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Implementation of Biogas Technology Curriculum In Schools of Agriculture for Effective Management Of Agricultural Wastes in Commercial Farms In South-East, Nigeria

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Abstract: *This study is focused on implementing biogas technology curriculum in Schools of Agriculture for effective management of agricultural wastes in commercial farms in South-east, Nigeria. Four research questions guided the study. The study adopted descriptive survey research design. It was carried out in the 5 states that make up South-eastern Nigeria. The population for the study was 84 instructors in Schools of Agriculture in the study area. The entire population was involved in the study. A 47- item questionnaire was used for data collection. The instrument was validated by five experts. Cronbach Alpha reliability method was used to determine the internal consistency of the questionnaire. A reliability coefficient of 0.86, 0.87, 0.85 and 0.87 were obtained for each of the 4 clusters and 0.86 for the entire instrument. Eighty-four copies of the questionnaire were mailed to the respondents by the researchers. Eighty-one copies were returned and analyzed using mean and standard deviation to answer the research questions. It was found that the instructors in Schools of Agriculture have limited knowledge and skills in biogas technology. The attitude of the instructors towards the implementation of biogas technology curriculum in Schools of Agriculture was positive. They accepted to play effective roles for the success of the implementation. It was, therefore, recommended that the instructors should be retrained and that government should purchase and make instructional materials in biogas technology available to schools of agriculture, among others.*
Keywords*: Biogas Technology, Biogas Technology Curriculum, School of Agriculture, Agricultural Waste, Agricultural Waste Management, Commercial farm.*

I. Introduction

A farm is an agricultural land and /or building where crops are grown or animals are reared for economic purposes. Emone (2003) explained a farm as an area of land used for growing crops or raising animals for either small scale or commercial purposes. Commercial farm, according to Gold (2007), is the agricultural land or building where crops are grown or animals are raised mainly for the purpose of generating income for the owners (farmers). In commercial farms, agricultural waste is one of the major problems facing farm managers due to the quantity of wastes produced at a small interval. Lawal (1995) defined waste as any substance, solid, liquid or gaseous that remains as residue or an incidental by-product of the processing of substance or for which no use can be found by the organism or system that produces it. Okebukola (1996) viewed waste as any material that is no longer needed and, therefore, discarded. Achi and Maiyaki (2000) observed that wastes are classified conveniently with respect to their sources. Such sources include municipal waste, agricultural waste, and industrial waste among others. In this context, agricultural waste include any substance of plant or animal origin considered to be contaminated, spoiled, useless and unwanted in commercial farms. This could be solid, liquid or gaseous in nature.

Agricultural wastes are wastes produced from agricultural activities which consist of animal's slurry, silage, effluents, end of spray residues and empty plastic packaging (Ezegwu and Aniago, 2011). Lawal (2010) posited that agricultural wastes include faeces in different heaps and sizes, dead small and large animals, animal bones and scales, poultry waste, animal dung and blood especially around abattoir. Gasser (1994) submitted that agricultural wastes include dung, droppings, beddings and litter, wasted feed, run-off from feedlots and holding areas, and waste water from buildings like dairy parlors and fish ponds. It also includes waste of plant origin such as straws, chaff and animal beddings. The Ministry of Agriculture (1994) observed that agricultural waste can pollute surfaces, ground water and contribute to air pollution if not properly handled. It also occupies land surfaces that could have been used for agricultural activities and serves as a breeding ground for crop and animal pest, disease pathogens and other disease causing/ spreading organisms. The ministry added that many farm by-products and wastes can be economically valuable resources when managed correctly.

Waste management, is described by Lawal (1995) as the appropriate method of disposing waste safely in such a way that it is less harmful. This could be in form of waste treatment or energy conversion through primary, secondary or tertiary treatment. Milahan, Osaseber and Ameh (2012) stated that waste management is the organized and systematic channelling of waste through practically and technically appropriate recovery or disposal route in accordance with acceptable public safeguards. Agricultural waste management therefore is the proper and systematic channel of handling waste in commercial farms to generate useful resources with minimum destruction and environmental pollution. The first goal of any waste management like every management system is to maximize the economic benefit from the waste resources and maintain acceptable environmental standard. 1rtwange and Sha(2009) posited that waste management method used throughout the world are water prevention, recycling (eg composting), incineration with or without energy recovery and dumping / land filling. State Environmental Protection Agency in Ezugwu and Aniago (2011) cautioned that previously common practices of waste management are not now allowed; for example, burning of waste in the open spaces, using unlicensed farm tips or burying waste; putting farm waste in the household dustbin and so on. The agency maintained that agricultural waste can be avoided or minimized through product design, recycling schemes for waste, silage plastics and pesticides packaging; 'take-back' service for veterinary and machinery wastes and improved management practices such as biogas technology.

Biogas refers to a gas produced by the biological breakdown of organic matter in the absence of oxygen. Biogas, in the statement of National Non-Food Crop Centre (2011) is a gas produced by biodegradable materials such as biomass sewage, manure, municipal waste, green waters, faeces (dropping and dung), and kitchen waste among others. The Centre stated that biogas comprises primarily methane (CH4:60%), carbon (IV) oxide (CO2:29%) and may have small amount of hydrogen sulphide (H2S), moisture and Siloxanes. Biogas technology is the application of science on micro organisms for harnessing their breaking down of organic matter in an oxygen-free environment (anaerobic digestion) to produce methane and other products useful to man. Biogas technology, according to Food and Agricultural Organization (FAO, 1996) is advantageous because of the following.

- It produces gases that can be used directly as fuel for cooking or converted to power generator for electricity.
- It produces effluent which can be used as liquid fertilizer.
- The remaining slurry is also a good source of manure to enhance soil fertility.
- Slurry can also be dried and used as liquid fertilizer.
- Heat in the digester chamber kills pests, pathogens and other disease causing or spreading organisms in the environment.
- The construction of biogas chambers and its management provides employment opportunities for individuals.

Besides, Micheal and Cuellar (2008) noted that converting cow manure into methane biogas, instead of letting it decompose, reduces global warming gases by ninety- nine million metric tones or four percent. Many educational institutions now have Biogas Technology included in their curriculum to prepare graduates that are involved in agricultural waste management. One of such institutions is the school of agriculture. Food and Agriculture organisation, FAO (1996) reported that more people and institutions are getting involved in biogas technology as users, technicians, extension workers, researchers, trainers, supervisors and investors which give rise to the need for suitable training programmes along with the development of high quality training manual and curriculum for sustainable growth of biogas sector. It was further reported by FAO that the contents of a sustainable curriculum of biogas technology include: system approach in biogas technology, relevance of biogas technology, biogas programmes, and utilization of slurry as feed and fertilizer and field visits for observation of biogas plant. The curriculum should also cover extension support services for biogas, installation cost and financial viability, subsidy and institutional financing, quality standards, monitoring and evaluation. Effective implementation of the curriculum would help the schools and graduates to reap the advantages of Biogas Technology in agricultural waste management. Effective implementation of biogas curriculum requires professional teachers/facilitators who are well trained, skilled and knowledgeable to present relevant and timely information to students to survive the new wave of technological advancement and utilization.

A School of Agriculture is a monotechnic with a 4-year study in Agriculture programme intervened with one or two years of work experience between ordinary National Diploma and Higher National Diploma (Olaitan, Amusa and Nwobu, 2009). During the course of the 4-year programme, instructors are expected to equip the students with knowledge, skills and attitude in areas of crop production, animal production, soil science, health management of plants and animals, agricultural waste management and others. The authors emphasized that it was the view of National Board for Technical Education (NBTE) that students could embark on self or paid employment in his/her area of study on graduation from a School of Agriculture.

In the area of the study, a pilot study carried out revealed that 9 out of 13 registered commercial farms are managed by graduates of schools of Agriculture. The study revealed that the graduates of agriculture singled

out agricultural waste management as the most environmental challenges bothering them. Such wastes include poultry dropping, pig dung and stalk and chaff of grains cereals. They admitted that the method of agricultural waste management such as composting of organic / farmyard manure, burning of waste and disposal (land fill) which they were taught in schools are not much effective and even prohibited by law, hence the innovation as biogas technology is highly needed for effective management. This confirms that a gap exist between what is taught to students in schools of agriculture and what they need to effectively manage agricultural wastes in the field as farmers or farm managers. Research has shown that effective implementation of innovations such as biogas technology curriculum in schools of agriculture could properly abridge the existing gap. Smith (1989) noted that the techniques of biogas technology are among the most complex and widely applied innovation in our time. The pilot study by researchers revealed that implementation of biogas technology aspect of the curriculum of schools of agriculture would greatly assist schools, students and the general public in the management of agricultural wastes. The major question, therefore, arose have the instructors the knowledge, skills and attitudes to teach students effectively the contents of Biogas Technology curriculum for effective management of agricultural wastes in schools of Agriculture in Nigeria.

Statement of Problem

In the area of study, the rapid increase in human population has made farmers expand their scale of production. This led to generation of enormous agricultural wastes that are difficult and cumbersome to manage by commercial farm managers. Most of the farm managers who are graduates of schools of agriculture adopt old methods of agricultural waste management which they were taught while in schools. Some of these methods such as burning of waste, burying of waste and waste disposal cause health hazard and environmental pollution. For instance, burning of agricultural waste causes depletion of ozone layers and increases global warming. Besides, waste disposal occupies agricultural land, pollutes water bodies and serves as a breeding habitat for pest and disease pathogens. As a result, the government of Nigeria through the Environmental protection Agency of different states has placed embargo on indiscriminate waste burning and disposal.

The implication is that the problem of Agricultural waste management will persist if a scientific innovation like biogas technology curriculum is not implemented in schools whose duty it is to manage Agricultural resources. One of such schools is the school of agriculture. It is also believed that successful implementation of biogas technology curriculum will enable prospective graduates of Schools of Agriculture to manage Agricultural waste in commercial farms effectively. Although, the degree of success, to a great extent, depends on the competence and mastery of the instructors in biogas technology, the competence and mastery of the instructors of biogas technology has not been verified and determined hence this study.

Purpose of the Study

The purpose of the study is to determine how biogas technology could be integrated into the curriculum of schools of agriculture for effective management of agricultural waste in commercial farms in south-east, Nigeria. Specifically, the study determined:

1. Level of knowledge possessed by instructors for implementing biogas technology curriculum in schools of agriculture for effective management of agricultural wastes in commercial farms in South-East, Nigeria.
2. Level of skills possessed by instructors for implementing biogas technology curriculum in schools of agriculture for effective management of agricultural wastes in commercial farms in South-East, Nigeria.
3. Attitudes of instructors towards the application of biogas technology for effective management of agricultural wastes in commercial farms in South-East, Nigeria.
4. Roles of instructors in implementing biogas technology curriculum in Schools of Agriculture for effective management of agricultural wastes in commercial farms in South-East, Nigeria.

Research Questions

1. What is the level of knowledge possessed by instructors for implementing biogas technology curriculum in schools of agriculture for effective management of agricultural wastes in commercial farms in South-East, Nigeria?
2. What is the level of skill possessed by instructors for implementing biogas technology curriculum in schools of agriculture for effective management of agricultural wastes in commercial farms in South-East, Nigeria?
3. What are the attitudes of instructors towards the application of biogas technology for effective management of agricultural wastes in commercial farms in South-East, Nigeria?
4. What are the roles of instructors in implementing biogas technology curriculum in Schools of Agriculture for effective management of agricultural wastes in commercial farms in South-East, Nigeria?

II. Methodology

Four research questions were developed to guide the study. Survey research design was used for this study. Olaitan, Ali, Eyoh and Sowande(2000) described survey research design as a plan, structure and strategy that the investigators wants to adopt in order to obtain solutions to research problem. The authors maintained that it guides the investigator in the process of collecting, analyzing and interpreting observations. A descriptive research design was appropriate for determining the knowledge, skills, attitude and roles of instructors for the study. The study was carried out in south-eastern, Nigeria. The population for the study is 84 instructors of animal and crop production in schools of Agriculture. The population frame was established using directory of instructors in schools of Agriculture in South-east, Nigeria. The entire accessible population, (a census) was used for the study because of the size was manageable. A 47-item questionnaire that covers knowledge possessed by instructors, skills possessed by the instructors, attitude of instructors towards biogas technology and roles of instructors in integrating biogas technology into the curriculum of schools of Agriculture developed from literature and interview guide were used for data collection. The questionnaire had two parts: A and B. Part A was used to obtain information on personal data of the respondents. Part B was divided into 4 sections of possessed level of knowledge, skills attitude and roles of instructors with different response options. Each of the response options had a corresponding value of 4, 3, 2 and 1 respectively. The revised copies of the questionnaire were given to a panel of five experts; two from Songhai Centre, Republic of Benin, two from Enugu State Songhai Centre, Adani and one from Energy Centre, University of Nigeria, Nsukka to establish face-validity of the questionnaire items. A panel of instructors serving in a College of Agriculture, Kano State was used to pilot test the questionnaire. Eighteen copies of the questionnaire were administered to the instructors and the data collected were used to establish the reliability of the questionnaire items. The reliability of the 4 constructs: knowledge about biogas technology, skills in biogas technology, attitudes towards biogas technology and roles of instructors in implementing biogas technology curriculum in schools of Agriculture were found to be 0.86, 0.87, 0.85 and 0.87 for the four clusters. Because the questionnaire was found to be reliable and the researchers used the entire population of instructors, the data collected during the pilot study was included in the final analysis. To add value to the data collected from the questionnaire, 10 instructors of the school of agriculture in the study area were interviewed to address specific areas of the research questions. Their views were used during data analysis.

In data collection, Dillman's (2000) suggestions for constructing survey instruments, cover letters and follow-up strategies were adopted. A survey with cover letter was sent to each of the instructors in the area of the study through mail. After two weeks, a follow-up letter was sent to remind those who delayed responding to the questionnaire that their cooperation was essential. A total of 81 copies of the questionnaire were returned representing 96.43 percent return rate. Data collected for the study were analyzed using mean and standard deviation to answer the research questions. In decision making, the real limit of numbers will be utilized. Also the data collected qualitatively were analysed using qualitative content analysis.

III. Results

The results of the study were obtained from the research questions answered.

Research Question 1

What is the level of knowledge possessed by instructors about biogas technology?

The data for answering research question 1 are presented in table one.

Table 1: Mean Ratings and Standard Deviation of Responses of Instructors on their Level of Knowledge about Biogas Technology

S/N	Knowledge areas of biogas technology	$\overline{X}$	SD	Remarks
1.	Content of biogas technology	3.51	0.82	Knowledgeable
2.	Site selection and construction of biogas chamber.	2.10	0.92	Little knowledge
3.	Preparation of biogas chamber.	1.76	1.01	Little knowledge
4.	Quality and Quantity of input matters.	1.64	1.90	Little knowledge
5.	Charging of biogas chamber.	1.24	1.04	No knowledge
6.	Sowing of micro organisms.	1.33	1.23	No knowledge
7.	Agitation of the substrate	1.98	1.08	Little knowledge
8.	Monitoring of the chamber environment (eg temperature, PH).	2.67	1.53	Some knowledge
9.	Harvesting of biogas.	1.05	1.33	No knowledge.
10.	Purification of biogas	1.47	0.93	No knowledge.
11.	Utilization of biogas	3.56	1.09	Knowledgeable
12.	Drainage and evacuation of effluent and slurry.	2.37	1.40	Little knowledge.
13.	Management of biogas chamber and accessories.	1.94	1.44	Little knowledge.
	Precautionary measure to produce good quality and quantity of biogas.	2.54	1.67	Some knowledge

X = mean, SD = standard deviation, knowledgeable = 3.50 – 4.00, some knowledge = 2.50 - 3.49, little knowledge= 1.50 - 2.49, no knowledge = 1.00 – 1.49.

The data presented in table 1 revealed that items 1 and 11had their mean scores as 3.51 and 3.56 respectively. This indicated that the instructors are knowledgeable enough on the two items. Also, items 8 and 14 had their mean score as 2.67 and 2.54 and were adjudged to have some knowledge on the items. This indicated that the instructors have some knowledge about biogas on the two items. Five out of 14 items had their mean score ranging from 1.64 to 2.37. This indicated that the instructors have little knowledge about biogas on the 5 items. The table also revealed that four out of fourteen items had their mean score ranging from 1.24 to 1.47. This indicated that the instructors have no knowledge of the 10 items about biogas technology.

Generally, the overall mean of the responses is 2.06 which is within the range of little knowledge. This indicates that instructors in schools of Agriculture generally possess little knowledge about biogas technology. The standard deviation ranged from 0.82 to 1.67, indicating that the respondents were not very far from the mean and from one another in their responses.

Research Question 2

What is the level of skill possessed by instructors in biogas technology for waste management?

The data for answering research question 2 are presented in table 2.

Table 2: Mean Ratings and Standard Deviation of Responses of Instructors on their Level of Skills in Biogas Technology for Waste Management

	Skills in biogas technology.	$\overline{X}$	SD	Remarks
1	Provide technical skill on construction of biogas chamber.	1.06	1.02	Not skilled
2	Wash biogas chamber for preparation.	1.27	0.72	Not skilled
3	Identify quality and quantity of input matters.	2.07	1.22	Lowly skilled.
4	Mix inputs matters and charge biogas chamber.	1.40	1.34	Not skilled.
5	Introduce micro organism into the biogas chamber.	1.34	1.71	Not skilled.
6	Position appropriate instruments to measure temperature and PH of the chamber environment.	2.44	1.90	Lowly skilled.
7	Agitate the substrate using appropriate instrument.	1.41	1.23	Not skilled.
8	Connect pipes and overhead tank properly to harvest biogas.	1.11	0.97	Not skilled.
9	Pass biogas through appropriate agents for purification	1.33	1.62	Not skilled
10	Turn the knob of the tank for biogas usage.	2.41	1.29	lowly skilled
11	Drain and evacuate affluent and slurry at the appropriate time.	1.10	0.55	Not skilled.

X = mean, SD = standard deviation, highly skilled = 3.50 – 4.00, averagely skilled = 2.50 - 3.49, lowly skilled = 1.50 - 2.49, not skilled = 1.00 – 1.49.

The data presented in table 2 revealed that 3 out of 11 items had their mean scores ranged from 2.07 to 2.44. This indicated that the instructors are lowly skilled on 3 items in biogas technology. The table also revealed that 8 out of 11 items had their mean score ranged from 1.06 to 1.41. This indicated that the instructors are not skilled on 8 items in biogas technology.

Generally, the over all mean of the responses is 1.54 which is within the range of low skills. This indicates that the instructors in schools of Agriculture are lowly skilled in biogas technology for waste management. The standard deviation ranged from 0.55 to 1.90, indicating that the respondents were not very far from the mean and from one another in their responses.

Research Question 3

What is the attitude of instructors towards biogas technology application in waste management?

The data for answering research question 3 are presented in table 3.

Table 3: Mean Ratings and Standard Deviation of the Responses of Instructors on their Attitude towards Biogas Technology in Waste Management

S/N	**Instructors' attitude towards biogas technology**	$\overline{X}$	**SD**	**Remarks**
1.	Biogas should be a topic in agriculture waste management practices.	3.62	0.88	Strongly agree.
2.	Biogas is environmentally friendly.	3.54	0.94	Strongly agree
3.	I can source local materials that should be used in teaching biogas technology.(in preparation)	3.03	1.20	agree
4.	I support that government at all levels should finance establishment and management of biogas technology in schools.	3.74	1.38	Strongly agree
5.	I encourage that affluent and slurry should be used as fertilizer to crops.	3.66	0.89	Strongly agree
6.	I support that slurry of biogas should be used as animal feed.	3.57	1.51	Strongly agree.
7.	I support the use of biogas technology for environmental	3.50	1.09	Strongly agree.

	sanitation.			
8.	The smell of biogas of good quality is aromatic.	3.22	1.62	Agree.
9.	Biogas technology should be taught to students by experienced instructors.	3.52	0.97	Strongly agree
10	I wish to be trained in biogas technology.	3.71	1.00	Strongly
11	I support the use of biogas technology for generating energy.	3.92	1.77	Strongly agree

X = mean, SD = standard deviation; strongly agree = 3.50 – 4.00, agree = 2.50 - 3.49, disagree = 1.50 - 2.49, strongly disagree = 1.00 – 1.49.

The data presented in table 3 revealed that 9 out of 11 items had their mean score ranged from 3.50 to 3.92 and were within the real limit described agreed. This indicated that the instructors have strong positive attitudes towards the 9 items of biogas technology. The table also revealed that two out of 11 items had their mean score as 3.03 and 3.22 and were above and are described as just agreed. This indicated that the instructors have positive attitudes towards the 2 items of biogas technology.

Generally, the over all mean of the responses is 3.54 which is with the range of strongly agree. This indicates that the instructors in schools of Agriculture strongly agreed on inclusion of biogas technology in the curriculum of schools Agriculture. The standard deviation ranged from 0.88 to 1.77, indicating that the respondents were close to each other in their responses.

Research Question 4

What are the roles of instructors in implementing biogas technology in the curriculum of Schools of Agriculture for waste management?

The data for answering research question 4 are presented in table 4.

Table 4: Mean Ratings and Standard Deviation of the Responses of Instructors on their Role on Biogas Technology for Waste Management

S/N	Role of instructors.	$\overline{X}$	SD	Remarks
1.	Teach students about biogas technology.	3.94	1.29	Strongly agree
2.	Educate school authority about biogas technology.	3.55	1.08	Strongly agree
3.	Educate farmers / Agriculturists about biogas technology	3.20	0.74	Agree
4.	Educate public policy makers about biogas technology.	3.65	0.86	Strongly agree
5.	Develop publication about biogas technology.	3.70	1.43	Strongly agree
6.	Stage campaign about biogas technology.	3.45	0.91	Agree
7.	Involve students and farmers in issues relating to biogas technology.	3.65	1.33	Strongly agree
8.	Educate biogas users about its value and uses.	3.60	1.01	Strongly agree
9.	Sponsor meeting and campaign related to biogas technology.	3.04	0.81	Agree
10.	Conduct research in biogas technology for improvement.	3.57	0.99	Strongly agree
11	Distribute innovation and publication about biogas technology.	3.86	0.64	Strongly

X = mean, SD = standard deviation; strongly agree = 3.50 – 4.00, agree = 2.50 - 3.49, disagree = 1.50 - 2.49, strongly disagree = 1.00 – 1.49.

The data presented in table 4 revealed that 8 out of 11 items had their mean ratings ranged from 3.50 to 3.92 and were within the real limit of 3.50 and 4.00. This indicated that the instructors strongly agreed on the 8 items as their roles in biogas technology. The table also revealed that two out of 11 items had their mean ratings as 3.04 and 3.20 and were within the real limit of agreed. This indicated that the instructors agreed on the 2 items as their roles in biogas technology.

Generally, the over all mean of the responses is 3.56 which is with the range of strongly agree. This indicates that the instructors in Schools of Agriculture strongly agreed on their roles in biogas technology if included in the curriculum of schools Agriculture. The standard deviation ranged from 0.64 to 1.43, indicating that the respondents were close to each other in their responses.

IV. Discussion of results

The results of this study in Table1 revealed that instructors in schools of Agriculture have little knowledge about biogas technology. This is in line with the finding of Boone, Bonne and Hughes (2006) that Agricultural education teachers globally and especially in West Virginia had limited knowledge of biotechnology topics. The teachers perceived themselves as having more knowledge of biotechnology topics that have traditionally been associated with agriculture (animal reproduction, hybridization) and less knowledge on topics that are associated with other field such as environmental biotechnology and human genetics. The finding of the study in table 2 implies that the instructors need improvement for them to be able to teach biogas technology curriculum to students of Schools of Agriculture in South-east, Nigeria.

The result of the study in Table 2 revealed that the instructors in schools of Agriculture are slightly skilled in biogas technology for effective teaching of students in schools agriculture. This implies that the instructors are not adequately skilled to teach biogas technology to teach students of Schools of Agriculture and hence requires improvement. The result of the study are in consonance with the findings of Asogwa, Ikelusi and

Mohammed (2012) in a study carried on skill improvement of instructors in teaching carrot production to students in schools of Agriculture in South-eastern Nigeria, where it was found out that instructors needed improvement in 17 skills in planting and pre-planting operations, 14 skills in planting and post planting operations and 14 skills in harvesting and post harvest operations of carrot production for effective teaching of students in Schools of Agriculture in South Eastern Nigeria.

The result of the study in Table 3 revealed that the attitude of instructors in schools of Agriculture towards implementation of biogas technology curriculum in Schools of Agriculture in South-east, Nigeria is positive. The findings of this study is in agreement with the observations of Balschweid, Thompson and Cole(2000) that participation in an integrated agriculture and science curriculum implementation by pre-service teachers resulted in a more positive attitude and increase their willingness to attend workshops for a more effective implementation. The teachers believed that effective implementation of the curriculum would assisted students in better understanding of science concepts and their application to Agriculture.

The result of the study in Table 4 revealed that the instructors strongly agreed to perform their roles in implementing biogas technology curriculum in schools of Agriculture in Southeast, Nigeria. Olaitan and Mama (2001) stated that the role of a teacher of agriculture in schools include to impart knowledge and skills to students in various areas of agriculture such as crop production, soil science, animal science, forestry, fisheries and agricultural management; stimulate students' interest to participate in agricultural activities in the school; encourage students to promote the growth and development of agriculture in the school through co-operative and clubs, among others.

The knowledge and skills of instructors in schools of agriculture about biogas technology is limited. The instructors need capacity building for them to be able to teacher biogas technology to students effectively. The attitude of the instructors towards biogas technology is positive. This implies that the instructors are willing to attend workshops and seminars to improve their knowledge and skills in biogas technology for successful instructions. The instructors strongly agreed that the implementation of biogas technology in the curriculum of Schools of Agriculture is their role and will take to their anus for effective teaching and learning of biogas technology in the schools. This will, on graduation, enable the students to carry out agricultural waste management in farms efficiently.

Summary

Agricultural waste has become a serious challenge to commercial farm managers. Biogas technology could be used to manage agricultural waste efficiently without adverse effect on the environment. It should be effectively implemented in schools of agriculture to enable its graduates manage agricultural waste well on employment in commercial farms. The instructors of Schools of Agriculture are not knowledgeable and skilled enough to teach biogas technology, but have accepted that it is their responsibilities to implement the content of the curriculum such as biogas technology to students. Therefore, they are willing to embrace capacity-building to enable them make their products fit in the world of work. It was therefore recommended that:

1. biogas technology should be effectively implemented in schools of agriculture.
2. in-service training should be provided for instructors in schools of Agriculture on biogas technology.
3. instructional materials on biogas technology should be adequately purchased and made available for instructors in schools of Agriculture.
4. The study should be replicated on regional and/or national bases for possible generalization.

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