higher proportion of older farmers (35.82%) belonged to the highest income class relative to the younger farmers (15.79%). This result suggests that older farmers earned significantly higher income than the younger ones. Alfa-Nla (2014) reported that farmers become more skilful as they grow older and this can influence their production capacity, output and income.

Farming experience: The results revealed that the less experienced farmers (40.43%) belonged to the highest income class of. ₦100,000 and above compared to the more experienced farmers (24.29%). It equally revealed that the more experienced farmers (52.17%) belonged to the lowest income class of less than ₦50,000 compared to the less experienced farmers (42.86%). This result, although contrary to *a priori* expectation, suggests that the less experienced farmers earned significantly higher income than the more experienced farmers. Onemolease (2005) noted that less

experienced farmers can be more positively disposed to farm innovations and by implication may produce more, and therefore realized grater income

Test of differences among constraints facing farmers in watermelon production

Friedman test was used to test the hypothesis that states that, there is no significant difference among the production constraints associated with watermelon production in the study area. The result is presented in Table The Friedman test result (χ^2 = 683.70; df = 16; p < 0.01) is highly significant, which means that there were significant differences among the production constraints associated with watermelon production in the study area. The post-hoc test revealed that inadequate preservative/storage facilities (mean rank = 12.89) and lack of access to extension services (mean rank = 12.47) were the most significant constraints associated with watermelon production in the study area. However, inadequate extension services (mean rank = 12.47), high cost of farm chemicals (mean rank = 11.74) and inadequate credit/finance were statistically different in terms of seriousness. The least significant production constraints were labour shortage (mean rank = 5.63) and use of crude implements (mean rank = 4.90).

Table 5: Test of difference in constraints associated with watermelon production (Friedman test)

Constraints	Mean rank
Use crude implements	4.90 [k]
Labour shortage	5.63 [jk]
Poor technical know-how	6.67 [ij]
Seed procurement problems	7.09 [hij]
Unavailability of fertilizers	7.43 [ghi]
Land procurement problems	8.11 [fghi]
Inadequate transportation facilities	8.40 [fgh]
Unavailability of improved seeds	8.78 [efg]
Lack of irrigation facilities	8.90 [efg]
Changes in climatic conditions	9.28 [de]
Poor access to farm chemicals (herbicides and insecticides)	9.36 [de]
Poor markets	9.86 [cde]
Pest and disease problems	10.39 [cd]
Inadequate credit/finance	11.12 [bc]
High cost of farm chemicals	11.74 [abc]
No access to extension services	12.47 [ab]
Inadequate preservative/storage facilities	12.89 [a]

Source: field survey, 2017; *χ^2 = 683.70; df = 16; p < 0.01*

Conclusion

The findings of this study show that the yield and income from watermelon production in the study area were low. These could be attributed to the several constraints identified in the study, which

are capable of affecting the output and the overall income of the farmers. These may constrain the use of the crop for poverty alleviation, and as a food security measure. To promote the cultivation of this emergent crop, there is need for concerted efforts to address the identified challenges.

Recommendations

Based on the findings of the study, it was recommended that;

i. Watermelon farmers should be advised to join associations such as cooperative societies so as to be better positioned in seeking government support and access loan from financial institutions. These associations or groups can also constitute a platform for bulk purchase of inputs, which is usually cheaper for the farmers.

ii. The State extension agency should link watermelon farmers to sources of farm inputs and marketing information such as pricing so that the farmers can take advantage of price differentials in different markets.

iii. The State extension agency should also develop special training programmes for watermelon farmers to build their capacity to manage the farm, employing improved practices. Such training should focus on pest and disease control methods, marketing opportunities and storage/preservative techniques.

iv. Farmers should be linked to sources of improved and quality seeds.

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