IJVOCTER: International Journal of Agricultural and Home Economics Education (IJAHEE)
Volume 1, Number 1 (Sep. 2014)
ISSN: 2449-1519. www.ijvocter.com

# Quality Assurance of Lecturers of Agricultural Education in Teaching Composting to Students of Colleges of Education for Climate Change Mitigation in North Central, Nigeria

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## Abstract

*This study x-rayed quality assurance of lecturers of agricultural education in teaching composting to students of Colleges of Education for climate change mitigation in North Central, Nigeria. Three specific purposes guided the study. The research design for this study was survey. The population of the study was 55 which constituted the sample for the study. An instrument for the study was Lecturers Composting Quality Assurance Questionnaire (LCQAQ). The LCQAQ was face and content validated by three experts. Cronbach Alpha reliability method was adopted to determine the internal consistency of the instrument which yielded a reliability coefficient of 0.86. The data collected were analyzed using weighted mean and Improvement Need Index. It was found out that the lecturers of agricultural education in Colleges of Education are of low quality assurance in 16 items in identification of organic materials used for composting manure, 14 items on aerobic method of composting manure and 22 items on anaerobic method of composting manure for mitigation of climate change mitigation in North Central, Nigeria. Recommendations were made based on the findings of the study.*

**Keywords:** quality assurance, lecturers of agricultural education, teaching, composting, climate change, mitigation

## Introduction

Climate change is menace affecting the whole world in recent years. Climate change is reported to be a shift in or deviation from the state of climate that can be identified by changes in the mean and/or the variability of its properties which persists for an extended period typically decade or longer (IPCC, 2007). The climate is said to have changed when the sequence of occurrence of weather events have shifted significantly from what they used to be over a period of time (Food and Agriculture Organization FAO, 2008).

Climate change is caused by the increasing amount of greenhouse gases in the atmosphere. Greenhouse gases are gaseous substances such as carbon dioxide, methane, nitrous oxide, chlorofluorocarbons and hydro-chlorofluorocarbons. These gases, when present in large quantities in the atmosphere, absorb sunrays thereby preventing infra-red radiation, thus increasing the temperature of the atmosphere, oceans and land masses (IPCC, 2007). These gases can be produced from natural factors such as volcanic eruptions, variations in the sun's intensity or anthropogenic (man-made) factors such as fossil fuel burning, changes in land use through agriculture and other human activities on the soil, application of inorganic fertilizers containing nitrogen. (Farouta,Idrisa, Egbule and Agu, 2011).Climate change has direct and indirect effect on human life. Directly, climate change affect agricultural productivity as yield is drastically reduced, natural disasters increases in occurrence such as drought, flood, storms, and incidences of pests and diseases that attack crops heightens. (Hassan and Nhemacena, 2008). Early cessation of rains, shortened rainy season which leads to decreased supply and available water are also common scenarios (Mohammed, 2009).

IPCC (2009) reported that climate change affect man by altering the conditions of food safety and changing the disease pressure from vector, water and food-borne diseases. IPCC further stated that health hazards such as skin eruptions, heat fatigue, and heat stroke are also increased as a

result of climate change. climate change indirectly affect the socio-economic life of human beings as there is in-adequate food for the growing population of the world, difficulty in the provision of shelter and clothing due to loss in agricultural productivity (Hassan and Nhemachena, 2008).In Africa, IPCC report predicted that millions of people will be exposed to water stress, reduction of crop yield from rain-fed agriculture up to 50%, thus compromising access to food by 2020 especially in developing countries like Nigeria. The increase in the temperature of the earth is already having negative effect on Nigerian's economic, social life, health, water resources and scientists have predicted the continuation of this scenario (Odjugo, 2012). This, therefore, calls for urgent steps to be taken by government, institutions of learning and individuals to abate the accumulation of these greenhouse gases in the atmosphere. This could be done through teaching of climate change mitigation measures to students of agricultural education in colleges of education who will convey the information to further generations in primary and secondary schools.

Climate change mitigation measures refer to the actions taken to limit the magnitude and/or rate of long term climate change (United Nations Environment Program, UNEP 2003). According to UNEP (2003), climate change mitigation entails all efforts to reduce or prevent emissions of greenhouse gases. The organization emphasized that mitigation could mean using new technologies and renewable energies, making older equipment more energy efficient or changing management practices or consumer behavior, protecting natural carbon sinks like forests and oceans or creating new sinks through silviculture or green agriculture. In this context, climate change mitigation involves all efforts towards controlling or preventing accumulation of nitrous oxide, methane and other greenhouse gases from being released to the atmosphere. This could be done through several agricultural practices among which include application of compost fertilizer.

Compost, according to Asogwa (2014), is a good organic material that can be used to increase mineral nutrients to the soil instead of inorganic fertilizers such as NPK, ammonium sulphate etc, which can release nitrous oxide, methane, (greenhouse gases) to the atmosphere, thus accelerating climate change. Composting is the process of bringing together waste and residue from plants and animals to produce organic fertilizer (Emone, 2003). Stephens and Kostewicz (2010) enumerated the advantages of composited organic manure to include; improvement of the quality of the soil by binding together soil particles thereby increasing water and nutrient rich soil that is needed to maintain healthy and productive crops. Other importance of compost manure as reported by Alberta Agriculture (2004) are that it improves the soil structure and makes the soil to be crumbly, makes it easier for the plant roots to penetrate the soil, helps to bind soil particles together and increase water and nutrient retention ability of the soil. Compost improves the texture of clay soil by binding together with clay particles thereby creating bigger air spaces between them; compost adds both micro and macro elements needed by plants for growth and development (Alberta Agriculture 2004).

There are two main methods that can be employed to make compost, the heap method and the pit method (Asogwa, 2014). The heap method involves piling the composting materials in a heap while pits are dug, vegetables and animal wastes to be composted are piled in layers in some pits, which are then moved into other pits subsequently. Materials that can be used for composting include leaves, roots and stubbles, crop residue – straw, hedge clippings, weed, saw dust, kitchen wastes and others. Due to the importance of composted organic manure in mitigation of climate change, it becomes necessary that the procedures in composting manure be taught to students of agriculture in colleges of education for future environmental sustainability.

A student is someone who is admitted into a college or a university (Miriam 2012). In the statement of Collins (2013), a student is a learner who attends a school to seek knowledge from professional teachers or books. In the context of this study, students are learners who gained admission into colleges of education to study or acquire knowledge and skills in agricultural programs.

A College of Education, according to National policy on Education (2004) is a tertiary institution that prepares individuals to become teachers in a particular subject within three years. This form of teacher preparation qualifies the students to obtain a National Certificate in Education (NCE) that enables them teach their subject area of specialization to students/pupils in the secondary and primary school. Colleges of education offer several programs to students such as agricultural education. Ukonze and Olaitan (2010) posited agricultural education as a program designed for equipping learners with knowledge, skill and attitudes in teaching and technical areas of agriculture to enable them impact same knowledge, skills and attitude to students in schools and colleges. National

Commission for Colleges of Education, Minimum Standard (2009) stated the objectives of agricultural education program as to:

i. prepare graduates with the right attitude to, and knowledge/professional competence in vocational competence in vocational agriculture;
ii. produce teachers who will be capable of motivating students to acquire interest in and aptitude for agriculture.
iii. develop in the student teachers the appropriate communicative skills for effective transmission of agricultural information and skills to the student in the context of their environment.
iv. equip the student teachers with adequate knowledge and ability to establish and manage a school farm effectively.
v. Provide a sound background to enhance further academics and professional progression of the student – teachers.

All these objectives are actualized with the aid of lecturers of agricultural education in colleges of education.

According to Isiwu and Okonkwo (2013), a lecturer of agricultural education is someone who had gone through a teacher preparatory program in the university and is responsible for imparting knowledge, skills and attitudes in agriculture to students in the subject. A lecturer, in the context of this study, is an individual who has been trained both in the methodology and technical aspects of agriculture in a university and is teaching relevant courses to students of agriculture in Colleges of Education. The lectures teach courses in the program to students, assess them for mastery before certification from Colleges of Education as holders of Nigeria Certificate in Education (NCE).

Teaching, in the submission of Ubale, Mohammed and Kura (2011) is a process of manipulating variables of instructions to produce intended changes in learners' behavior. Teaching, in this study refers to the process of inculcation knowledge, skills and attitudes in composting to students in a systematic manner under a definite period of time. In the area of study, the researchers discovered that graduates of agriculture from Colleges of Education apply only inorganic fertilizers to crops on the school farm. During teaching practice supervision, the researchers observed that all the 7 secondary schools visited had neither pits nor plots for preparation of organic manure (composting). Most principals of the schools visited when interviewed by the researchers, expressed disappointment from the NCE teachers of agriculture in junior secondary schools with regards to composting. The principals explained that they have adequate school farms with spaces and vegetation to carry out composting yet the teachers of agriculture only demand money from them to purchase inorganic fertilizer every year. They wondered the type of training the teachers had while they were in Colleges of Education with regards to use of organic fertilizer in the farms. This made the researcher wonder what could be the long time effect of continued use of synthetic fertilizers by teachers of agriculture in Benue State.

However, IPCC (2007) report pointed out that agro-chemicals such as herbicides, inorganic fertilizers contribute to the increasing level of greenhouse gases in the atmosphere that result to anthropogenic global warming. This implies that there will be increase in global warming in Benue State if the use of inorganic fertilizers by teachers of agriculture in secondary schools is allowed to continue unabated. The question now is what is the quality assurance of the lecturers of agricultural education in composting for effective preparation of their students in Colleges of Education?

Quality assurance, by Campbell and Rosznyai (2002) is all embracing efforts covering policies and actions through which the worth of higher education is determined and maintained. According to Hornby in Asogwa, Uko and Omeh (2010), quality assurance is the practice of managing the way services are provided to make sure they are kept at high standard. Alaribe, Ellah and Olaitan (2013), viewed quality assurance as the process of obtaining evidence that teachers are competent in implementing the content of a subject curriculum in schools. With reference to this study, quality assurance is the process of obtaining evidence on the technical competence of the lecturers in composting for effective preparation of students in Colleges of Education in North Central, Nigeria. Such evidence could be ascertained through assessment of the lecturers in composting manure.

Assessment, according to Okoro (2000) is an evaluation that uses collected data for estimating the worth, quality or effectiveness of a programme or project. Okoro further stated that assessment is documenting in measurable terms, knowledge, skills, attitudes and beliefs of an

individual group of people, a policy or institution or the educational system as a whole. With reference to this study, quality assurance is the process of obtaining evidence on the technical competence of the lecturers in composting for effective preparation of students in Colleges of Education. Therefore, the purpose of this study was to determine quality assurance of lecturers of agricultural education in teaching composting to students of Colleges of Education for climate change mitigation in North Central, Nigeria. Specifically, the study sought to determine quality assurance of lecturers of agricultural education in:

1. identifying organic materials used for composting manure.
2. aerobic method of composting manure for climate change mitigation.
3. aenarobic method of composting manure for climate change mitigation.

## Research Questions

1. What is the quality assurance of lecturers in identifying the organic materials used for composting manure?
2. What is the quality assurance of lecturers in aerobic method of composting manure for climate change mitigation?
3. What is the quality assurance of lecturers in anaerobic method of composting manure for climate change mitigation?

## Methodology

The research design for this study was survey. Survey research design was used because the study made use of structured questionnaire which was used to elicit response from the sampled respondents and the findings were generalized on the whole population. The study was carried out in Colleges of Education in the North-central zone of Nigeria which comprises Benue State, Nasarawa, Kwara, Kogi, Niger and Federal Capital Territory. The population of the study was 55 made up of 32 lecturers of agricultural education in Colleges of Education and 23 lecturers of agricultural education in universities. The entire population was involved in the study because of it manageable size.

An instrument titled: Lecturers Composting Quality Assurance Questionnaire (LCQAQ) developed by the researchers from literature reviewed was used for data collection from the respondents. The LCQAQ had 52 items. The questionnaire items had two categories of response options as requirement and performance. Each questionnaire item of required category had a 4 point response scale of highly required, averagely required, slightly required and not required with corresponding values of 4,3,2 and 1 respectively, while the performance category had a response scale of high performance, average performance, low performance and no performance with corresponding scores of 4,3,2 and 1 respectively.

The instrument was face and content validated by three experts, one from the Department of Agricultural Education and one from the Department of Soil Science, University of Agriculture, Makurdi and the other from the Department of Agricultural Education, Emmanuel College of Education, Otukpo. Cronbach Alpha reliability method was adopted to determine the internal consistency of the instrument. A reliability coefficient of 0.86 was obtained. Fifty-five copies of the questionnaire were administered with the help of 3 research assistants. One (1) from each sampled College of Education. The researchers personally administered the questionnaire to the lecturers of agricultural education in universities.

The requirement category was responded to by lecturers of agricultural education in the university while the performance category of the questionnaire was responded to by lecturers of agricultural education in Colleges of Education.

The data collected was analyzed using weighted mean (Xn) and Improvement Need Index (INI).

a. The weighted mean Xn of the requirement scale was determined for each item.
b. The weighted mean (Xp) of the performance scale was determined for each item.
c. The performance gap (PG) which represented the quality assurance was determined by the difference between the values of Xn and Xp = PG

A negative (-) difference implies high quality assurance because the level at which the lecturers in Colleges of Education could perform the item was more than what is required. A difference of Zero (0) means good quality assurance because the level at which the lecturers in Colleges of Education could perform the item was equal to the level that is required. A positive (+) performance gap (PG) indicates low quality assurance and need for improvement because the level at which the lecturers in Colleges of Education could perform the item was lower than the level at which it was required.

## Results

Data collected for the study were analyzed in the tables bellow.

**Table 1: Need Performance Gap Analysis of mean Ratings of Responses of the respondents on identification of organic materials used for composting manure (N=55)**

| S/N | Items on organic materials | Xr | Xp | PG Xn-Xp | Remark |
|---|---|---|---|---|---|
| 1 | Banana peels (nitrogen source) shred or chopped | 3.80 | 3.51 | 0.29 | LQA |
| 2 | Corn stalk or corn cob (carbon source) shred or chopped | 3.46 | 2.22 | 1.24 | LQA |
| 3 | Cowpea (nitrogen source) | 3.50 | 3.11 | 0.39 | LQA |
| 4 | Cocoa hulls (carbon source) shred into small pieces | 3.47 | 1.22 | 1.25 | LQA |
| 5 | Vegetable peels and scraps (nitrogen source) | 3.71 | 3.01 | 0.70 | LQA |
| 6 | Peat moss (a neutral organic soil conditioner) | 3.66 | 2.76 | 0.90 | LQA |
| 7 | Wood shavings and saw dust (not kiln dried) | 3.48 | 2.08 | 1.40 | LQA |
| 8 | Droppings from herbivores rabbits, horse, sheep (nitrogen source) | 3.95 | 3.33 | 0.62 | LQA |
| 9 | Leaves (carbon source) shredded or chopped | 3.01 | 2.00 | 1.01 | LQA |
| 10 | Dry and weathered hay (nitrogen source) | 2.31 | 1.11 | 1.20 | LQA |
| 11 | Rice husks (carbon source) | 2.95 | 2.33 | 0.62 | LQA |
| 12 | Ashes (neutral) from wood not coal | 3.80 | 3.00 | 0.80 | LQA |
| 13 | Buck wheat straw or hulls (carbon) shred or chop to help break down | 2.88 | 2.25 | 0.63 | LQA |
| 14 | Fruit peels (not limes) nitrogen source | 3.55 | 3.00 | 0.55 | LQA |
| 15 | Green grass clippings | 3.96 | 3.04 | 0.92 | LQA |
| 16 | Kitchen wastes (egg shell, feathers) | 3.89 | 2.42 | 0.47 | LQA |

Xn = mean of requirement, Xp = mean of performance, PG = performance gap, LQA=Low quality assurance.

Data in Table 1 showed that all the 16 items had their performance gap values ranged from 0.55 to 1.40 and were positive. This implies low quality assurance of lecturers of agricultural education in identifying organic material used for composting organic manure. Hence, there is need for improvement of the lecturers in teaching materials used for composting manure to students of Colleges of Education for climate change mitigation in North Central, Nigeria.

**Table 2: Need Performance Gap Analysis of mean Ratings of Responses of the respondents on aerobic method of composting manure for mitigation of climate change mitigation (N=55).**

| S/N | Items on aerobic method | Xr | Xp | PG Xn-Xp | Remark |
|---|---|---|---|---|---|
| 1 | Collect the used beddings, sweepings from cattle shed and some urine soaked earth from the stubble floor of animal pen everyday | 3.60 | 2.68 | 0.92 | LQA |
| 2 | Mix the collected materials with cattle dung and 2 or 3 handful of wood ash | 3.62 | 2.67 | 0.95 | LQA |
| 3 | Deposit the mixture on a well drained site well secured demarcation | 3.64 | 3.60 | 0.04 | LQA |
| 4 | Build up a low pile of about 30-40cm gradually to a height, 5cm in width with any convenient length | 3.63 | 2.74 | 0.89 | LQA |
| 5 | Complete the pile up of compositing materials before the start of the rainy season | 3.67 | 2.31 | 0.36 | LQA |
| 6 | Get relevant facilities ready for turning the pile after the first heavy rain | 3.55 | 2.54 | 1.01 | LQA |
| 7 | Turn the wetted material in a 1.2cm strip of each side of the long heap into a 2.4cm wide strip in the middle | 3.67 | 2.69 | 0.97 | LQA |
| 8 | Continue the process until a heap of about 1m is obtained on the strip | 3.00 | 2.54 | 0.46 | LQA |

| | | | | | |
|---|---|---|---|---|---|
| 9 | Allow the heap to decay properly for about 3 weeks | 3.42 | 2.74 | 0.68 | LQA |
| 10 | Observe the decomposition of the materials using the sinking of the pile | 3.73 | 2.68 | 1.05 | LQA |
| 11 | Turn again the heap (in about 3-4weeks) into another strip to make a fresh heap | 3.58 | 2.66 | 0.92 | LQA |
| 12 | Repeat the turning into another strip after one month depending on the incident of rain fall | 3.04 | 2.11 | 0.93 | LQA |
| 13 | Turn finally to a storage strip on a cloudy or moderately rainy day after one 3weeks. | 3.36 | 2.65 | 0.71 | LQA |
| 14 | Rebuild a hip on the site within a cloudy or moderately rainy day to continue another round | 3.22 | 2.70 | 0.52 | LQA |

Xn = mean of requirement, Xp = mean of performance, PG = performance gap, LQA=Low quality assurance.

Data in Table 2 showed that all the 14 items had their performance gap values ranged from 0.04 to 1.05 and were positive. This indicated low quality assurance of lecturers of agricultural education in aerobic method of composting manure for mitigation of climate change mitigation. The implication is that there is need for improvement of the lecturers in teaching aerobic method of composting manure to students of Colleges of Education for climate change mitigation in North Central, Nigeria.

**Table 2: Need Performance Gap Analysis of mean Ratings of Responses of the respondents on anaerobic method of composting manure for mitigation of climate change mitigation**

| S/N | Items on anaerobic method | Xn | Xp | PG Xn-Xp | Remark |
|---|---|---|---|---|---|
| 1 | Select appropriate site for composting | 3.54 | 3.13 | 0.41 | LQA |
| 2 | Map out seven plots or spaces | 2.78 | 1.54 | 1.24 | LQA |
| 3t | Label the plots/spaces A,B,C1,2,3 and 4 | 3.66 | 2.71 | 0.95 | LQA |
| 4 | Dig pits of about 1m depth in each mapped out plot | 3.68 | 3.05 | 0.63 | LQA |
| 5 | Provide wall or fence round the edge of each plot | 2.90 | 1.55 | 1.35 | LQA |
| 6 | Source compost materials of plant and animal origin | 3.77 | 3.42 | 0.35 | LQA |
| 7 | Chop out the materials into pieces | 2.30 | 1.11 | 1.19 | LQA |
| 8 | Arrange the materials in alternate layers of plant and animal origin into 1,2,3 and 4 | 3.55 | 3.04 | 0.51 | LQA |
| 9 | Spread urine, wood ash, animal dung or a head pan or bucket full of old compost on top of each heap | 3.00 | 0.28 | 0.72 | LQA |
| 10 | Sprinkle water on each of the 4 heaps if the materials are dry | 2.93 | 1.60 | 1.33 | LQA |
| 11 | Sprinkle hand full of soil to form a light layer on the heap | 3.72 | 2.70 | 1.02 | LQA |
| 12 | Add additional layers in alternate manner | 2.31 | 1.10 | 1.21 | LQA |
| 13 | Repeat the process of applying water after each layer until the required level of the compost is attained | 2.50 | 1.23 | 1.27 | LQA |
| 14 | Drive a strong long stick (tester) through the top into the center of the heap | 3.27 | 3.05 | 0.22 | LQA |
| 15 | Cover the pit with layers of refuse of 15-20cm thick to provide warm temperature and drive away flies | 3.83 | 3.11 | 0.72 | LQA |
| 16 | Remove the tester after three weeks to check/feel for hot or cold temperature, damp or moist | 3.97 | 3.82 | 0.15 | LQA |
| 17 | Turn the decomposed materials (removing layer by layer) from heap 1 and 2 into space A and materials in heap 3 and 4 into space B | 3.53 | 2.32 | 1.21 | LQA |
| 18 | Stock the materials in the spaces from where the materials were removed, that is, plot 1,2,3 and 4 to continue another process | 2.50 | 1.35 | 1.15 | LQA |
| 19 | Move the materials in heap A to C and those in B and C | 2.85 | 1.02 | 1.83 | LQA |
| 20 | Provide a shade over heap C | 2.25 | 1.03 | 1.22 | LQA |
| 21 | Cover the prepared compost with tarpaulin or mulch to prevent nutrient loss. | 3.20 | 2.00 | 1.20 | LQA |
| 22 | Apply compost materials to farm using appropriate method at the accurate time | 3.48 | 2.35 | 1.13 | LQA |

Xn = mean of requirement, Xp = mean of performance, PG = performance gap, LQA=Low quality assurance.

Data in Table 3 showed that all the 22 items had their performance gap values ranged from 0.15 to 1.83 and were positive. This indicated low quality assurance of lecturers of agricultural education in anaerobic method of composting manure for mitigation of climate change mitigation. The implication is that there is need for improvement of the lecturers in teaching anaerobic method of

composting manure to students of Colleges of Education for climate change mitigation in North Central, Nigeria.

## Discussion of results

The result of the study revealed that lecturers of agricultural Education in Colleges of Education are of low quality assurance in 16 items in identification of organic materials used for composting manure, 14 items on aerobic method of composting manure and 22 items on anaerobic method of composting manure for climate change mitigation in North Central, Nigeria. The implication of the findings of this study is that the lecturers of agricultural education in Colleges of Education need improvement in teaching composting to students of Colleges of Education for climate change mitigation in North Central, Nigeria. The result of the study contradicted the view of the researchers who were thinking that the quality assurance of the lecturers in performing some of the items in identification of organic materials used for composting manure would be high since some of them are common in the locality. However, the result is in agreement with the findings of Alaribe, Ellah and Olaitan (2013), where it was found out that the teachers have low quality assurance generally in teaching the content of agriculture curriculum. This study also revealed that the teachers generally possess low quality assurance in the use of material resources in teaching the content of agriculture curriculum.

Besides, Asogwa, Lan and Olaitan (2013), found out that lecturers in agricultural education have low quality assurance in the content of agro-climatology for teacher preparation in Colleges of Education. The authors found out that the lecturers have low quality assurance in the use of equipment in agro-climatology for teacher preparation in agricultural education programs in Colleges of Education and therefore needed improvement.

## Conclusion

Concerted efforts must be made by individuals, institutions and government to minimize the use of the activities that leads to greenhouse gas emissions and subsequent climate change. The effects of climate change on agriculture, ecosystem and human beings has become so alarming that urgent attention is needed from all individuals and stakeholders. However, there are evidences that man contribute to the causes and increase of global warming especially through agricultural practices such as use of inorganic fertilizer. The implication is that the teachers of agriculture may not have been properly trained in the use of organic manure like compost to mitigate climate change. This suspicion on the quality assurance of teachers of agricultural education motivated the researchers to embark on this study. It was found out that lecturers of agricultural Education in Colleges of Education are of low quality assurance in composting manure for climate change mitigation in North Central, Nigeria. Therefore, it was recommended that:

1. Lecturers of agricultural education in Colleges of Education should use the findings of this study to seek sponsorship from their school administration to enable them attend workshop, seminars and conferences for improvement in composting manure.
2. Lecturers of agricultural education in universities should use the findings of this study to organize training and retraining programs such as workshop, seminars and conferences for their graduates who are teaching in colleges of Education.

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