IMPROVING SWEET POTATO PRODUCTION COMPETENCIES POSSESSED BY FARMERS FOR SUSTAINABLE FOOD PRODUCTION IN ENUGU STATE

Nwosu P.I., Ph.D
phindave@gmail.com
Department of Technology and Vocational Education
Enugu State University of Science and Technology, Enugu

Abstract
The study focused on improving sweet potato production competencies possessed by farmers for sustainable food productions in Enugu state. The study was carried out in Enugu state, Nigeria using a descriptive survey research design. The population consisted of 380 respondents. There was no sampling because the population was manageable. Structured questionnaire was used for data collection made up of 42 items. The instrument was validated by three experts and Cronbach Alpha statistics was used to determine the internal consistency of the instrument and a coefficient of 0.72 was obtained. The data collected were analyzed using mean and standard deviation to answer the research questions, whereas ANOVA and T-test were used in testing the null hypothesis. The study found out that the competencies of sweet potato farmers need to be improved in pre-planting, planting and post –planting operations for food sustainability in Enugu state. The study also revealed that using strategies such as workshops, seminars, demonstration plots etc. could improve the competencies of sweet potato farmers. The null hypothesis tested showed some significant differences in some items of non- significant differences in others. Based on these findings, it was recommended that extension workers should emphasize on sweet potato production competencies during training and retraining of the farmers and agricultural science teachers in schools should integrate the identified competencies when planning their lessons.
Keywords: Competencies, sweet potato plants improvement, sweet potato farmers

Introduction

Sweet Potato is herbaceous perennial vine (crop) cultivated as an annual (crop). The cultivation of the crop started in 3000 BC and it is now grown throughout the tropics, sub tropics and warm temperate zones of both hemispheres (Anikwe, Ngwu, Onyia and Mba, 2005). Sweet potato flesh can be white, yellow, purple, red, pink, violet, or orange while the skin colour varies from yellow, red, orange and brown. Varieties with pale yellow or white flesh are less sweet and moist than those with red, pink or orange flesh. These varieties also have little or no beta-carotene and higher levels of dry matter (*http://www.encyclopedia.com, 2019).* The author further opined that sweet potatoes also vary enormously in size, shape, taste and texture, although all are smooth skinned with roots always tampered at both ends. The most prevalent forms according to Anikwe et al (2005) are those with twinning and trailing long stems of slender to moderate thickness and moderately to widely spaced leaves. This implies that with the trailing long stems sweet potatoes can easily provide covers where it is growing and survive even in harsh conditions according to Woodward (2000). Sweet potatoes grow in all warm, humid areas of the world and at the beginning of the twenty-first century were the seventh largest world food crop, 95% of which was produced in developing countries. The author further started that sweet potatoes are typically grown by small

farmers often on marginal ground (soil), and has a long history of saving lives. This is because it matures fast, is rich in nutrients and is often the first crop planted after a natural disaster, providing abundant food for otherwise starving populations. This indicates that sweet potatoes has the potentials for food sustainability.

Sustainability is defined by Hornby (2012) as something that can continue or be continued for a long time. This implies that since sweet potato is a crop that matures fast, rich in nutrients and often the first crop planted after a natural disaster. Its continuity is possible and is a crop that can provide food whenever there is a need. In the context of this study, there are competencies possessed by sweet potato farmers that need to be improved for sustainable food productions.

Competency is a skill, knowledge and attitude that can lead to a superior performance, it is an acceptance or standard demonstration of production practices and provides a framework for distinguishing between poor and exceptional performances. Robinson Sparrow, Clegg and Birdi (2007). Olaitan, Alaribe and Omeh (2010) described it as the ability acquired through experience or training, it is the ability to do a job properly. Competence specifies the "how" of performing the job tasks in sweet potato production.

Production is the creation of utilities capable of satisfying human wants (Nwosu, 2015). Iwena (2013) defines production as the process of making or manufacturing goods. In the context of this study, sweet potato production refers to the processes involved in growing sweet potato which according to Anikwe et al (2005) includes activities that are carried out at different stages of growing sweet potatoes. These activities are:

- Pre –planting activities such as selection of suitable site, clearing, stumping, ridging and making of mounds etc.
- Planting activities such as selection of viable vegetable parts (e.g. Small slips, shoots growing from tubers and soft wood or vine culling), maintaining correct spacing and seed rate.
- Post planting activities such as supplying, thinning, weeding, fertilizer application, pest and disease control, harvesting, storage and marketing. In the study area, it seems that in most cases farmers seem not to carry out these skills satisfactorily.

A farmer is a person who owns a farm. In the view of Hornby (2010) a farmer is person who owns or manages an area of land and the buildings on it used for growing crops or keeping animals. It may then be deduced that a farmer is a person who grows, plant or rear animals for the benefit of mankind. A farmer takes all the necessary steps to ensure proper nourishment of the items that he raises for his family and then sells the items to buyers (consumers). The farmer aims at minimizing cost and maximizing profit. In the context of this study, a sweet potato farmer is the farmer who is trained and experienced in managing sweet potato crops and the related crop from planting till the crop is processed and marked either for human consumption or industrial purposes. In Enugu state, which is the study area, farmers are able to produce sweet potatoes successfully with the assistance of agricultural extension workers.

Agricultural extension workers are trained personnel employed by the government with the aim of disseminating new research information on the improved techniques of farming to farmers, weeping them to improve on their farming skills ,general welfare ,as well as the development of leadership qualities in them (Ugwuoke and Ejiofor 2010). An extension worker acts as an

intermediary between researchers and farmers (Nwosu, 2015). With reference to this study, an extension agent is a person who identifies cassava farmers' problems, takes the problems to the research institutes for solutions and then takes the solutions back to the farmers. An extension worker also educates sweet potato farmers to adopt new farming practices to improve their output by using some strategies. These strategies the extension worker uses can be through exposing the farmers to seminars, workshops, skill acquisition centers, demonstration, agricultural shows etc. All these will help educate farmers on skills that will improve their competencies for sustainable food productions. This is why Hornby (2010) stated that a strategy is a plan that is intended to achieve a particular purpose. Sweet potato farmers and agricultural extension workers would be of great help in identifying the competencies improvement areas in sweet potato productions.

Improvement as defined by Hornby (2010)is the act of making something better , that is the process of something becoming better, when applied to sweet potato production improvement means a change that will make sweet potato production better than it was before . Improvement in sweet potato competencies implies that sweet potato farmers will have more knowledge of the pre-planting, planting, and post planting competencies in sweet potato production, the degree of success of any sweet potato production depends on the skills of the farmer which he has acquired through some level of trainings.

Sweet potato production has been recognized as viable source of income to the farmer since it is highly demanded and used for food and industrial purposes. They are rich sources of fibres as well as containing an array of vitamins and minerals and high in antioxidant known as beta-carotene which converts to vitamin A once consumed (Nicola 2019). It is the fifth most important crop .more than 105 million metric tons are produced globally each year, 95% of which are grown in developing countries *(https://www.crop.trust.org>crop>sweet* 2019). Yet the demand for this food crop exceeds supply.

However, in Enugu state, the researcher has observed that sweet potato production is still practiced at low levels despite its high demand as a source of food for both man and animals and its ability to eliminate food crisis. If adequate training are given to farmers to improve their competencies, it will help update their knowledge and skills in sweet potato production. When the skills of farmers are updated, it will lead to increase in sweet potato production which will in turn lead to meeting up the market demand on food sustainability. But when the farmers' skills are not updated, there will be low productions and low supply of sweet potato which will also lead to low supply of raw materials to industries, low food for man and his animals and income to the farmers. Therefore, the need arose to determine the production competencies possessed by sweet potato farmers that need improvement for food sustainability. Specifically, the study sought to determine the:

(1) Pre- planting operation competencies possessed by sweet potatoes farmers for sustainable food productions in Enugu state.
(2) Planting operations competencies possessed by sweet potato farmers for sustainable food productions in Enugu state.
(3) Post planting operations competencies possessed by sweet potato farmers for sustainable food productions in Enugu state.
(4) Strategies for improving the competencies possessed by sweet potato farmers for sustainable food productions in Enugu state.

Research Questions

The following research questions guided the study:

(1) What are the pre-planting operations competencies possessed by sweet potato farmers that need improvement for sustainable food productions in Enugu State?
(2) What are the planting operation competencies possessed by sweet potato farmers that need improvement for sustainable food productions in Enugu State?
(3) What are the post-planting operation competencies possessed by farmers by sweet potato farmers that need improvement for sustainable food productions in Enugu State?
(4) What are the strategies for improving the competencies possessed by sweet potato farmers for sustainable food productions in Enugu State?

Hypothesises

The following null hypotheses were tested at 0.05 level of significance.

Ho_1: A significant difference do not exist in the mean ratings of the responses of agricultural extension workers from Agwu, Enugu and Nsukka agricultural zones of Enugu State

Ho_3: There is no significant difference between the mean ratings of the responses of agricultural extension workers from Agwu, Enugu and Nsukka agricultural zones of Enugu state on the planting operation competencies possessed by sweet potato farmers that need improvement for sustainable food productions in Enugu State.

Ho_3: There is no significant difference between the mean ratings of the responses of sweet potato farmers and extension workers on the post planting operation competencies possessed by sweet potato farmers that needs improvement.

Research Method

The descriptive survey research was adopted for the study. This research design was used because the study collected data from agricultural extension workers and sweet potato farmers in the studies area. The area of study was Enugu state which comprised six agricultural zones namely Agbani, Agwu, Enugu, Enugu-Ezike, Obollo-Afor and Udi. The population for the study comprised 380 respondents made up of 286 registered sweet potato farmers in Enugu state and 94 agricultural extension workers in the six agricultural zones in Enugu State. (Source: Enugu State Agricultural Development Program office, Enugu 2019). The entire population size was manageable, therefore no sampling was made.

A self –structured questionnaire items were used as instrument for data collection. The questionnaire contained a total of 32 structured sweet potato production competencies items and 10 strategies for improvement generated from an extension review of literature and information from sweet potato farmers and extension workers. Each competency item and strategy improvement items had a four- point response scale of Very Highly Needed (VHN)/Strongly

Agree-4, Highly Needed (HN)-3, Moderately Needed/Diagree-2 and Not Needed (NN)-Strongly Disagree.

The instrument was subjected to face validation by two experts from the Department of Technology and Vocational Education and one from the Department of Measurement and Evaluation, Faculty of Education, Enugu State University of Science and Technology, Enugu. They validated the instrument to ensure the appropriateness of the measuring instrument and that the instrument was structured to address the purpose of the study (Uzoagulu, 2011). The comments of the validators were used to modify the final instrument used for data collection. The reliability of the instrument was determined by using Cronbach Alpha reliability method to determine the internal consistency of the instrument. The clusters yielded a coefficient reliability of 0.72.

A total of 380 copies of the questionnaire were distributed to the respondents with the help of three research assistants. These assistants were properly guided to assist the researcher in administrating the instruments to the respondents. A total of three hundred and sixty- two copies (362) were properly filled and returned. The return rate was 95%. It is thus 362 properly filled copies that were used for data analysis. The data were analyzed using weighted mean with standard deviation to answer the research questions. The analysis of variance were used to test the null hypothesis of no significant differences at probability level of 0.5. The analysis of variance and T-test were used to determine whether location can affect the mean responses of agricultural extension workers from three out of the six agricultural zones in Enugu state on the competencies possessed by sweet potato farmers that need improvement for sustainability in food productions. These zones specifically used were Agwu, Enugu and Nsukka agricultural zones. These zones were chosen because they covered both urban and rural areas in Enugu state. The mean standard deviation and analysis of variance are presented on the same table for each research question. The decisions were based using real limits of the mean thus:

- Very Highly Needed (VHN) - 35 – 4.00
- Highly Needed (HN) - 2.50 – 3.49
- Moderately (M) - 1.50 – 2.49
- Not Needed (NNd) - 1.00 – 1.49

The null hypotheses were rejected if the F- calculated were less than the critical F-ratio but accepted if the F-calculated exceeds the critical F-ratio.

Research Question 1: What are the pre-planting operation competencies possessed by sweet potato farmers that need improvement for sustainable food productions in Enugu State?

$H0_1$: A significant difference do not exist in the mean ratings of the responses of agricultural extension workers from Agwu, Enugu and Nsukka agricultural zones of Enugu state on the pre-planting operation competencies possessed by sweet potato farmers that needs improvement for sustainable food production. To answer this research question and null hypothesis the results are presented in table 1 below

Table 1:

Mean, Standard Deviation And Analysis Of Variance Of Agricultural Extension Workers (From Agwu, Enugu And Nsukka) And Sweet Potato Farmers Regarding Pre-Planting Operation Competencies That Needs Improvement For Sustainable Food Production In Enugu State.

S/N	Pre-Planting Operation Competencies in sweet potato production	N	X	SD	Decision	X_1	SD	X_2	SD	X_3	SD	F-Cal	F-tab	Decision
1	Ability to select a suitable site	362	3.60	0.54	VHN	4.00	0.00	3.19	0.40	3.18	0.40	26.19	3.18	S
2.	Ability to clear the bushes	362	3.42	0.56	HN	4.00	0.00	3.15	0.36	3.54	0.52	24.15	3.18	S
3.	Ability to lay out the farmland	362	3.52	0.54	VHN	4.00	0.00	3.38	0.50	3.36	0.50	10.05	3.18	S
4.	Ridging making of ridges especially in swamps	362	3.01	0.83	HN	4.00	0.00	3.88	1.07	3.63	1.21	7.66	3.18	S
5	Making of big mounds in water logged soils	362	3.10	0.62	VHN	4.00	0.00	3.19	0.63	3.18	0.60	10.87	3.18	S
6..	Ability to remove stumps	362	3.27	0.70	VHN	4.00	0.00	3.42	0.70	2.72	0.78	12.24	3.18	S
7.	Ability to use minimum tillage	362	2.96	0.79	HN	4.00	0.00	3.81	0.49	2.55	1.29	1.27	3.18	S
8.	Ability to use reduced tillage	362	3.41	0.62	HN	4.00	0.00	3.42	0.50	3.09	0.94	0.08	3.18	S
9.	Ability to use optimum tillage	362	3.06	0.78	HN	4.00	0.00	3.35	0.49	3.27	0.79	8.64	3.18	S
10.	Ability to use zero tillage	362	3.51	0.62	VHN	4.00	0.00	3.19	0.63	3.18	0.60	10.87	3.18	S
	Grand Cluster Value	**362**	**3.21**	**0.66**	**HN**	**4.00**	**0.00**	**3.17**	**0.57**	**3.07**	**0.76**	**11.21**	**3.18**	**S**

NOTE: *VHN = very highly needed; HN = Highly Needed; X = Mean; SD = Standard Deviation; S = Significant; NS = Not Significant*

The **Table 1** above shows items 1, 3, 4 and 10 were identified by the respondents as areas are very highly needed by farmers in sweet potato productions in Enugu State. Their means ranged from 3.51 – 3.60. Also items 2, 4, 6, 7, 8, 9 were also perceived as areas that highly needed. Their mean ranged from 2.96 – 3.42. A grand cluster mean of 3.32, with standard deviation of 0.66 was obtained for all the items 1 – 10, thereby showing that the itemized competencies were all highly needed by farmers in Enugu State. For sweet potato productions based on the principle of upper and lower limits. The relatively low standard deviation (0.66) shows that the respondents had similar views on all the times as being needed by the farmers.

The table also showed that the F-calculated for the eight items ranged from 7.66-26.19while the critical value is 3.18. The null hypothesis is accordingly rejected since the calculated value of F- is greater than the critical or table F value. The items are items 4, 8, 9,10,5,3,2,1. The tables also showed that only one (1) item have no significant difference. Its F- ratio calculated is 1.27. It is item 7. Therefore, the hypothesis of no significant difference is not rejected for this item.

Research Question 2: What are the planting operation competencies possessed by sweet potato farmers that needs improvement for sustainable food production in Enugu State?

H_{O2}: There is no significant difference between the mean ratings of the responses of agricultural extension workers from Agwu, Enugu and Nsukka agricultural zone s of Enugu state on the planting operation competencies possessed by sweet potato farmers that needs improvement for sustainable food production in Enugu State.

Table 2:

Mean, Standard Deviation and Analysis of variance of agricultural extension workers (from Agwu, Enugu, Nsukka) and sweet potato farmers regarding the planting operation competencies that needs improvement for sustainable food production in Enugu state.

S/N	Planting Operation Competencies	N	X	SD	Decision	X_1	SD	X_2	SD	X_3	SD	F-Cal	F-tab	Decision
1	Ability to select viable cuttings, slips, shoots, or tubers	362	3.52	0.61	VHN	3.00	0.00	3.27	0.45	3.36	0.67	2.24	3.18	S
2.	Ability to choose correct planting date	362	3.76	0.45	VHN	4.00	0.00	3.42	0.50	3.55	0.52	7.58	3.18	S
3.	Ability to use the correct spacing planting distance	362	3.69	0.50	VHN	4.00	0.00	3.50	0.51	3.36	0.50	7.68	3.18	S
4.	Ability to use the correct seed rate	362	3.54	0.62	VHN	3.00	0.00	3.42	0.50	3.09	0.53	4.74	3.18	S
5	Ability to use the correct sowing depth	362	3.29	0.76	HN	4.00	0.00	3.61	0.50	3.09	0.70	10.48	3.18	S
6.	Ability to select vine cuttings from near the lip	362	3.63	0.58	VHN	4.00	0.00	3.35	0.56	3.45	0.52	8.43	3.18	S
7.	Ability to use long cuttings for planting	362	3.47	0.56	HN	3.92	0.00	3.31	0.47	3.27	0.47	10.27	3.18	S
8.	Ability to use cuttings with 7 or more nodes	362	3.60	0.54	VHN	4.00	0.00	3.42	0.50	3.36	0.50	9.06	3.18	S
9.	Ability to use tubers that have been planted in nursery bed	362	3.58	0.60	VHN	4.00	0.00	3.58	0.50	3.55	0.52	4.68	3.18	S
10.	Ability to use shoots grown from adventitious buds	362	3.54	0.60	VHN	4.00	0.00	3.54	0.51	3.36	0.67	5.92	3.18	S
11.	Ability to plant on ridges	3.62	3.37	0.68	HN	4.00	0.00	3.46	0.51	3.90	0.70	14.69		
12.	Ability to plant on mounds	3.62	3.33	0.73	HN	4.00	0.00	3.62	0.50	3.64	0.50	3.73		
	Grand Cluster Value	**362**	**3.52**	**0.60**		**3.83**	**0.02**	**3.46**	**0.42**	**3.75**	**0.46**	**6.64**	**3.18**	**S**

NOTE: *VHN = very highly needed; HN = Highly Needed; X = Mean; SD = Standard Deviation; S = Significant; NS = Not Significant*

Table 2 above shows that items 1, 10, 4, 9, 8, 6, 3, and 2 have means scores above 3.50 showing that the farmers very highly needs improvement in these competencies, while items 12, 5 and 7 are highly needed by farmers for improvement. They have mean scores ranging from 3.23-3.47.Their standard derivations also range from 0.56-0.76. This is an indication that the subjects mean responses are close or homogeneous. With a good cluster mean of 3.52 and standard deviation of 0.60, it shows that all the planting operation competencies possessed by the potato farmers need improvement.

The table also showed that the F-calculated for eleven (11) items ranged from 3.73 -14.69, while critical value is 3.18. The null hypothesis is rejected since the calculated value of F is greater than the table F-value. The items are 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12. The only item with F-calculated below F-table is item. The value is 2.24 showing no significant difference. Therefore the hypothesis of no significant difference is not rejected for this item.

Research Question 3: What are the post-planting operation competences possessed by sweet potato farmers that need improvement for sustainable food production in Enugu state?

H_{O3}: There is no significant difference between the mean rulings of the responses of sweet potato farmers and extension workers on the post-planting operation competences possessed by sweet potato farmers that needs improvement for sustainable food production in Enugu state.

Table 3:

Mean, standard derivation and t-test of agricultural extension workers and sweet potato farmers and sweet potato farmers regarding the past planting operation competencies that need improvement for sustainable food production in Enugu state.

S/N	Post-Planting Operation Competencies	N	X	SD	Decision	X_1	SD_1	X_2	SD_2	F-Cal	F-tab	Decision
1	Ability to supply ungerminated cuttings	362	3.63	0.60	VHN	3.65	0.62	3.59	0.53	0.89	1.96	NS
2.	Ability to thin down excess plants	362	3.38	0.84	VHN	3.41	0.90	3.27	0.64	1.46	1.96	NS
3.	Ability to weed at the eight time	362	3.59	0.67	VHN	3.66	0.67	3.38	0.64	3.44	1.96	S
4.	Ability to apply the correct fertilizer	362	3.55	0.70	VHN	3.53	0.76	3.59	0.51	0.60	1.96	NS
5	Ability to apply organic manure	362	3.28	0.51	HN	3.24	0.58	3.39	0.65	-2.17	1.96	NS
6.	Ability to control pest	362	3.71	0.51	VHN	3.77	0.49	3.53	0.52	3.92	1.96	S
7.	Ability to control diseases	362	3.12	0.75	HN	3.15	0.74	3.08	0.79	1.01	1.96	NS
8.	Ability to harvest at the right time	362	3.17	0.72	VHN	3.10	0.74	3.36	0.63	1.85	1.96	NS
9.	Ability to adopt different processing methods	362	3.50	0.60	VHN	3.54	0.59	3.40	0.61	-2.19	1.96	NS
10.	Ability to use correct storage/preservation methods	362	3.46	0.66	VHN	3.43	0.69	3.16	0.53	-1.21	1.96	NS
11.	Ability to market sweet potato products	3.62	3.22	0.66	HN	3.19	0.69	3.29	0.58		1.96	NS
	Grand Cluster Value	**362**	**3.41**	**0.66**		**3.42**	**0.67**	**3.36**	**0.60**	**0.04**	**1.96**	**NS**

NOTE: *VHN = very highly needed; HN = Highly Needed; X = Mean; SD = Standard Deviation; S = Significant; NS = Not Significant*

The data analyzed in **Table 3** above shows that five (5) items has means of 3.50, 3.55, 3.59, 3.63 and 3.71 for items 9, 4, 3, 1 and 6. This shows that the sweet potato farmers very highly need improvement in these competencies. Item 7 8, 1, 5, 2, and 10 has their mean ranging from 3.12, 3.17, 3.22, 3.28, 3.38 and 3.46, showing also that these items highly need improvement. Their standard derivation of 0.75, 0.72, 0.66, 0.61, 0.84 and 0.66 shows that the subject responses are close or homogeneous.

The table also shows that the F-calculated for nine (9) items ranged from -.60 to 1.85 while critical value is 1.96. The null hypothesis not rejected since the value of F-ratio is greater than the F-calculated. Two items 3 and 6 had their calculated F-ratio greater than the value of F-table showing that the null hypothesis is not accepted for these two items.

Table 4:

Mean, standard derivation and analysis of various of the responses of sweet potato farmers and agricultural extension workers on the strategies for improving the competencies possessed by sweet potato farmers for sustainability in Enugu State.

S/N	Strategies For Improving Competencies	N	X	SD	Decision	Agwu zone N = 13		Nsukka Zone N = 26		Enugu Zone N = 11		F-Cal	F-tab	Decision
						X_1	SD_1	X_2	SD_2	X_3	SD_3			
1	Help in sourcing for improved varieties/farm inputs	362	3.59	0.60	SA	4.00	0.00	3.19	0.40	3.55	0.52	19.85	3.18	S
2.	Organize seminars on the use of correct storage/preservation methods	362	3.44	0.61	A	4.00	0.00	3.31	0.47	3.36	0.67	10.29	3.18	S
3.	Organize workshops on the different ways of processing sweet potato	362	3.31	0.69	A	3.00	0.00	3.42	0.50	3.45	0.52	4.68	3.18	S
4.	Use of demonstration plots	362	3.21	0.72	A	2.00	0.00	3.27	0.67	2.00	1.00	22.38	3.18	S
5	Conduct lectures on the use of conservation tillage	362	3.07	0.66	A	2.00	0.00	3.12	0.59	2.91	0.94	14.74	3.18	S
6.	Train sweet potato farmers on how to keep farm records	362	3.44	0.60	A	4.00	0.00	3.38	0.49	3.09	0.70	11.51	3.18	S
7.	Provide education aimed at identifying sings of diseases and control measures	362	3.43	0.68	A	3.00	0.00	3.46	0.51	3.18	0.60	4.61	3.18	S
8.	Organize agricultural shows	362	3.51	0.66	SA	3.00	0.00	3.42	0.58	3.00	1.00	2.86	3.18	NS
9.	Organize symposium for farmers	362	3.57	0.62	SA	4.00	0.00	3.46	0.51	3.64	0.50	6.56	3.18	S
10.	Organize field trips	362	3.10	0.79	A	3.00	0.00	3.38	0.57	3.27	0.65	2.45	3.18	NS
	Grand Cluster Value	**362**	**3.36**	**0.66**	**A**	**3.20**	**0.00**	**3.34**	**0.52**	**3.14**	**0.70**	**9.99**	**3.18**	**S**

NOTE: *SA = Strongly Agree; A = Agree; x = Means; SD = Standard deviation; S = Significant; NS = Not Significant*

Table 4 reveals that all the items had a mean above 3 showing that the respondents agreed that these strategies can be used to improve the sweet potato farmers' competences for sustainable food production. All the items had a grand mean of 3.36 and standard deviation of 0.66. The low standard deviation obtained for all the items indicates that the sweet potato farmers and agricultural extension workers did not differ remarkably in their views regarding the relevance of the strategies to sweet potato farmers.

The null hypothesis tested showed that there is significant items in the ranging of agricultural extension workers from Awgu, Enugu and Nsukka agricultural zones. However, the items that showed no significant difference are items 8 and 10. They have their F-calculated as 2.86 and 2.45 respectively

Findings

The following findings were made based on the result of the data analyzed.

(1) Sweet potato farmers need improvement in their pre-planting operation for sustainability in food production.
(2) Sweet potato farmers need to be improved in their planting operation competences for sustainability in food production.
(3) Post-planting operation carried out by sweet potato farmers need to be improved for sustainability in food production.
(4) The study proved that all the factors identifiable in study were adequate for improving the sweet potato farmers' competences for food sustainability in Enugu state.

Discussion

A grand mean of 3.32 and standard deviation of 0.66 obtained for all the items in research question 1 showed that all the, Henrized pre-planting operation competences were highly needed to be improved for sustainable food production in Enugu state. This agreed with the findings of Okaro (2001) that pre-planting operations should include such activities as selection of site, clearing, stumping, plotting, tilling or ridging. These activities are carried out to prepare and make the soil conducive for the crop to be planted.

Ekwu and Eje (2004) agreed with all these skills by stating that farming as a business must be profitable, otherwise no person would invest in it. Hence, deliberate efforts must be made to minimize the cost of production while increasing crop yields. As a result of this, the authors listed minimum tillage, reduced tillage, zero tillage and optimum tillage as pre-planting operations that will help farmers to cut production cost and increase crop yields. Anikwe etal (2005) are also in line with the findings by opening that there is a trend for more tuber yield with increase in height of mounds and ridges especially in swamps and in heavy and water-logged soils where the water table is high. Sweet potatoes are better grown on ridges and mounds, since it makes harvesting easier, helps to prevent erosion and the potatoes will grow straight (Akwudi 2003).

The hypothesis tested showed that there was a significant difference in the mean responses of the farmers in 9 out of 10 items. Such items are ability to select a suitable site, ability to use zero tillage. The difference in opinion may be based on the locations of the extension workers and traditions/culture of the agricultural area. However, Item 7 which is ability to use minimum tillage

showed no significant difference. This may be that the sweet potato farmers in their different locations are aware of this competency and have been using it.

Research question two (2) revealed that all the planting operation competences in sweet potato production is needed, improvement for sustainable food production. This is in line with Robinson et al (2007) that viewed competency as skill, knowledge and attitude that can lead to a superior performance. It is an acceptable or standard demonstration of production practice and provides a frame of work for distinguishing poor and exceptional performances. Sweet potato farmers in Enugu state seem to possess these planting skills but not at a level that they can use them for sustainable food production. This is why Olaitan, Alaribe and Omeh (2010) described competency as the ability to a job properly. Competence specifies "how" of performing job task or what a person needs to do (a job) successfully. This finding is also in line with production concept of Iwena (2013) that states production as the process of making or manufacturing goods. Planting operation competences are in line with production. This is because a sweet potato farmer who do have the abilities select viable vine cuttings, or do not use the correct planting date or correct spacing cannot successfully produce sweet potatoes. Anikwe et al (2005). Supported this by listing planting activities as selection of viable vegetative parts (small slips, shoots growing from tubers and vine cuttings), maintaining correct spacing and seed rate.

The hypothesis tested on planting operations indicated that there is significant difference in the mean ratings of agricultural extension workers from Awgu, Enugu and Nsukka agricultural zones regarding the planting operation competences that needs to be improved for sustainable food production in Enugu state in 11 items. The significant difference may be that all the itemized competences need to be improved for sustainable food production, the farmers in the study area may not have value.

Sweet potato like other crops (such as yam and cassava) and this may have influenced their responses. This sweet potato production values from one locality to the other. From research question three (3), it was found out that sweet potato farmers in the study area highly needs improvement in their ability to control pests, supply ungerminated cuttings and use the correct storage and preservation methods among others as post-planting operations. This is in line with Okaro (2001) that states that supplying is placing of seeds/cuttings that failed to germinate, or seeds that germinated and died. The vacant position should be filled soon after germination by supplying. The study is also in line with the findings of Ogbe and Emehute (2004) who opined that organic manure should be applied regularly to the farm land because it helps to improve nutrient supply and increase productivity.

Food and agricultural organization (FAO 2014) is also in line with improvement in the post-planting production competences of farmers when it recommended non-chemical measures that can help sweet potato farmers reduce losses to diseases in addition to the use of chemicals when needed. These measures are use of varieties with good tolerance, sterilizing tools with disinfectants, intercropping to reduce plant to plant infection, timely and good sanitations etc. Anikwe et al (2005) is in line with this findings when they also recommended the use of fertilizer ratio of NPK 10:10:15 or 15:15:15 applied at the rate of 400-500kg/ha. A sweet potato farmer who is not aware of this may use any type which may intend to increase the acidity of the soil. The authors warned that when inorganic fertilizers are used, care would be taken to use urea and ammonia nitrate fertilizer instead of ammonium sulphate fertilizer, which tends to increase acidity. They added that excess nitrogen tends to decay tuberization and vegetative growth. Anikwe etal (2005) in line with this study also highlighted that potato storage can be improved by storing them

in trenches, dark rooms, drying and storing in dry places, putting tubers mixed with ashes in holes and covering them with soil or processing and canning them.

The null hypothesis tested in table 3 revealed that there was no significant differences in the mean responses of potato farmers and the extension workers in 9 items listed. This shows that the sweet potato farmers possess these competences but they need improvement in them to increase their productions. This is in line with Hornby (2010) that states that a farmer is a person who owns or manages an area of land and the building on it. This means that as a manager, a sweet potato farmer needs improvement in post-planting operations, this is because a farmer aims at minimizing cost and maximizing profit. Meanwhile two items showed that there was a significant difference. This may be that the traditional farming system have influenced their responses.

From the findings in research question 4, the table revealed the strategies that could be used to improve the competences possessed by sweet potato farmers for sustainable food production in Enugu. These strategies ranged from organizing field trips to helping the farmers to source for improved varieties of sweet potato. This work is in line with Hornby (2010) that defined strategy as a plan that is intended to achieve a particular purpose. The study also revealed that the 10 strategies identified were all suitable for integration into the sweet potato farmers; training and re-training program for upgrading their knowledge and skills in sweet potato productions. Alio and Uzor (2010) asserted that provision of returning program, extension education and organizing workshops and seminars were commendable strategies for improving competences. This means that if adequate training is given to sweet potato farmers, food production will be increased.

Conclusion

Improvement in sweet potato competences implies that sweet potato farmers will have knowledge of the pre-planting, planting and post-planting operations carried out in sweet potato production. Therefore sustainability in food production through sweet potato depends on the level of improvement of the production competencies of the farmers. Based on this, if the pre-planting, planting and post-planting operation competences identified by this study is adopted by sweet potato farmers, it will help to increase food production in Enugu state.

Recommendation

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

(1) Agricultural science teachers in schools should integrate the identified competences when planning their lessons.
(2) Extension workers should emphasize on sweet potato production competences during training and re-training of the farmers.
(3) Government should help in providing opportunities for sweet potato farmers re-training.
(4) Non-Governmental organizations should help in sponsoring seminars and workshops aimed at improving the competences of sweet potato farmers.

References

Akwudi, N.J (2003) *The Problems and Prospects of Cassava Production and Processing in Udi Local Government Area of Enugu State.* Unpublished B.Sc. Project, Department of Agricultural Economics and Extension. Enugu State University of science and technology Enugu.

Alio, A.N & Uzor, O.O (2010) Enhancing Management Competencies of Electronic Craftsmen in the informal Sector of the Economy of Enugu State. *International Technology Research Journal (INTERJ).* 1(1)38-57.

Anikwe, M.A.N, Onyia, V.N, Ngwu, O.E & Mbah, C.N (2005) *Ecophysiology and Cultivation Practices of Arable Crops.* Enugu: New Generation Books.

Ekwu, F.C and Eje, B.E (2004). Basic Agricultural Mechanization. Enugu: Cheston Agency Limited.

Encyclopedia (2019) Encyclopedia of food and culture. *http://www.encyclopedia.com* Retrieved 12/10/19.

Hornby, A.S (2010)*: Oxford Advanced Learners Dictionary of Current English*. Eighth Edition, Ibadan: Oxford University Press.

House.

Iwena, O.A(2008*) Essential Agricultural Science for Senior Secondary Schools* Abeoguta: Tonad Publishers Limited.

Nicola, S. (2019) The Health Benefits of Sweet Potato /BBC Good Food. *http://www.bbcgoodfood.com>guide Retrieved 13/10/19.*

Nwosu, P.I (2015). Entrepreneurial skills Needed in cassava Production for self-Reliance by Senior Secondary Agricultural Science Students in Enugu State. *Unpublished Ph.D. thesis. Department of Technology and Vocational Education, Faculty of Education, Enugu State University of Science and Technology Enugu.*

Okaro, E.U (2001). *New Intensive Agriculture Science for Junior Secondary Schools.* Onitsha Elite Publishers.

Olaitan, S.O, Alaribe, M.O & Omeh, R.U (2010).Competency Improvement Needs of Instructors in Teaching Soil Conservation in Schools of Agriculture in South Eastern States of Nigeria. Review of Education Journal, University of Nigeria, Nsukka. 21(183-185).

Olaitan, S.O, ARble, M.O. & Omeh, R.U. (2010) Competency Improvement Needs Of Instructors in Teaching Soil Conservation in Schools of Agriculture in South Eastern States of Nigeria. *Review of Education Journal*. University of Nigeria, Nsukka (183-185).

Robinson, M.A Sparrow, P.R, Clegy, C. & Birdi, R. (2007) Forecasting Future Competency Requirement. A three phase Methodology, *Personal Review* 36(1)65-90.

Ugwuoke, C.U and Ejiofor, T.E (2010). Skills Required by Secondary School Graduates for Success in Pineapple Production Enterprise in Nsukka Agricultural Zone of Enugu State. *Journal of the Nigerian Vocational Association* 15(1). Sweet Potato-Crop Trust http://www.crop trust.org>crop>sweet Retrieved 13/10/19.

Woodward .P. (2000) *Asian Herbs and Vegetables*. Flemington, Victoria: Hyland