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Agricultural Education and Sustainable Practice of Precision and Organic Farming among Undergraduate Students in Tertiary Institutions in Imo State

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ABSTRACT

This study focused on agricultural education and sustainable practice of precision and organic farming among undergraduate students in tertiary institutions in Imo State. Two objectives and two research questions guided and answered in the study. The population of the study comprised 1,554 lecturers and students of Agricultural Education Departments from Federal University of Agriculture and Environmental Science Umuagwo and Imo State University

Owerri. The sample size was 318 respondents consisting lecturers and students which was determined using the Taro Yamane Formula. A multistage sampling technique was used to achieve this sample. To determine the validity of the instrument, copies of the instrument attached with the objectives and research questions were given to two experts in the Department of Agricultural Education Federal University of Agriculture and Environmental Science Umuagwo. The instrument was vetted in terms of relevancy, appropriateness, and language level, their recommendations and corrections were incorporated into the final version of the instrument before it was administered to the respondents in the study area. To determine the reliability of the instrument, twenty (20) copies of the instrument were administered to 15 students and 5 lecturers from a university outside the study area but with similar characteristics of the study population. The responses obtained were analyzed using the Cronbach Alpha method to determine internal consistency. A reliability coefficient of 0.83 was obtained, indicating that the instrument was reliable for the study. A structured research questionnaire developed by the researcher consisting of 20 items developed in four-point rating scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). Responses to the questionnaire were analyzed using mean and standard deviation in answering the research questions with an acceptance mean value of $\geq$ 2.50 otherwise rejected. The finding of the study among others shows that Agricultural Education contributes positively to students' knowledge, skills acquisition, environmental consciousness, and practical understanding of modern agricultural practices such as organic farming, but agricultural Education does not sufficiently promote precision farming among students in Imo State Universities. It was therefore recommended among others that, universities offering Agricultural Education programmes should provide modern technological facilities such as drones, GPS devices, soil testing kits, and digital mapping tools to improve students' practical exposure to precision farming techniques.

Introduction

Agriculture is of great importance to man due to its impact on food security, economic growth and livelihood of rural dwellers. In Nigeria, agriculture has come a long way and continues to play a crucial role in the country's development and there are still so much untapped potential resources in the sector which individuals need to be taught and harness to better their living standard. These potentials can be acquired through agricultural education. Agricultural Education according to Obibua in Osinem (2008) is an education and training given in agriculture from primary school through secondary and special schools, to the university. It provides students with sound academic knowledge and skills as well as ample opportunity to apply this knowledge through classroom activities, laboratory experiment, project participation and supervised agricultural experiences. Also, it is saddled with the responsibility of training undergraduates in several disciplines in agriculture (Koyenikan and Anozie, 2018). Agricultural

education also encompasses the training of students on the techniques of teaching agriculture to the training in developing competences in agricultural mechanics and electrification for sustainable food security. This programme exposes students to the various aspects of agriculture which include Horticulture, Plant science, animal science, farm mechanization among others. It also exposes students on the techniques needed to effectively pass this knowledge to others through utilization of experiential learning. The students could also be engaged in farming or non-farming occupation.

Most agricultural education curricula today consist of five areas of instruction. They include agricultural workshop, agricultural power and machinery, agricultural electrification, agricultural buildings and conveniences and soil and water management. These five general instruction areas are considered necessary for students to be successful in their areas of specialization.

According to Olaitan and Mama (2001), Agricultural Education equips students with technical knowledge and practical competencies necessary for improving agricultural productivity and sustainability. Through Agricultural Education, students gain understanding of sustainable agricultural systems and environmentally friendly farming practices. This supports the broader goals of university education in Nigeria, which include manpower development, innovation, and national transformation (Famade, Omiyale and Adebola, 2015). To achieve these goals, university is expected to integrate into their agricultural education programmes, innovative farming techniques such as precision and organic farming etc, in order to enable the students, acquire skills and competencies that is employable.

Precision farming is one of the emerging innovations in modern agriculture. It involves the use of technologies such as Global Positioning Systems (GPS), sensors, drones, geographic information systems, and data analytics to improve efficiency, increase crop yield, and minimize waste. This system of food production utilizes data and geographical positioning system, remote sensor for decision making. It makes use of analyzed data to apply inputs (fertilizers, water, pesticides) precisely where and when needed. Precision farming is a modern agricultural practice that utilizes advanced technologies such as Global Positioning Systems (GPS), Geographic Information Systems (GIS), drones, sensors, and data analytics to manage variability in the field thus enhance productivity. Gebbers and Adamchuk (2010) described precision agriculture as a major technological advancement capable of improving farm management and productivity. The integration of precision farming into Agricultural Education will expose students to digital agricultural technologies and enhances their readiness for modern farming practices (Gebbers and Adamchuk, 2010).

Organic farming is another important innovative farming technique. This emphasizes environmentally friendly agricultural practices through the use of natural soil enhancement methods and biological pest control while minimizing dependence on synthetic chemicals.

Mäderm, Fliessbach, Dubies, Gunst, Fried and Niggli (2002) noted that organic farming contributes significantly to environmental sustainability and long-term food security.

IFOAM (2021) further define organic farming as a sustainable agricultural system that emphasizes ecological balance, biodiversity conservation, and the use of natural inputs rather than synthetic chemicals. It seeks to produce healthy food in harmony with the environment by minimizing pollution and maintaining soil fertility through biological processes. In the face of environmental degradation, loss of soil quality, and health risks associated with synthetic agrochemicals, organic farming offers a sustainable alternative.

Nigeria faces significant challenges in achieving food security while preserving environmental integrity. The indiscriminate use of chemical fertilizers and pesticides has led to soil acidification, water contamination, and long-term health effects (Ayoola, 2010). Organic farming addresses these issues by emphasizing soil health, the use of compost and bio-fertilizers, crop rotation, and natural pest control. Agricultural education plays a central role in promoting organic agriculture by equipping students with the knowledge, values, and practical skills needed to implement and advocate for eco-friendly farming practices (Ezeano and Ezeano, 2019). Students develop skills for integration of organic farming in agricultural production through hands on experience in agricultural education programme. Areas such as compost and organic production of manure, biological pest control, crop rotation and intercropping, use of bio-fertilizers and green manures, seed preservation and use of indigenous varieties and organic livestock management. Nwachukwu, Odoemenam and Okafor (2021) is of the view that biofertilizers like Rhizobium, Azotobacter, and mycorrhizal fungi improve nutrient uptake by plants. Green manures

(crops grown and plowed back into the soil) improve organic content and structure. Students are trained to inoculate seeds and apply green manures like legumes to improve soil nitrogen. They further said, promotion of organic farming through agricultural education aligns with national efforts toward climate-smart and sustainable agricultural systems, especially as consumers increasingly demand healthy and environmentally friendly food options.

The success of precision and organic farming education also depends on well-trained educators and adequate resources. To enhance this, it is expected that there is the need for continuous professional development for educators to stay abreast of rapidly evolving technologies. Furthermore, the integration of experiential learning and knowledge transfer in agricultural education programmes through utilization of demonstration farms where students can experiment with and observe precision farming technologies in action play a role in promoting interests in modern farming techniques.

Lowenberg-DeBoer and Erickson (2019) noted that through developing comprehensive curricula, employing innovative pedagogical approaches, and investing in researches and resources, agricultural education will play an indispensable role in promoting the innovative farming thus, enhance profitability in agriculture. This will not only lead to increased agricultural productivity and profitability but also contribute significantly to environmental sustainability and food security. Consequently, effective integration of precision and organic farming into agricultural education curricula is paramount especially in Nigeria, where agriculture remains a vital sector. The embedding innovative farming concepts into university curricula can bridge the knowledge gap and promote adoption among young, tech-savvy students (Olawoye, Ogunlade and Adeola (2019).

Statement of the Problem

Agriculture remains a major contributor to food security, employment generation, and economic development in Nigeria. In ensuring the sustainability of food security, agricultural Education is expected to play a significant role in equipping and transferring to the students the knowledge, practical skills, and competencies innovative farming techniques. However, observations and previous studies have indicated that Agricultural Education programmes in some Nigerian tertiary institutions still face challenges such as inadequate practical facilities, insufficient technological exposure, limited integration of emerging agricultural innovations into the curriculum, and poor emphasis on experiential learning approaches (Adebayo and Oladele, 2021; Nwachukwu, Odoemenam and Okafor 2021). These limitations may affect students' readiness to adopt innovative farming techniques necessary for sustainable agricultural development. Furthermore, despite increasing global attention on sustainable and technology-driven agriculture, it is not clearly known to what extent Agricultural Education programmes in Imo State Universities promote innovative farming techniques such as precision and organic farming among students. The absence of empirical evidence by the researchers on this issue creates a knowledge gap requiring investigation. It is against this background that this study was design to ascertain agricultural education and sustainable practice of precision and organic farming among undergraduate students in tertiary institutions in Imo State.

Purpose of the Study

The main purpose of the study is to ascertained agricultural education and sustainable practice of precision and organic farming among undergraduate students in tertiary institutions in Imo State,

Specifically, the study sought to:

1. Ascertain the role of agricultural education in promoting sustainable practice of precision farming among undergraduate students in tertiary institutions in Imo State.
2. Examine the role of agricultural education in promoting sustainable practice of organic farming among undergraduate students in tertiary institutions in Imo State.

Research Questions

This study sought to answer the following questions:

1. What is the role of agricultural education in promoting sustainable practice of precision farming among undergraduate students in tertiary institutions in Imo State?
2. What is the role of agricultural education in promoting sustainable practice of organic farming among undergraduate students in tertiary institutions in Imo State?

Methodology

The study employed survey research design. Survey research design involves gathering of information or asking questions from a group of individuals called respondents. The population of the study comprised 1,554 lecturers and students in Agricultural Education Departments. This population included 73 agricultural education lecturers and 1,481 agricultural education students from two government-owned universities offering agricultural education programmes which are,

Federal University of Agriculture and Environmental Science Umuagwo and Imo State University Owerri. The sample size for this study was 318 respondents consisting lecturers and students. This was determined using the Taro Yamane Formula. A multistage sampling technique was used to achieve this sample. To determine the validity of the instrument, copies of the instrument attached with the objectives and research questions were given to two experts in the Department of

Agricultural Education Federal University of Agriculture and Environmental Science Umuagwo. The instrument was vetted in terms of relevancy, appropriateness, and language level, their recommendations and corrections were incorporated into the final version of the instrument before it was administered to the respondents in the study area. To determine the reliability of the instrument, twenty (20) copies of the instrument were administered to 15 students and 5 lecturers from a university outside the study area but with similar characteristics of the study population. The responses obtained were analyzed using the Cronbach Alpha method to determine internal consistency. A reliability coefficient of 0.83 was obtained, indicating that the instrument was reliable for the study. A structured research questionnaire developed by the researcher consisting of 20 items developed in four-point rating scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). Responses to the questionnaire were analyzed using mean and standard deviation in answering the research questions with an acceptance mean value of $\geq$ 2.50 otherwise rejected.

Results and Discussion

The data presentation is made in tables according to each research questions.

Research Question 1: What is the role of agricultural education in promoting precision farming amongst Imo State university students?

Table 1: Mean rating on the role of agricultural education in promoting precision farming among Imo State university students

S/N	Items	FUAES (n = 155)			IMSU (n = 163)			Aggregate		
		$\bar{x}$	SD	Rmks	$\bar{x}$	SD	Rmks	$\bar{x}$	SD	Rmks
1	Agricultural Education provides students with training and skills on the use GPS in farming.	2.19	1.05	D	2.03	1.02	D	2.34	1.04	D
2	It establishes awareness and knowledge of drones use in farming among students and lecturers	2.09	0.78	D	2.16	0.55	D	2.13	0.76	D
3	Agricultural education provides capacity building for soil mapping to university Students in Imo State.	2.10	1.05	D	2.66	1.14	A	2.38	1.11	D
4	Agricultural Education Equip Students with the potentials to practice precision farming for productivity	2.12	1.06	D	3.01	1.07	A	2.57	1.05	A
5	Agricultural Education promote skills on site specific management techniques among University Students in Imo State.	2.69	1.02	A	2.17	1.09	D	3.21	0.94	A
	Grand Mean/SD	**2.10**	**1.00**	**D**	**2.80**	**0.72**	**A**	**2.4**	**0.76**	**D**

Source: Field Survey Data, 2026

Table 1 presents the mean ratings of respondents from Federal University of Agriculture and Environmental Sciences (FUAES) and Imo State University (IMSU) on the role of Agricultural Education in promoting precision farming among students in Imo State Universities. The findings reveal that Agricultural Education provides students with training and skills on the use of GPS in farming, with mean ratings of 2.03 (SD = 1.02) for FUAES and 2.34 (SD = 1.04) for IMSU, giving an aggregate mean of 2.19 (SD = 1.05). Since the aggregate mean is below the benchmark mean of 2.50, respondents disagreed with the item. Similarly, Agricultural Education establishes awareness and knowledge of drone usage in farming among students, with mean ratings of 2.09 (SD = 0.78) for FUAES and 2.16 (SD = 0.55) for IMSU, and an aggregate mean of 2.13 (SD = 0.76). The aggregate mean being below the benchmark indicates disagreement among respondents. Furthermore, Agricultural Education provides capacity building for soil mapping to university students in Imo State, with mean ratings of 2.10 (SD = 1.05) and 2.66 (SD = 1.14) respectively, giving an aggregate mean of 2.38 (SD = 1.11). Since the aggregate mean is below

2.50, respondents disagreed with the item. Respondents, however, agreed that Agricultural Education equips students with the potential to practice precision farming for productivity, with mean ratings of 2.12 (SD = 1.06) for FUAES and 3.01 (SD = 1.07) for IMSU, giving an aggregate mean of 2.57 (SD = 1.05). Similarly, respondents agreed that Agricultural Education promotes skills on site-specific management techniques among university students in Imo State, with mean ratings of 2.17 (SD = 1.09) and 3.21 (SD = 0.94), and an aggregate mean of 2.69 (SD = 1.02).

The grand mean ratings for FUAES and IMSU were 2.10 (SD = 1.00) and 2.80 (SD = 0.72) respectively, while the overall aggregate grand mean was 2.40(SD = 0.76). Since the aggregate grand mean is below the benchmark mean of 2.50, the study concludes that respondents generally disagreed that Agricultural Education sufficiently promotes precision farming among students in Imo State Universities.

Research Question 2: What is the role of agricultural education in promoting organic farming amongst Imo State university students?

Table 2: Mean rating on the role of agricultural education in promoting organic farming amongst Imo State university students

S/N	Items	FUAES (n = 155)			IMSU (n = 163)			Aggregate		
		$\bar{x}$	SD	Rmks	$\bar{x}$	SD	Rmks	$\bar{x}$	SD	Rmks
1	Agricultural education provides knowledge of organic farming principles to University Students in Imo State.	3.04	1.11	A	2.73	1.06	A	2.89	1.09	A
2	Agricultural Education teaches students sustainable practices such as composting among others.	2.65	1.05	A	2.56	1.09	A	2.61	1.08	A
3	Establishes opportunities for training and capacity building.	2.55	1.12	A	2.69	1.07	A	2.62	1.10	A
4	Anchors and increased awareness of organic pest control.	2.83	1.08	A	2.90	1.01	A	2.87	1.05	A
5	Promotes knowledge of organic food standards and certification.	2.90	1.11	A	2.82	1.19	A	2.86	1.15	A
	Grand Mean/ SD	**2.79**	**0.85**	**A**	**2.74**	**0.85**	**A**	**2.77**	**0.86**	**A**

Source: Field Survey Data, 2026

Table 2 presents the mean ratings of respondents from Federal University of Agriculture and Environmental Sciences (FUAES) and Imo State University (IMSU) on the role of Agricultural Education in promoting organic farming among students in Imo State Universities. The findings reveal that Agricultural Education provides knowledge of organic farming principles to university students, with mean ratings of 3.04 (SD = 1.11) for FUAES and 2.73 (SD = 1.06) for IMSU, giving an aggregate mean of 2.89 (SD = 1.09). Since the aggregate mean is above the benchmark mean of 2.50, respondents agreed with the item. Similarly, respondents agreed that Agricultural Education teaches sustainable practices such as composting, with mean ratings of 2.65 (SD = 1.05) and 2.56 (SD = 1.09), giving an aggregate mean of 2.61 (SD = 1.08). Agricultural Education also establishes opportunities for training and capacity building, with mean ratings of 2.55 (SD = 1.12) for FUAES and 2.69 (SD = 1.07) for IMSU, resulting in an aggregate mean of 2.62 (SD = 1.10). This indicates agreement among respondents. Furthermore, Agricultural Education anchors increased awareness of organic pest control, with mean ratings of 2.83 (SD = 1.08) and 2.90 (SD

= 1.01), and an aggregate mean of 2.87 (SD = 1.05), indicating agreement. In addition, Agricultural Education promotes knowledge of organic food standards and certification, with mean ratings of 2.90 (SD = 1.11) and 2.82 (SD = 1.19), giving an aggregate mean of 2.86 (SD =

1.15). Respondents also agreed with the item. The grand mean ratings for FUAES and IMSU were

2.79 (SD = 0.85) and 2.74 (SD = 0.85) respectively, while the overall aggregate grand mean was 2.77 (SD = 0.86). Since the aggregate grand mean is above the benchmark mean of 2.50, the study concludes that Agricultural Education positively promotes organic farming among students in Imo State Universities.

Discussion of Findings

The findings of this study revealed that Agricultural Education plays a significant role in promoting innovative farming techniques among students in Imo State Universities, although the level of promotion varies across the different innovative farming practices examined.

The findings on precision farming revealed that Agricultural Education does not sufficiently promote precision farming among students in Imo State Universities. Respondents disagreed that Agricultural Education adequately provides training and skills on the use of GPS technology, drone applications, and soil mapping techniques. However, respondents agreed that Agricultural Education equips students with the potential to practice precision farming for improved productivity and promotes site-specific management skills. The aggregate grand mean of 2.40 (SD = 0.76), which falls below the benchmark mean of 2.50, indicates overall disagreement among respondents. This is in consonant with the idea of Lowenberg-DeBoer and Erickson (2019) which noted that through developing comprehensive curricula, employing innovative pedagogical approaches, and investing in researches and resources, agricultural education will play an indispensable role in promoting the innovative farming thus, enhance profitability in agriculture. On organic farming, the study found that Agricultural Education positively promotes organic farming among students through the provision of knowledge on organic farming principles, composting practices, organic pest control, training opportunities, and certification standards. The aggregate grand mean of 2.77 (SD = 0.86) indicates agreement among respondents that Agricultural Education contributes meaningfully to their understanding of organic farming practices. This is in agreement with Ezeano and Ezeano (2019) which says, agricultural education plays a central role in promoting organic agriculture by equipping students with the knowledge, values, and practical skills needed to implement and advocate for eco-friendly farming practices.

Also, with Nwachukwu, Odoemenam and Okafor (2021) who says the promotion of organic farming through agricultural education aligns with national efforts toward climate-smart and sustainable agricultural systems, especially as consumers increasingly demand healthy and environmentally friendly food options.

Conclusion

Based on the findings of this study, it was concluded that Agricultural Education plays a generally positive role in promoting innovative farming techniques among students in Imo State Universities, although the level of promotion varies across the different farming practices examined. “The study established that Agricultural Education contributes positively to students’ knowledge, skills acquisition, environmental consciousness, and practical understanding of modern agricultural practices such as organic farming, but agricultural Education does not sufficiently promote precision farming among students in Imo State Universities. The study further concluded that Agricultural Education strongly promotes sustainable and environmentally friendly agricultural practices through practical exposure, experiential learning, and innovationdriven instruction. However, despite the positive contributions of Agricultural Education, the study revealed that precision farming technologies such as GPS usage, drone applications, and soil mapping are still inadequately promoted among students, particularly in some institutions. Similarly, urban farming techniques such as hydroponics and efficient space utilization require greater emphasis and practical integration into agricultural training programmes.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Universities offering Agricultural Education programmes should provide modern technological facilities such as drones, GPS devices, soil testing kits, and digital mapping tools to improve students’ practical exposure to precision farming techniques.
2. Agricultural Education programmes should strengthen extension and community outreach services to facilitate knowledge transfer between universities and local farmers on innovative farming practices.

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