Original Research Article

Profitability of Watermelon Production Diversification Strategy: Evidence from smallholder farmers in Taraba State, Nigeria

ABSTRACT

The profitability of a watermelon production diversification plan for smallholder farmers in Taraba State, Nigeria, was investigated in this study. During the 2021 farming season, data for the study was collected from 355 randomly selected farms.Descriptive statistics and a farm budgeting approach were utilized to assess the data. The mean age of respondents was 42.3 years, 85.1% of them were married with an average household of six people. The majority (77.5%) of the respondents were educated with a mean farming experience of 8.6 years. On average, the respondents cultivate 4.2 hectares of land. The budgeting technique showed that a mixture of melon and cowpea has the highest average net farm income, followed by a mixture of melon and Bambara-nut while a mixture of melon and groundnut has the least average net farm income per hectare. The estimated gross margin and net farm income for all the enterprises stood at₦ 143618.11and ₦ 135051.13 respectively. The return on the owner's labour and management for all the enterprises is₦ 87801.13 and the return on investment is 127.58%. This demonstrates that the watermelon crop diversification strategies in the research area are profitable. A melon and cowpea combination was discovered to be more profitable than other firms. Because of this, it is suggested that a large amount of land be set aside for growing this crop.

Key Words: Profitability; Waterelon; Production; Diversification; Strategy

1. INTRODUCTION

Watermelon (*CitrullusLonatus*) is a tropical fruit that is grown all over the world for its nutritional value [1]. Watermelon has 46 percent calories, 20 percent vitamin C and 17 percent vitamin A, as well as more lycopene than tomato [2]. Vitamins A, B, C, carotenoids, and antioxidants are all found in watermelon [3]. As a result of its nutritional profile and allied health benefit its consumption has increased. Cancer, cardiovascular disease, diabetes, blood pressure, and obesity can all be reduced by eating watermelon [4]. As a result, the commodity's use has grown dramatically in recent years affecting people from all walks of life and socioeconomic classes.

The production of valuable crops particularly watermelon is insufficient to meet the demands of Nigeria's teeming population [5]. Watermelon production is dominated by small-scale farming households with a heavy reliance on the agricultural labour market, with little or no savings, and very intensive agricultural practice [6]. Furthermore, due to the numerous environmental, production, marketing, and other risks and uncertainties that have afflicted the small-scale agricultural production, farmers are desperately seeking sustainable production practices as a hedge to ensure their households food security and income stability. Crop diversification is recognized as a key method for increasing revenue, reducing poverty and food security, and improving the nutritional status of the rural people [7]. Crop diversification refers to a variety of farming practices rather than a transition from one business to another [8]. Farmers allocate their resources to varied sub-units of production regions for sustainable food supply, enhanced food security, and poverty

reduction among farm families making it a veritable approach for managing risks in small-scale subsistence agriculture [9, 10]. Crop diversification allows for a greater variety of crops to be grown on a given area of land hence increasing family food output and related agricultural activities.

Watermelon is grown throughout the world, in tropical, subtropical, and temperate climates. It is consumed in many parts of Nigeria and is used by small-scale farmers as a source of employment and revenue. Watermelon is produced in combination with other crops such as cassava, maize, yam, and pepper to maximize land usage and boost the return generated by the production system which may be accounts for the rise in the land area dedicated to its production [11]. The choice of inputs, as well as the marketing channel for the output are influenced by the availability of a guaranteed market. The transaction cost of market exchange can be constant or variable. Given that agriculture is a prominent industry in most African economies, particularly in rural areas where farming is the primary vocation, commercialization of the sector demands strengthening small-holder farmers' ability to engage in the market. Small-scale farmers would be interested in participating in the market if they knew whether they are making a profit or not. It is based on this backdrop that this study analysed the profitability of watermelon diversification strategy in Taraba State, Nigeria

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Taraba State; the State is located in North-east part of Nigeria. The state lies between Latitudes 6^0 30'N and 10^0 36'N of the equator and Longitude 9^0 10' and 11^0 50'E of the Greenwich Meridian [12]. The state has a land area of about fifty-nine thousand four hundred square kilometres (59,400km^2) with the population of two million and three hundred thousand (2,300,000) people [13]. The state shares boundaries with Bauchi and Gombe states in the North, Adamawa state in the East, Cameroun Republic in the South, Nasarawa, Plateau and Benue States in the Southwest. The state has a tropical wed-dry climate, well-drained alluvial soils, and has both savannah and rain forest vegetation. The rainfall ranges between 1000mm to 2500mm per annum in the South and between 1000mm to 1850mm per annum in the North with a maximum temperature of 32^0C particularly from March to April which is the hottest period in the state. The minimum temperature is about 18^0C experienced between December and January each year. The relative humidity is extremely low (13%) between January and February [12]. The state is predominantly agrarian, with about 80% of its inhabitants depending on subsistence agriculture. The climate, soil, and hydrology of the area are conducive for the cultivation of food crops, grazing of animals, fishing and forestry. Due to the verities of cultures, different farming systems are practiced in the state [12].

2.2 Sampling Procedure and Sample Size

The respondents were chosen using multistage sampling approaches.Taraba State is made up of four agricultural zones namely: Zone I which comprises of Jalingo,

Lau, Ardo-kola, Karim-lamido, Yorro and Zing local government area of Taraba State. The vegetation zone falls under Sub-Sudan savannah with sandy-loamy soil which supported watermelon diversification strategy. Zone II is made up of part of Bali, Gassol, Ibi and Wukari, and Zone III comprises of, Donga, Kurmi, Gashaka, Ussa,Takum and part of Bali. Zone II and III falls under guinea savannah with sandy clay loam soil,which also supported watermelon diversification strategy. Zone IV is made up of Sardauna local government area, it has a semi temperate vegetation and the soil type does not support the growing of melon-based cropping system.

The respondents were chosen using multistage sampling approaches. In stage 1, purposive sampling was used to select three agricultural Zones and three blocks from each Zone totalling 9 blocks. The Zones and blocks were selected based on their predominance in the production of watermelon. In stage two, three farming communities were randomly chosen from each of the 9 blocks totalling of 27 farming communities. The list of all watermelon farming households in the 27 communities was obtained from Taraba State Agricultural Development Programme (TADP) totalling 3119 people.Following [14], the sample size was determined at 95% confidence interval. The formula for calculating the sample size is specified as:

$$n = \frac{N}{1+N(e^2)} \quad \text{..... (2.1)}$$

Where; n = Sample size, N= Population, and e= confidence interval

Therefore; n = $\frac{3119}{1+3119(0.05)2}$ = 355

In stage 3 simple random sampling relative to the population of each zone was used to obtained the respondents for each zone.Thus, in zone I: n= $\frac{850}{3119} * 355$ = 97 respondents. Similarly in zone II n = $\frac{1139}{3119} * 355$ = 129 respondents. In zone III, n= $\frac{1130}{3119} * 355$ = 129.In the final stage simple random sampling relative to the population of each zone was used to obtained the respondents.

2.3 Method of Data Analysis

Descriptive statistics and farm budget analyses were the analytical method employed to achieve the research objectives. The method for determining the farmers labour and management returns is as follows: the total output was multiply by market prices of the output presented in Naira to obtain the output gross value. Total Variable Cost (TVC) of production includes the costs of seeds/seedlings, fertilizer, agrochemicals, sacks, transportation, storage, hired labour and family labour. The amount that the farmer would have spent if they did not own the land make up the Total Fixed Cost (TFC) which is made up of land-related expenses.

Depreciation charges for items like hoes and cutlasses were computed using a straight line method with no consideration for salvage value. The estimated cost of family labour for each farmer was calculated in man-days. The current wage rate in the study field is taken as the opportunity cost of family labour at the time.

The farm budget techniques are specified as;

Gross Margin (GM) = $\sum_j^n = Q_y P_y - \sum_j^n = j\, X_i P_{xi}$…… (1)

Where;

GM = Gross Margin (₦/ha)

Q_y = Quantity of output (Kilogram melon equivalent)

P_y = Unit price of output (₦/Kg)

$Q_y P_y$ = Total farm revenue generated (₦/ha)

X_i = Quantity of ith variable input (₦)

$\sum_j^n = jX_i P_{xi}$ = Total variable cost associated with all the ith inputs consumed per hectare (₦)

Producing the melon

$\sum$ = Summation

$NFI = GI - TC$…… (2)

Where;

NFI = Net Farm Income

GI = The Gross Income

TC = Total Cost

The net revenue less the aforementioned projected cost of family labour is used to calculate the farmer's labour and management returns. This is the primary finding of the cost and return analysis. The rate of returns (ROR) which is a measure of economic success of each farm in terms of income and capital invested was calculated and expressed as a percentage as follows:

$ROR = \frac{TR-TVC}{TVC} \times 100$…… (3)

3. RESULTS AND DISCUSSION

3.1 Socio-economic Characteristics of Respondents

The result of the socioeconomic characteristics of the respondents is presented in Table 1. The mean age of the farmers was 42 years. This implies that the farmers were in their productive age. This is in line with [15]. The result of marital status showed that 85% of the respondents in the study area were married, this indicates that married people have to be up and doing to cater to the basic need of their family. The result agreed with [7].The mean household size of the respondent was 6 persons. This implies that there is available cheap family labour. Table 1 also showed that 77.5% of the respondents had formal education can read and write. Education will increase the level of adoption technology or innovation. The result is in line with [1].Farming experience is the number of years the farmers spend on watermelon production. Table 1 showed the average farming experience of the respondents was 8.6 years. This implied that they had experience in watermelon diversification strategy that may result in a high level of output and income. The finding coincides with [1].The average farm size cultivated in the study area was 4.2 hectares. This shows that farmers in the study area will not be able to enjoy the economy of scale in production. The larger the farm size of the household, the higher the expected level of output. The finding agreed with [7].

Table 1: Socio economic characteristics of the respondents

Variable	Frequency	Percentage	Mean
Age of the respondent			
15-30	115	32.4	42.3
31-60	190	53.5	
61-90	50	14.1	
Total	**355**	**100**	
Marital status of the respondent			
Married	302	85.1	
Single	53	14.9	
Total	**355**	**100**	
Household size			
1-5	195	54.9	6
6-10	120	33.8	
11-15	40	11.3	
Total	**355**	**100**	
Educational level of the respondent			
Non-formal education	80	22.5	
Primary	215	60.6	
Secondary	40	11.3	
Tertiary	20	5.6	
Total	**355**	**100**	
Respondents farming experience			
1-6	125	35.2	8.6
7-12	210	59.2	
13 and above	20	5.6	
Total	**355**	**100**	
Farm size (ha)			

1-4	225	63.4	4.2
5-8	110	30.9	
9 and above	20	5.6	
Total	**355**	**100**	

Source: Field survey, 2021

3.2 Costs and Returns Analysis

Any production process involves outlays for raw materials and returns from the sales of the finished product.The average expenditure and revenues by each enterprise per hectare are summarized in Table 2. The majority (31.3%) of the respondents produced only melon, 22 percent blended melons and cowpeas, and 0.3 percent combined melons, millet and cowpeas (Table2). The table also showed that on per hectare basis, blended melon and cowpea has the highest ATVC (₦ 144, 377.0) and ATC (₦ 144,789.6), while solitary melon has the least ATVC (₦ 57,416.9) and ATC (₦ 58,121.4) respectively. On the other hand, melon and cassava had the highest AFC (₦ 8031.0), while melon and sorghum had the least AFC (₦ 77.2). The table further showed that all the businesses engaged in the diversification plan for melon production experienced favourable Average Gross Margin (AGM), Average Net Farm Income (ANFI), Average Return to Land Labour Management (ARLLM), Average Return to Labour Management (ARLM), and Average Rate of Return (AROR) in Naira per Hectare (₦/ha). This demonstrated financial success of each of the twelve businesses. The study also demonstrated that the highest AGM, ANFI, ARLLM, and ARLM/ha are found in melon and cowpea mixture. The second-best crop in terms of AGR, ANFI, ARLLM and ARLM/ha was a mixture of melon and Bambara-nuts. However, Solitary Melon (SM) has the least AGR/ha.

Table 2: Summary of average costs and returns by enterprise per hectare (₦)

Ente.	F	%	AGR	ATVC	AFC	ATC	AGM	ANFI	ARLLM	ARLM	AROI
SM	111	31.3	113523.0	57416.9	704.5	58121.4	56106.1	55401.6	54757.03	25757.0	97
M/C	78	22.0	551223.0	144377.0	412.6	144789.6	406845.9	406433.4	406148.2	356148.2	282
M/M	31	8.7	195415.5	128723.6	573.3	129296.9	66691.9	66118.6	65638.6	25638.6	51
M/M/C	31	8.7	256512.5	114687.8	4870.5	119558.3	141824.7	136954.2	132126.9	76126.9	119
M/S	27	7.6	186394.3	121020.8	77.2	121098.0	65373.5	65296.2	63296.2	18,296.2	54
M/G	18	5.1	138702.8	98374.2	2094.3	100468.5	40328.8	38234.2	36234.2	5234.2	39
M/MI	16	4.5	178241.6	101623.8	1101.0	102724.8	76617.8	75516.8	74506.4	46506.4	74
M/M/S	19	5.4	177232.4	124332.9	574.1	124907.0	52899.5	52325.5	52374.3	374.3	42
M/B	16	4.5	405467.0	112401.3	1705.5	114106.8	293065.7	291360.2	289708.1	240708.1	259
M/CA	03	0.8	265151.3	131043.8	8031.9	139075.8	134107.5	126075.5	118139.5	48139.5	96
M/MI/CA	01	0.3	298000.0	86380.5	505.1	86885.6	211619.5	211114.5	207114.5	159114.5	244
M/M/Y	04	1.1	308446.0	137356.3	4157	141513.3	171089.8	166932.8	162890.8	93890.8	122
Total	**355**	**100**	**3074309.4**	**1357738.9**	**24807**	**1382546**	**1716570.7**	**1691763.5**	**1662934.7**	**1095934.7**	**1479**

Source: Field Survey, 2021

Table 3 shows that the average production costs that all of the respondents are expected to pay is ₦ 121,141.29 per hectare. Most of the inputs were not bought, so the costs have to be estimated. Variable and fixed costs both contribute to the overall cost of production. This result is the same as what [16,18] found, which was that variable costs made up 86.96% and 92.20%, respectively, of the total cost of production. Fixed costs accounted for only 7.07 percent of the area's average total cost. This shows that there is not a lot of money being put into fixed items for

diversifying melon production in the study area. In fact, buying hoes, cutlasses, and sometimes watering cans is the only way to invest in capital goods. To figure out the fixed cost, the costs of the goods were depreciated using the straight-line method and an assumed zero end value. The labour input, which accounted for 60.41 percent of the ATC, was responsible for a sizable portion of the variable costs. This reveals labour as the research area's most expensive input by far. Since farming tasks like clearing land, levelling it, planting, weeding, and, in some cases, watering and harvesting are done by hand, this is not an unusual situation. Agrochemicals, fertilizer, and seed all had comparatively inexpensive prices. The estimated cost of unpaid family labour accounted for 64.6 percent (₦ 47,250) of the total labour cost. Even though the farmers did not pay for family labour directly, it was thought that if they had not worked on the farmer's farm, they might have hired out their services to other farmers. So, the average age group and gender of the people living in the research area were used to figure out how much family labour costs. One-day of family work was therefore given the same weight as one man-day of non-family work. But this need not be the case [19]. If a majority of farmers decide against growing melon, they might not be able to find lucrative employment elsewhere or on other people's farms. As a result, it is possible that the opportunity costs of family labour are not as high as those of non-family labour. However, it is presumed to be the same in this study for consistency's sake.

For all respondents in the study area, average gross margin (AGM), average net farm income (ANFI), average returns to farmers' land, labour and management (ARLLM), average returns to farmers' labour and management (ARLM), and average rate of returns to investment (AROR) in ₦/ha were also calculated as shown in table 3. The study area's average gross revenue for all respondents was ₦ 256192.42/ha, while the AGM was ₦ 143618.11/ha. The table also shows that the farmers' ANFI, was ₦ 135,051.13/ha. The rent value of the farmer's land (also known as the opportunity cost of the farmer's land) was deducted from the ANFI to arrive at the ARLLM, which came to ₦ 128,600.90/ha. The returns to farmers' labour and management, which is the ANFI less the opportunity cost of family labour in the study area, was ₦ 87,801.13/ha. Including the cost of family labour, the average annual rate of total investment was 127.58 percent. This means that for every Naira put into diversifying melon production in the study area, an average profit of ₦1.27 was made, which means that, on average, the investment is very profitable. The result is consistent with [18].

Table 3: Average Costs and Returns of Watermelon Production Diversification Strategy

Cost and returns	Costs (₦ /ha)	Percentage
Variable costs (VC):		
Seed/seedlings	10,116.25	8.35
Fertilizer	6,898.37	5.69
Agrochemicals	11,732.17	9.68
Sacks	1,695.92	1.40
Transportation	7,758.02	6.40
Storage	1,183.11	1.00
Hired labour	25,940.47	21.41
Family labour (Opportunity cost)	47,250.00	39.00
Total Variable Cost (TVC)	**112,574.31**	**92.93**
Fixed cost (FC)		
Imputed rent value of land	6,450.23	5.32
Depreciation on farm tools	2,116.75	1.75
Total fixed cost (TFC)	**8,566.98**	**7.07**
Total cost of production (TC)	**121,141.29**	**100**
Gross returns (GR)	256,192.42	
Gross margin (GM)	143,618.11	
Net farm income (NFI)	135,051.13	
Average returns to land labour and management (ARLLM)	128,600.90	
Average returns to labour and management (ARLM)	87,801.13	
Average rate of returns to investment	1.2758	127.58

Source: Field survey, 2021

Key: (a) Enterprises: SM = Sole Melon; M/C = Melon/Cowpea; M/M = Melon/Maize; M/M/C = Melon/Maize/Cowpea; M/S = Melon/Sorghum; M/G = Melon/Groundnut; M/MI = Melon/Millet: M/M/S = Melon/Maize/Sorghum; M/B = Melon/Bambara-nut; M/CA = Melon/Cassava; M/MI/C = Melon/Millet/Cowpea; M/M/Y = Melon/Millet/Yam;

(b) Ratios: AGR = average gross return ₦/ha. ATVC = Average Total Variable Cost₦/ha; AFC = Average Fixed Cost ₦/ha; ATC = Average Total Cost ₦/ha; AGM = Average Gross Margin ₦/ha; ANFI = Average Net Farm Income ₦/ha; ARLLM = average return on labour

land and management ₦/ha; ARLM = average return to labour and management ₦/ha; AROI = Average Returns on Naira Invested ₦/ha.

4. CONCLUSION AND RECOMMENDATIONS

The study used descriptive statistics and partial budget analysis to describe and assess the profitability of melon production diversification strategy in Taraba State, Nigeria. The mean age of the respondents was 42.3 years, and the majority (85.1%) of them were married with an average household size of six people. The majority (77.5%) of the respondents had formal education with an average farming experience of 8.6 years and an average farm size of 4.2 hectares. The gross return was ₦ 256192.42. The farmers in the research area also generated an average gross margin and net farm income of ₦ 143,618.11 and ₦ 135051.13, respectively. In the research area, ₦ 128600.90 is the rate of returns to labour, land, and management, while ₦ 87801.90 is the rate of returns to the owner's labour and management. The overall return on investment is 127.6 percent. This demonstrated that melon production diversification plans in the research area are quite profitable. According to the analysis, some crop combinations are more profitable than others. Melon and cowpea mixture has the highest Average Gross Return (AGR), Average Gross Margin (AGM), Average Net Farm Income (ANFI), Average Rate of Return to Land Labour Management (ARLLM), and Average Return to farmers Land Management per hectare (ARLM/ha).Therefore, the finding recommends the following:

1.Young educated married men who are not employed in the study area should engage in watermelon production diversification strategy.

2. Tt is advised that quite a significant piece of their land be set aside for the growth of watermelon and cowpea in the study area.

References

1. Ndanitsa, M.A., Salawu, H., Bako, R.U., Oseghale, A.I. and Jibrin, S. (2021). Economic analysisAnd technical efficiency of watermelon production in Niger State, Nigeria. *Journal of Agripreneurship and sustainable development,* 4(4): 64-80. Retrieved from www.jasd.daee.atbu.edu.ng
2. Biswan, R., Ghosal, S., Chattopadhyay, A. and Dalta, S. (2017). A comprehensive review onWatermelon seed oil and utilized product. *Journal of pharmacy*, 7 (11): 1-11.
3. Maoto, M., Beswa, D. and Jideani, A.I. (2019). Watermelon as a potential fruit snack.*International journal of food properties*, 22 (1): 353-370.
4. Lum, T., Connolly, M., Marx, A., Beidler, J., Hooshmand, S., Kern, M., Liu, C. and Hong,M.Y (2019). Effects of fresh watermelon consumption on acute safety response andCardio metabolic risk factors in overweight and obese adults. *Nutrients*, 11 (3): 595.

5. Okuneye, P.A. (2015). Employment generating potentials of agricultural processing and Storage technology: additional gain in increased food availability pursuit: Paper Presented at the workshop for Local Government officials, Lagos State, Nigeria.

6. Bakare, A.S. (2013). An econometric analysis of sustainable agriculture and rural Development in Nigeria. A Vector Auto-Regressive Approach (VAR). *Journal OfAgricultural economics and development.* 2 (5): 184-193.

7. Waha, K., van Wijk, M.T., Fritz, S., See, L., Thornton, P.K., Wichern, j. and Herrero, M. (2018). Agricultural diversification as an important strategy for Achieving food security in Africa. *Global change biology, 8 (24):* 3390-3400.

8. Abdullah, Rabbi, F., Ahmad, R., Ali, S., Chandio, A.A. Ahmad, W., and Ud Din, I. (2019).Determinants of commercialization and its impact on the welfare of smallholder riceFarmers by using Hecman's two-stage approach*. Journal of Saudi society of agricultural sciences*, 18: 224-233.

9. Makate, C., Wang, R., Makate, M., and Mango, N. (2016). Crop diversification And livelihoods of smallholder farmers in Zimbabwe. *Adaptive management for Environmental change. Springer plus*, 5: 1135. dio:10.1186/s40064-016-2802-4.

10. Aheibam, M., Singh, R., Feroze, S.M., Singh, N.U., Singh, R.J. and Singh, A.K (2017)Identifying the determinants and extents of crop diversification at household level:An evidence from Ukhrul District, Manipur. *Economic affairs*, 62 (1): 89-95.

11. National Agricultural Extension Research and Liaison Service [NAERLS) (2005). FieldSituation assessment of 2005 wet season, agricultural production in Nigeria. AhmaduBello University Zaria and Federal Ministry of Agriculture and Rural DevelopmentAbuja, Nigeria, 12pp.

12. Taraba State Agricultural Development Programme [TADP (2016)]. Crop production recommendation for Taraba State Government printer Jalingo, Taraba State, Nigeria, 35-39.

13. National Population Commission, [NPC, (2006)]. Retrieved from www.wikipedia.com.

14. Kara, A.H., Shamsudin, M.N., Mohamed, Z., Latif, I.B. and Seng, K.W.K (2019). Teechnical Efficiency and production risk of rice farms under the Anchor Borrowers Programme in Kebbi State, Nigeria. *Asian journal of agricultural extension, economics* and *Sociology*, 31 (4): 1-12.

15. Oyediran, W. O., Omoare, A. M. and Ajagbe, B. O. (2016). Factors Affecting Sustainability of Melon production in rural farming households of southwest, Nigeria. *AmericanJournalof Agricultural Research,*1(1): 0001-0012.

16. Robert, K., Kara, H.A., Adamu, M.M. and Muhammad, Bala (2021). Analysis of dry SeasonVegetable production among Kiri dam users in Adamawa State, Nigeria (2021).*Journal of Agripreneurship and sustainable development,* 4(4): 173-179. RetrievedfromwwwLjasd.daee.atbu.edu.ng

17. Oranusi, S., and Dahunsi, S. (2015). Preliminary study on hazards and critical control point of Kokoro, a Nigerian indigenous fermented maize snack. *Springer plus*, 4 (1):253.

18. Tsoho, B.A and Salau, S. A. (2012). Profitability and constraints to dry season Vegetable production under fadama in Sudan savannah ecological zone of Sokoto State, Nigeria *Journal of Development and Agricultural Economics,* 4(7): 214-222.

19. Baba, K.M., and Wamdo, M.A. (1989). Impact of membership of Fadama Users Association on incomes: a case study from two Local Government Areas of Niger State,Nigeria. *Nigerian journal of basic and applied sciences*, 7: 31-41.