Assessment of Stakeholders' Satisfaction for Sustainable Ecological Agricultural Practices that Promote Climate Smart Agriculture in Northeastern Nigeria

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Abstract:

Sustainable Ecological Organic Agricultural (EOA) practices are essential to the fulfilment of environment concerns that climate change poses. Stakeholders' satisfaction in the ecological agriculture value chain has potentials to raise opportunities and remove the barriers to sustainable agricultural practices. A study was conducted in Northeastern Nigeria to analyse stakeholders' satisfaction for sustainable EOA practices that promote climate smart agriculture. Multi-stage sampling procedure was used to select 120 respondents. Information items were collected on personal characteristics, satisfaction with issues related to value chain, extent of involvement and perceived benefits from EOA practices. Data were analysed using frequency counts, percentages, weighted score, and Pearson product moment correlation. Results showed that majority (59.2%) of stakeholders were male, married (64.2%) and had high (68.3%) level of involvement in EOA practices. Majority (90.0%) benefited from enhanced farm biodiversity, 70.8% had high level of benefits from EOA practices, (329.9) were satisfied with organic land tenure system and 58.3% had high level of satisfaction. Significant relationship existed between stakeholders' involvement in EOA practices and satisfaction with issues related to value chain of organic fruits, vegetables and spices (r= 0.223, p =0.01). Therefore, stakeholders' involvement and satisfaction in EOA practices should be consciously entrenched for their symbiotic relationship when promoting ecological organic agriculture for climate smart agriculture.

Keywords: Sustainable ecological agricultural practices, climate smart, organic fruits vegetables and spices, stakeholders' satisfaction, climate change

1. Introduction

Sustainable agriculture integrates the main goal to sustain biodiversity, enhance the quality of natural resources, economic profitability, and social equity. Sustainable ecological organic agriculture aims at alleviating the long term effects in environment to providing various benefits for human and earth. Organic agriculture; an holistic production management system which promotes and enhances agro-ecosystem health, from biodiversity, biological cycles, and soil biological activity is based on precise standards of production which aim at achieving optimal agro-ecosystems which are socially, ecologically and economically sustainable [1]. It avoids the use of synthetic pesticides, herbicides, chemical fertilizers, growth hormones, antibiotics or gene manipulation. Therefore, ecological organic agriculture sustainability is hinged on productivity, economic viability, social wellbeing and especially on environmental impact metrics. According to a US National Academy of Sciences report [2], organic agriculture can only be deemed sustainable if it produces adequate amounts of high-quality food,

enhances the natural-resource base and environment, is financially viable, and contributes to the wellbeing of stakeholders and their communities.

Specifically, organic fruits, vegetables and spices value chain cannot be overemphasized in sustainable organic agriculture for the numerous advantages to plants, animals, human, environment and earth in general. Beginning from production to consumption; the benefits are not limited to improved health, profitability but more importantly the environmental benefit. Thus, the environmental concern goes simultaneously with stakeholders' awareness of the relationship between the production practices and quality of food products or produce. It not a mere saying that fruits, vegetables and spices value chain is greatly threatened in the North by climate change. According to [3] climate change and its consequences pose a severe threat to agricultural systems and food production. It affects the level of food production by altering agro-ecological conditions necessary for crop growth and postharvest preservation and indirectly affecting income and consumption distribution in the society.

Northern part of Nigeria, the major producer of fruits, vegetables and spices [4] is most affected by the effects of climate change in the country and this is worrisome, especially with the evident increased temperature, unpredictable variable rainfall, flooding, drought, desertification, land degradation and other frequent extreme weather events that affected fresh water resources as well as loss of biodiversity compared to other parts of the country. It was reported [5] in 2011 that the Nigerian desert, which is advancing inland at 0.6 km per annum, now covers almost 35 % of the nation's land mass. According to [5-6], 15 out of 19 Northern states in Nigeria are affected by desertification while the desert has spread across Bornu, Kebbi, Kano, Kaduna, Gombe, Jigawa, Bauchi, Kastina, Sokoto, Yobe and Zamfara states.

However, these environmental impacts can be reduced by engagement in ecological organic agriculture. Ecological organic agriculture has potentials to reduce GHG emissions and increasing soil carbon sequestration, ensure better soil quality while sustaining healthy soils and protecting biodiversity and ecosystem functions compared with conventional systems [7-13]. In addition, organic farms generally have more plant diversity, greater faunal diversity as well as habitat and landscape diversity [8-16]; these are elements that promote healthy environment on a sustainable basis. Furthermore, organic agriculture uses virtually no synthetic pesticides hence, there is little to no risk of synthetic pesticide pollution of ground and surface waters, as well as reduced or no nitrate or phosphorous leaching and greenhouse gas emissions. [8, 11, 12, 17-18]. These elements are expected to promote climate smart practices to some extent and ensure reduced negative impact of climate change on the environment.

Although the need for climate change mitigation and adaption measures in the country is germane. According to IPCC [19], the mitigation options include reduction in burning of fossil fuels and reduction of greenhouse gases and soot from the energy sector; reduction of deforestation; increase in reforestation and afforestation; modification of agricultural practices to reduce emissions of greenhouse gases and build up soil carbon. These and more are promised using sustainable ecological organic agriculture because of the embedded climate smart elements in its activities. However, it is important to ascertain sustainability of organic agriculture by probing stakeholders' involvement in organic agriculture and determine their satisfaction as regard issues related to the value chain of organic fruits, vegetables and spices in other to promote the sustainable climate smart organic agricultural practices. It is based on this backdrop that the study assessed stakeholders' satisfaction for sustainable ecological agricultural practices that promote climate smart agriculture in Northeastern Nigeria. The study addressed the following specific objectives:

1. to describe the personal characteristics of the respondents
2. to ascertain stakeholders' extent of involvement in ecological organic agriculture or agricultural practices.
3. to determine climate smart elements entrenched in ecological organic agricultural practices.
4. to establish stakeholders' satisfaction with issues related to (production, marketing, and processing) the value chain of organic fruits, vegetables and spices.

Test of hypothesis

$H_0$1: There is no significant relationship between respondents' extent of involvement in organic agricultural practices and their satisfaction with issues related to the value chain (production, marketing, and processing) of organic fruits, vegetables and spices.

2. Materials and Methods

Northeastern Nigeria was the area of study and it is located between latitude 90 5'N to 130 44'N and longitude 90 50'E to 140 38'E [13-14], with land resources of 176 000 km2 (68 000 mi2). Stakeholders engaged in production, processing and marketing of organic fruits, vegetables and spices value chain were selected using multistage sampling procedure as population of the study. Northeast, has six states (Adamawa, Borno, Bauchi, Yobe, Gombe and Taraba), out of which fifty percent (Gombe, Adamawa and Taraba states) were selected using simple random sampling technique. Then, ten percent out of 16 Local Government Areas (LGAs) in Taraba; 21 LGAs in Adamawa and 7.0% of 11 LGAs in Gombe states were selected using a simple random sampling technique. In all, six local government areas were selected. Moving to the next stage, twenty percent of wards from selected LGAs in Taraba and Adamawa states as well as fifteen percent of wards from LGAs in Gombe state were. They were selected using a simple random technique, which amount to 12 wards selected in all. The final stage involved selection of at least one village from all the selected wards and this amount to 12 villages, the selection was done using simple random technique. Then in the villages 40 farming households were sampled using simple random technique. Therefore, one hundred and twenty stakeholders were sampled for this study. Data were collected using structured interview schedule. Data were analyzed using frequency count, percentage, mean weighted score and Pearson Product Moment Correlation at α 0.05.

Stakeholders' satisfaction with issues related to the value chain (production, processing and marketing) of organic fruits, vegetables and spices was measured by providing respondents with 14 items. They were provided with five response options of "Excellently Satisfactory (ES)", "Very Satisfactory (VS)", "Satisfactory (S)", "Somewhat Satisfactory (SS)" and "Not Really Satisfactory (NS)". Scores of 4, 3, 2, 1 and 0 were assigned to the response options respectively, the minimum obtainable score was 0 while the maximum obtainable score was 56. Then, weighted score was computed for each score in order to rank the satisfaction items. Thereafter, satisfaction index was computed, and the mean of the index was determined. The mean was used as the benchmark to categorize of the satisfaction index scores into low and high level of satisfaction with issues related to the value chain (production, processing and marketing) of organic fruits, vegetables and spices.

Stakeholders' extent of involvement in ecological organic agriculture or agricultural practices was measured by asking respondents to state the extent to which they were involved in the basic 23 provided principles and practices of organic fruits, vegetables and species. They had three response options of not all, to some extent and to a large extent, which were a score of zero, one (1) and three (3), respectively. The maximum obtainable score was 46 and a minimum of 0. Then, extent involvement index was computed as a measure of level of respondents' involvement in organic fruits, vegetables and species practices. Using mean as the benchmark, involvement index was categorized into high and low levels. Respondents with mean score and above were categorized as high while those with scores below mean were categorized as having low level of extent involvement in organic fruits, vegetables and species practices.

3. Results

3.1. Personal characteristics of the respondents

Table 1 shows that majority (68.3%) of stakeholders were between age ranges 21- 45 years. This implies that they are youth who according to [22] are agile and health to put up with the rigours of farming. More than half (59.2%) were male, married (64.2%) and 31.7% had secondary education while majority

(63.3%) had at least 1 – 5 persons in their households. This implies that apart from the fact that majority of the stakeholders are young and agile, they are female, married, literate and have average household size.

Table 1. Stakeholders' personal characteristics

Characteristics	Frequency	Percentage
Age categories		
21-45 years	82	68.3
46 years and above	38	31.7
Total	120	100
Sex		
Male	71	59.2
female	49	40.8
Total	120	100
Marital status		
Single	34	28.3
Married	77	64.2
Separated	13	7.5
Total	120	100
Household size		
1-5 persons	76	63.3
6 persons and above	44	36.7
Total	120	100
Educational background		
No formal education	15	12.5
Primary education	36	30.0
Secondary education	38	31.7
Tertiary education	31	25.8
Total	120	100

3.2. Extent of involvement in ecological organic agricultural practices in the value chain

Data in Table 2 shows that a high percentage (68.3%) of the stakeholders had high level of involvement in organic fruits, vegetables and species practices. Stakeholders' high involvement is a good indication that might boost their satisfaction with issues related to the value chain of organic fruits, vegetables and spices. Thereafter, mitigating negative effects of climate change directly or indirectly.

Table 2. Extent of involvement in ecological organic agricultural practices in the value chain.

Level of involvement	Frequency	Percentage
High extent	82	68.3
Low extent	38	31.7
Total	120	100.0

3.3. Perceived benefits in ecological organic agricultural practices in the value chain

Table 3 indicates that a higher percentage (94.2%) benefited from greater net return, reduced exposure to pesticides and harmful chemicals (91.7%), enhanced farm biodiversity (90.0%), safe and healthy environment (89.2%), cleaner groundwater and surface water (87.5%) as well as reduced greenhouse gas emission (86.7%). Also, Table 3 observes that overall, majority (70.8%) of stakeholders claimed that they had high level of benefits derived from ecological organic agricultural practices in the value chain. The implication is that climate smart elements embedded in ecological organic agriculture are greater net

return, reduced exposure to pesticides and harmful chemicals, enhanced farm biodiversity, cleaner groundwater and surface water as well as reduced greenhouse gas emission. According to [23] organic farming relies on establishing closed nutrient cycles and minimizing nitrogen losses instead of being dependent on external fossil-fuel intensive fertilizer or pesticide inputs, which can reduce global agricultural GHG emissions by around twenty percent. It is also a confirmation of the potentiality of ecological organic agriculture to mitigate the negative effects of climate change and a possibility of considering ecological organic agriculture as a major component of climate smart agriculture in the country.

Table 3. Perceived benefits from ecological organic agricultural practices in the value chain.

Climate smart elements	**Not achieved**	**Fully achieved**
Greater net return	5.8	94.2
Reduced exposure to pesticides and harmful chemicals	8.3	91.7
Enhanced farm biodiversity	10.0	90.0
Safe and healthy environment	10.8	89.2
Cleaner groundwater and surface water	12.5	87.5
Reduced greenhouse gas emission	13.3	86.7
Improved soil quality	15.0	85.0
Level of benefit derived	**Frequency**	**Percentage**
High benefit	85	70.8
Low benefit	35	29.2
Total	120	100.0

3.4. Satisfaction with issues related to the value chain of organic fruits, vegetables and spices

Table 4 observes that among issues related to the value chain of organic fruits, vegetables and spices, stakeholders were excellently satisfied with organic land tenure system, as this was ranked first with weight score of (329.9). This issue is immediately followed by business risks (329.0), growth rate and future business plan (322.6), technical skills and energy expended in management of the crops (322.3), off taking system (320.9), finance availability (320.7) as well as pricing of organic fruits vegetables and spices (319.7) respectively. The implication is that, stakeholders involved in organic fruits, vegetables and spices value chain are really satisfied in the study area and this could probably be related to their great involvement in the basic principles and practices of organic agriculture. Generally, stakeholders had high level (58.3%) of satisfaction with issues related to the value chain of organic fruits, vegetables and spices. This high level of satisfaction in the organic agriculture value chain related issues, implies that stakeholders have tendency to participate more in the value chain of organic fruits, vegetables and spices. The more they practice organic agriculture, there is tendency to promote climate smart knowingly or unknowingly and this eventually will reduce the negative effects of climate change in the country.

Table 4. Respondent's satisfaction with respect to the issues that concern the value chain of organic fruits, vegetables and spices.

Organic agriculture value chain issues	**Weighted score**	**Ranks**
Organic land tenure system	329.9	1st
Business risks such as lower yield, pest infestation and contamination, etc.	329.0	2nd

Growth rate and future business plan	322.6	3rd
Technical skills and energy expended in management of produce or products	322.3	4th
Off taking	320.9	5th
Finance availability	320.7	6th
Pricing of organic fruits, vegetables and spices	319.7	7th
Time consumption in production	319.2	8th
Profit from sales of organic fruits, vegetables and spices	316.4	9th
Harvesting and postharvest handling such as packaging and shelf life storage	314.3	10th
Tedious nature of cultivating with hoe and cutlass	302.5	11th
Quality control and certification system	280.2	12th
Logistics such as transportation, marketing, and so on.	279.8	13th
Organic inputs cost	279.2	14th
Level of satisfaction	**Frequency**	**Percentage**
High satisfaction	70	58.3
Low satisfaction	50	41.7
Total	120	100.0

3.5. Test of relationship between respondents' extent of involvement in organic agricultural practices and satisfaction with respect to the issues related to the value chain of organic fruits, vegetables and spices

Table 5 shows that there was a significant relationship between stakeholders' extent of involvement in organic agricultural practices and their satisfaction with respect to the issues related to the value chain of organic fruits, vegetables and spices (r= 0.223, p =0.01). This implies that organic agriculture sustainability is guaranteed, this is because the more the stakeholders are involved in organic agricultural practices, the more their satisfaction. It could also means that their satisfaction in the issues related to the value chain of organic fruits, vegetables and spices enhanced their involvement. Therefore, as much as organic agriculture is sustained, climate smart will be promoted and negative impacts of climate change is alleviated.

Table 5. Pearson product moment correlation analysis between respondents' extent of involvement in organic agricultural practices and satisfaction with respect to the issues related to the value chain of organic fruits, vegetables and spices.

Variable	r - value	P-value
Extent of involvement index* satisfaction index	0.233	0.011

1. **Significant p <0.05

4. Conclusions

The study concluded that majority of the organic stakeholders in the study area are youth, male, married and literates with average household sizes. They have high level of involvement in organic

agricultural practices, high level of climate smart's benefits derived from ecological organic agricultural practices as well as high satisfaction with issues related to the value chain of organic fruits, vegetables and spices.

Stakeholders benefited from climate smart elements such as greater net return, reduced exposure to pesticides and harmful chemicals, enhanced farm biodiversity, cleaner groundwater and surface water as well as reduced greenhouse gas emission. While, majority are satisfied with organic land tenure system, business risks, growth rate and future business plan as well as technical skills. Stakeholders' level of involvement in organic agricultural practices is related to their satisfaction with respect to the issues related to the value chain of organic fruits, vegetables and spices.

It is therefore recommended that ecological organic agricultural practices should be adopted for climate smart agricultural promotion by government, international donors and organizations in other to curb the negative effects of climate change in the country. This can be done by sustaining ecological organic agriculture practices through enhancing stakeholders' involvement in organic agricultural practices and issues related to their satisfaction in the value chain.

It is also recommended that stakeholders are frequently trained on issues of climate smart, as well as issues related to the value chain of organic fruits, vegetables and spices, so as to ensure their involvement in ecological organic agricultural practices and mitigate negative effects of climate change.

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