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Agripreneurial Skills Required For Training Agricultural Education Graduates In White Button Mushroom (*Agaricus bisporus*) Production In North - Central, Nigeria

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ABSTRACT
This study identified skills required for training agricultural education graduates in white button mushroom (*A.bisporus*) production in North-Central, Nigeria. The study was guided by four specific objectives, four research questions and four hypotheses formulated and tested at 0.05 level of significance. Descriptive survey research method was adopted for the study. The population of the study was 270 registered agricultural education graduates and registered agricultural extension agents in North-Central, Nigeria. The sample for the study consisted of 270 respondents made up of 170 registered agricultural education graduates and 100 registered agricultural extension agents in North-Central, Nigeria. Taro-yamane for used to determine the sample size. The instrument for data collection was a self-structured questionnaire titled: *Agripreneurial Skills Required for Training Agricultural Education Graduates in White Button Mushroom Questionnaire (ASRFTAEGIWBMQ)*. The instrument consisted of a 32-item questionnaire developed by the researchers. The items of the instrument were validated by five experts in the areas of vocational agriculture and technology education, measurement and evaluation, crop production, and agribusiness. The reliability coefficient for the instrument was 0.89 which indicated that the instrument was reliable. The research questions posed in the study were answered using mean and standard deviation. The hypotheses formulated were tested at 0.05 level of significance using t-test. It was found that ten (10) agripreneurial skills were required composting compost materials, eleven (11) agripreneurial skills were required in pasteurizing compost materials, twelve (12) agripreneurial skills were required in spawning compost materials and, nine (9) agripreneurial skills were required in casing compost materials for training agricultural education graduates in *A.bisporus* production in North-Central, Nigeria. The following recommendations have been made based on the findings of the study and the study recommended that all the identified agripreneurial skills required for training agricultural education graduates in white button mushroom should be given more emphasis when training the graduates and others who are interested in going into mushroom production and all the identified agripreneurial skills should be packaged as training manual by skills acquisition centres to train agricultural education graduates and other set of graduates who are interested in going into white button mushroom production.
Keywords: Agripreneurial Skills, A.bisporus, Production, Training, Agricultural Education Graduates, North Central, Nigeria.

INTRODUCTION

Nigeria is primarily an agriculture-based country and it offers vast potential for mushroom cultivation due to varied climate suited for the cultivation of different types of mushrooms. For many years, an increasing demand is seen in mushrooms for their taste, flavour, nutritional value and preparing various products in food

industry and housekeeping, its fruit bodies have been known as a food source since ages (Ali, 2014). There are hundreds of identified species of fungi since time immemorial; and have made a significant global contribution to human food and medicine (Wasser, 2014). The use of mushrooms as a substrate in vegetable processing creates a possibility of preparation of many products such as pickles, and mushroom vegetable salads among others. Food and Agricultural Organization Statistics (FAOSTAT, 2014) reported that, total world production of mushrooms was nearly 8million metric tons in 2012 with China being by far the leading producer (5.2 million tons) and has over four million (4,000,000) species and *A. spp* dominating worldwide with over fifty (50) species.

Mushrooms can be grouped into four categories; those which are fleshy and edible fall into the edible mushroom category: *A.bisporus*, mushrooms that are considered to have medicinal application are referred to as medicinal mushrooms: *A.bisporus poisono* and *Ganoderma lucidum* among others, those which are proven to be or suspected of being poisonous are named as poisonous mushrooms: *Amanita phalloides* and a miscellaneous category which includes a large number of mushrooms whose properties remain less well defined, which is tentatively grouped together as other mushrooms. Many mushrooms are not only edible, but also possess tonic and medicinal qualities and rapidly spreading after the second world war when reliable spawn (mushroom seed) became available in a number of countries including Nigeria.

Mushroom is commonly known by different tribes in Nigeria and within North-Central states as *naman kaza* in Hausa, *ero* in Igbo, *osun* in Yoruba, in Benue state (*ijouv* in Tiv, *ifu* in Idoma, *ihwu* in Igede and *alulou* in Etulo), in Nasarawa state (*ekhamu* in Eggon and *gy'un* in Mada) in Plateau state (*tass* in Goemi, and *shwi* in Bromley) in Kogi state (*oru* in Igala and *oru* in Ebira) in Niger state (*munun dankun* in Nupe, *munun dankun* in Patigi) in Kwara state (*goomi* in Fulani and *osun* in Yoruba) and in the Federal Capital Territory (F.C.T *amunu* in Gbagyi and *ontoruwa* in Gwandara). *A.bisporus* is one of the popular, economic and medicinal fungi grown in tropical, sub-tropical and sub-sahara region of Africa for food and other purposes. White button mushroom according to Islam (2015), originated from France in 17th Century and belongs to the kingdom: fungi; sub-division: *Basidiomycotina;* phylum: *Basidiomycota*; class: *Agaricomycetes*; sub-class *Agaricomycetidae*, order: *Agaricales*; family: *Agaricaceae*; genus: *Agaricus,* species: *A.bisporus.* It grows best in extremely high or extremely low temperatures but the best temperature for germination is 14 to 18 ^{o}C. Rohit et al., (2018) affirmed that, it is prolific in nature; it produces its first flush 3days and second flush 7days after planting, taking about 2 to 3 weeks to mature for harvest.

The study of mushrooms is called mycology, and mushroom cultivation is technically called fungi culture (Rohit et al., 2018). Mushrooms are saprophytes, the organism (plants that do not have chlorophyll) which feed on nutrients from dead and decaying plant and animal matter. Adodo (2018) submitted that, many people mistakenly refer to mushrooms as plants; the fact is that mushrooms are not plants, vegetables or animals. They are specifically classified as fungi, and have always been a puzzle for scientists. Mushrooms share many attributes with plants and vegetables and animals, but they belong to a different kingdom of the organism that also contains yeast, moulds and many other variations of fungus. Islam (2015) assert that, mushrooms like all fungi, occupy a place between plant and animals and they do not make chlorophyll.

The chemical on which plants thrive by transmitting sunlight into food, and mushrooms eat or absorb nutrients from by-products of rotting vegetation, which explains why they grow well in damp and dark conditions. Mushroom production makes use of recycling of organic wastes into mushrooms, bio-fertilizer and biogas to reduce environmental pollution, raises social status when sold, enhances human immune systems and improves quality of life, improves economic standard of the people, it is a short return agricultural business and can be of immediate benefit to the community through the restoration of damaged environment by mushroom mycelia (Ndem & Oku, 2016).

Mushrooms are appreciated for their nutritive, medicinal, economic values, characteristic flavour and texture and have been traditionally used for medicinal purposes which contains hypo-cholesterolemic, antimor and antioxidant (Nagdeve, 2019), anti-fungal, anti-viral, immunomodulatory, anti-bacterial, anti-parasitic, hepataprotective and antidiabetic properties (Chioza & Ohga, 2014). They are also used for the treatment of cardiovascular diseases, inflammatory diseases and also have the ability to maintain the blood cholesterol at the optimum level, and contains tonic and cosmetic products. Compounds extracted from mushroom have anti-

fungal and anti-bacterial properties: anti-fungal (Wasser, 2014), anti-viral, immunomodulatory, anti-bacterial, anti-parasitic, hepataprotective and anti-diabetic properties (Ali, 2014).

The nutritional analysis of mushroom showed that mushrooms contain 90 to 93 per cent moisture, 28 to 42.5 per cent crude protein, 8.3 to 16.2 per cent crude fibre, 9.4 to 14.5 per cent ash, 59.4 per cent carbohydrates and 3.1 per cent fat. Among minerals, 71 mg calcium, 912 mg phosphorous, 106 mg sodium, 8.8 mg iron and 2850 mg potassium (per 100 g dry weight basis) are present. Among vitamins, 0.16 mg thiamine (B1), 2.4 mg riboflavin (B2) and 54.30 mg niacin (B3) are also available per 100 g dry weight basis (Angwenyi, 2016). Nutritionally, Kadhila,et al., (2012) noted that, nutracenticals in white button mushrooms have dietary fiber, Poly-Unsaturated Fatty Acids (PUFA-Fish oil), proteins, peptides, amino acids, keto acids, minerals, anti-oxidative vitamins and other antioxidants like glutathione, selenium among others for its production.

Production is the process of transforming raw materials or components into finished goods or an act of rendering services (Amozua & Gudugu, 2016). Anjov and Mojekwu (2016) referred to production as all economic activities that result in the creation of goods and services to certify human wants. Thus, the need for skills to be inculcated in agricultural education graduates for its production. Skill is the ability or capacity that is required or developed from training or experience by an individual to do an activity or job function well. Asogwa, et al., (2015) stated that skills are well-established habits of performing tasks in a manner acceptable by workers in the profession. There are various ways through which individuals are trained to acquire skills in mushroom production.

Training is the process of preparing an individual for job, a prerequisite for manpower development, economic development and economic growth (Amusa, et al., as cited in Ifeanyieze, et al., 2018). Training in this study, means the process of imparting agripreneurial skills in white button mushroom production for training agricultural education graduates. Agripreneurial skills are expertness or ability to explore, create and manipulate the business environment for gain or other usefulness in agriculture. Agripreneurial skills are processes of using available capital in any form of agricultural business endeavour in an open free-market economy for the sole purpose of making profits (Muhammed, et al., 2019). Agripreneurial skills in this study are the expertness or ability to explore, create and manipulate the business environment for gain or other usefulness in agriculture like mushroom production. Agripreneurs are individuals who organize and manage any business enterprise in agriculture (Alaribe, et al., 2019). Mittal as cited in Ekele (2019) submitted that agripreneurs are special category of entrepreneurs who have love for agriculture and apply their acquired skills and competencies to leverage potentials of all the agricultural sector of the economy which agricultural education graduates (agripreneurs) need for mushroom production in the study area.

Graduates are individuals who are recognized by a high school as having completed the requirements of a course of study at the school and be able to move to something more advanced. In the submission of Ekele (2018), agricultural education graduates are those who had completed a 3 years or 4 years course of study from college of education or university leading to the award of National Certificate of Education (NCE) or Bachelor of Agricultural Education (B.Agric.Ed).

Statement of the Problem

In North Central Nigeria white button mushroom is a fungus that is highly valued and appreciated as a delicacy among households. However, most of the white button mushroom supplied to the market are harvested from the wild or bush by farmers who had no training in the area of production before embarking on it without any means of replacement. Overtime, the researchers observed that, the quantity of mushroom supplied from the wild or bush falls below the quantity demanded by the consumers in the market as the quantity harvested from the bush is reducing due to deforestation, urbanization and the number of consumers increasing drastically due to high protein demand and increase in the population thereby widening the gap between quantity demanded and quantity supplied to the market. There is need for urgent measure to fill up this gap. This informed the researchers to embark on this study to ensure the quantity of mushroom demand and supply gap and increase in the nutritional supply and intake of households in North Central, Nigeria.

Purpose of the Study

The purpose of this study was to identify agripreneurial skills required for training agricultural education graduates in white button mushroom in North-Central, Nigeria. Specifically, the study ought to identify agripreneurial skills required by agricultural education graduates in:

1. Composting compost materials;
2. Pasteurizing compost materials;
3. Spawning compost materials and
4. Casing compost materials.

Research Questions

The following research questions were raised to guide the study:

1. What are the agripreneurial skills required by agricultural education graduates in composting compost materials?
2. What are the agripreneurial skills required by agricultural education graduates pasteurizing compost materials?
3. What are the agripreneurial skills required by agricultural education graduates in spawning compost materials?
4. What are the agripreneurial skills required by agricultural education graduates in casing compost materials?

Research Hypotheses

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

i. There is no significant difference between the mean responses of agricultural education graduates and agricultural extension agents in composting compost materials of white button mushroom for training agricultural education graduates in North-Central, Nigeria.

ii. There is no significant difference between the mean responses of agricultural education graduates and agricultural extension agents in pasteurizing compost materials of white button mushroom production for training agricultural education graduates in North-Central, Nigeria.

iii. There is no significant difference between the mean responses of agricultural education graduates and agricultural extension agents in spawning compost materials of white button mushroom production for training agricultural education graduates in North-Central, Nigeria.

iv. There is no significant difference between the mean responses of agricultural education graduates and agricultural extension agents in casing compost materials of white button mushroom production for training agricultural education graduates in North-Central, Nigeria.

METHODOLOGY

Four research questions and four hypotheses guided this study. Descriptive survey research method was adopted for this study. Emaikwu (2019) stated that descriptive survey research design is a plan, structure and strategy than an investigator adopts in order to obtain solution to research problems using questionnaire in collecting, analyzing and interpreting the data. This design is suitable because the study made use of questionnaire developed literature and functions of industry to collect data from the respondents. The area of the study was North- Central Nigeria: the population for the study was 270 comprising of 170 Number of Agricultural Education Graduates and 100 Agricultural Extension Agents. The entire population was used for the study because the size was small and manageable. Hence, there was no sampling. The instrument for data collection was 32-item questionnaire titled: Agripreneurial Skills Required for Training Agricultural Education Graduates in White Button Mushroom Questionnaire (ASRFTAEGIWBMQ). The questionnaire was developed from related literature by the researchers' with response scale of Highly Required, Averagely Required, Slightly Required and not Required with a corresponding value of 4, 3, 2 and 1. The instrument was face validated by five experts: one from the Department of Vocational Agriculture and Technology Education, two from the Department of Educational Foundation and General Studies (EFOGENS-Measurement and Evaluation), one from the Department of Crop Production, and one from Department of Agribusiness all from the Joseph Sarwuan Tarka University Makurdi, Benue state. Their corrections and suggestions were utilized to improve the initial copy of the questionnaire to produce the final copies. Cronbach-alpha reliability method was adopted to determine the internal consistency of the questionnaire items. A Cronbach-alpha coefficient of 0.89 was obtained. Two hundred and seventy copies of the questionnaire were administered to the respondents were retrieved and analyzed. Mean and standard deviation were used to answer the research questions while t-test statistic was used to test the hypothesis at 0.05 level of significance and at 268 degree of freedom. The

average mean of 2.50 was used for decision-making. Any item with a mean rating of 2.50 or above was regarded as a competency item that is required while any competency item with a mean rating less than 2.50 was regarded as not required. Any item with standard deviation between 0.00 and 1.98 indicated that the respondents were not far from the mean and the opinion of one another. The hypotheses of no significant difference was upheld for any item whose t-calculated value was less than the t-table value of 1.96 level of significance and at 268 degree of freedom.

RESULTS

The results of the study were obtained from the research questions and presented in Tables 1 - 4.

Research Question 1: *What are the agripreneurial skills required by agricultural education graduates in composting compost materials?*

The data answering research question one were presented in Table 1.

Table 1: Mean Ratings and Standard Deviation of Agricultural Education Graduates and Agricultural Extension Agents on Composting Compost Materials for Mushroom Production in North-Central Nigeria (n=270)

S/N	Item Statement Composting Compost Materials	$\bar{X}1$	σ_1	$\bar{X}2$	σ_2	$\bar{X}g$	Sg	Sig	Rmk
1.	Spread shredded straw (rice straw) in low pile of 60 to 80cm high and wet thoroughly for composting with other substrate materials	3.52	.88	3.50	.87	3.51	.88	.21	* NS
2.	Mix manure using garden fork with rice straw and gypsum very well to utilize a carbohydrate source with protein source.	3.41	.85	3.39	.84	3.40	.85	.21	*NS
3.	Make piles of 1.5m high and 1.8m wide for easy mixing of substrate materials.	3.28	.81	3.26	.81	3.27	.81	.22	*NS
4.	Add as much water as possible without run-off to mix the substrate materials very well for composting.	2.98	.73	2.95	.72	2.97	.73	.37	*NS
5.	Use boards to ensure vertical sides for easy composting.	3.53	.88	3.50	.87	3.52	.88	.36	* NS
6.	Compress the top to make the heap compact and leave for three days	3.19	.79	3.15	.77	3.17	.78	.46	* NS
7.	Make the first turn and add lime (gypsum) and reduce the width of the compost pile but maintain the height for good pile	3.31	.82	3.28	.81	3.29	.82	.33	*NS
8.	Make the second turn after three days to ensure adequate mixture of substrate.	3.43	.85	3.40	.84	3.42	.85	.32	*NS
9.	Turn the compost pile the third time to ensure adequate turning.	3.39	.84	3.35	.83	3.37	.84	.43	* NS
10.	Mix with garden fork very well adding water and reduce width to 1.5cm to get a fine texture for pasteurization.	3.21	.79	3.20	.79	3.20	.79	.11	*NS

Key: *N_1= Number of Agricultural Education Graduates, N_2= Number of Agricultural Extension Agents X_1= Mean of Agricultural Education Graduates, X_2= Mean of Agricultural Extension Agents, σ_1=Standard Deviation of Agricultural Education Graduates σ_2= Standard Deviation of Agricultural Extension Agents, *Required and ** Not Required*

Source: *Field Survey, 2024*

Table 1 revealed that all the 10 items had mean values ranging from 3.15 to 3.53; which are all above the cut off mean of 2.50. This implies that all the 10 items are composting compost materials skills for mushroom production in North-Central Nigeria. Also, the standard deviation ranged from 0.73 to 0.87. This shows that the responses of the respondents are not far from each other and from the mean, implying that the opinion of the respondents are not far from each other. Further, the Table showed that all the items had their calculated

value ranged from 0.11 to 0.46, which are all above the Table value of 1.96. This means that there is no significant difference in the mean response of respondents on pinning compost material skills for mushroom production in North-Central, Nigeria.

Table 2: Mean Ratings and Standard Deviation of Agricultural Education Graduates and Agricultural Extension Agents on Pasteurizing Compost Materials for Mushroom Production in North-Central, Nigeria (n=270).

S/N	Item Statement Pasteurizing Compost Materials	$\bar{X}1$	σ_1	$\bar{X}2$	σ_2	$\bar{X}g$	Sg	Sig	Rmk
1.	Pasteurize using heat source like firewood in tunnel to eliminate ammonia, eggs and larvae of harmful insects.	3.28	.81	3.25	.80	3.27	.81	.31	*NS
2.	Pasteurize using heat source like fire wood in heat chamber to eliminate ammonia, eggs and larvae of harmful insects.	3.17	.78	3.14	.77	3.16	.78	.30	*NS
3.	Pasteurize using heat source like firewood in drum to eliminate ammonia, eggs and larvae of harmful insects.	3.27	.81	3.23	.79	3.25	.80	.37	* NS
4.	Steam at 60-70^{0}C for 3-6hours to ensure adequate heat in the pasteurizing tunnel	3.31	.82	3.28	.81	3.30	.82	.33	*NS
5.	Place a wooden platform about 15-20inches tall inside tunnel heat chamber or drum to compress the substrate materials.	3.43	.85	3.40	.84	3.42	.85	.32	*NS
6.	Fill water to about a quarter of the tunnel	3.26	.81	3.22	.79	3.24	.80	.45	*NS
7.	Heat tunnel, chamber or drum to about 5 inches below the wooden platform to allow for penetration of heat	3.29	.81	3.26	.81	3.28	.81	.33	*NS
8.	Pack substrates using spade into heat resistant porous bags to allow for penetration of heat to destroy ammonia and creating a suitable climate for specific organisms to eliminate eggs and larvae. organisms to eliminate eggs and larvae	3.52	.88	3.49	.87	3.51	.88	.31	*NS
9.	Cover the drum with cover tightly to hold steam.	3.44	.85	3.40	.84	3.42	.85	.42	*NS
10.	Provide heat under the drum to boil producing steam that seeps into the substrates in the bags within the drum.	3.32	.82	3.30	.82	3.31	.82	.22	*NS
11.	Keep the bags of the substrate to cool in sterilized environment before being dispensed into plastic bags for inoculation.	3.19	.79	3.15	.77	3.17	.78	.46	*NS

Key: *N_1= Number of Agricultural Education Graduates, N_2= Number of Agricultural Extension Agents X_1= Mean of Agricultural Education Graduates, X_2= Mean of Agricultural Extension Agents, σ_1=Standard Deviation of Agricultural Education Graduates σ_2= Standard Deviation of Agricultural Extension Agents, *Required and ** Not Required*

Source: *Field Survey, 2024*

Table 2 showed that all the 11 items had mean values ranging from 3.14 to 3.49; which are all above the cut off mean of 2.50. This implies that all the 10 items are pasteurizing compost materials skills for mushroom production in North-Central, Nigeria. Also, the standard deviation ranged from 0.77 to 0.88. This shows that the responses of the respondents are not far from each other and from the mean, implying that the opinion of the respondents are not far from each other. Further, the Table showed that all the items had their calculated value ranged from 0.22 to 0.46, which are all above the Table value of 1.96. This means that there is no

significant difference in the mean response of respondents on pasteurizing compost materials skills for mushroom production in North-Central, Nigeria.

Table 3: Mean Ratings and Standard Deviation and t-test of Agricultural Education Graduates and Agricultural Extension Agents on Spawning Compost Materials for Mushroom Production in North-Central, Nigeria (n=270)

S/N	Item Statement Spawning Compost Materials	$\bar{X}1$	σ_1	$\bar{X}2$	σ_2	$\bar{X}g$	Sg	Sig	Rmk
1.	Propagate mycelium (thin, thread-like cells) vegetatively from germinated spores for spawning.	3.05	.75	3.00	.73	3.03	.74	.60	*NS
2.	Multiply culture of spawn by sub-culturing onto medium on petri dishes for neat culture production.	3.17	.78	3.15	.77	3.16	.78	.23	*NS
3.	Sterilise a mixture of millet grain with rye and wheat from germ infestation.	2.89	.78	2.86	.69	2.88	.74	.39	*NS
4.	Shake mycelium 3times at 4-day intervals over a 14-day period for active mycelial growth.	2.99	.73	2.91	.73	2.95	.73	.12	*NS
5.	Refrigerate spawn at -20^{0}C for 2 minutes and freeze dry in a freeze drier for about 7days for preservation.	3.09	.76	3.07	.75	3.08	.76	.24	*NS
6.	Encapsulate micro-droplets of mushroom compost at spawning to overcome the limitations of delayed release of supplements for mushroom culture.	3.49	.87	3.47	.86	3.48	.87	.21	*NS
7.	Stimulate mushroom yield at spawning with Micromax®	3.51	.87	3.49	.87	3.5	.87	.21	*NS
8.	Mix spawn thoroughly using spade and garden fork.	3.31	.82	3.29	.81	3.3	.82	.22	*NS
9.	Add spawn to the sterilized/pasteurized substrate under hygienic conditions in an enclosed space.	3.28	.81	3.27	.81	3.28	.81	.11	*NS
10.	Remove a portion of the substrate colonized by the mushroom spawn from the new crop using it for spawning the following crop.	3.00	.73	2.99	.73	3.00	.73	.12	*NS
11.	Chop rice straw with sharp small knife (or water hyacinth leaves) into pieces about 2 to 3cm (1inch) long and soak in water for 4-12 hours for good spawn.	3.16	.78	3.17	.78	3.17	.78	.12	*NS
12.	Sterilise to kill all the microbes for at least an hour at 121^{0}C before inoculating with mother spawn.	2.93	.71	2.90	.70	2.92	.71	.38	*NS

Key: *N_1= Number of Agricultural Education Graduates, N_2= Number of Agricultural Extension Agents, X_1= Mean of Agricultural Education Graduates, X_2= Mean of Agricultural Extension Agents, σ_1=Standard Deviation of Agricultural Education Graduates σ_2= Standard Deviation of Agricultural Extension Agents, *Required and ** Not Required*
Source: *Field Survey, 2024*

Table 3 showed that all the 11 items had mean values ranging from 2.93 to 3.51; which are all above the cut off mean of 2.50. This implies that all the 10 items are spawning compost materials skills for mushroom production in North-Central, Nigeria. Also, the standard deviation ranged from 0.69 to 0.87. This shows that the responses of the respondents are not far from each other and from the mean, implying that the opinion of

the respondents are not far from each other. Further, the Table showed that all the items had their calculated value ranged from 0.11 to 0.60, which are all above the Table value of 1.96. This means that there is no significant difference in the mean response of respondents on pinning compost material skills for mushroom production in North-Central, Nigeria.

Table 4: Mean Ratings and Standard Deviation of Agricultural Education Graduates and Agricultural Extension Agents on Casing Compost Material for Mushroom Production in North-Central Nigeria (n=270)

S/N	Item Statement Casing Compost Materials	$\bar{X}1$	σ_1	$\bar{X}2$	σ_2	$\bar{X}g$	Sg	Sig	Rmk
1.	Mix peat moss using spade and garden fork with ground limestone to maintain a moist surface for easy casing.	3.28	.81	3.25	.80	3.27	.81	.22	*NS
2.	Supply as much water as possible to the casing without leaching into underlying compost to provide the greatest yield of mushroom	3.28	.81	3.25	.80	3.27	.81	.33	*NS
3.	Sundry partially milled peat before packaging to remove the moisture content in it preventing spoilage	2.97	.72	2.95	.72	2.96	.72	.25	*NS
4.	Transport wet-dug peat in saturated form for its high water holding capacity.	3.44	.85	3.40	.84	3.42	.85	.42	*NS
5.	Sterilize mixture of peat, vermiculate and wheat bran for colonized mushroom mycelium to kill contaminating moulds insects	3.15	.77	3.14	.77	3.15	.77	.46	*NS
6.	Mix using spade and garden fork peat, vermiculate, wheat bran and case to decrease cropping cycle time for improved uniformity of mushroom distribution over the bed to decrease cropping cycle time and improving uniformity of mushroom.	3.34	.83	3.32	.82	3.33	.83	.22	*NS
7.	Eradicate using formalin or chloripin weed moulds, nematodes and pathogens in the compost when supplementing at casing to enhance proper mushroom growth.	3.28	.81	3.25	.80	3.27	.81	.22	*NS
8.	Case Farm Yard Manure (FYM) 1part and loamy soil 1Part for top dressing of perfect mushroom formation.	3.30	.81	3.19	.79	3.25	.80	1.23	*NS
9.	Sterilize casing soil with chemicals like formalin or chloripin using FYM to eradicate unwanted organisms like contaminating moulds.	3.43	.85	3.32	.82	3.38	.84	1.17	*NS

Key: *N_1= Number of Agricultural Education Graduates, N_2= Number of Agricultural Extension Agents, X_1= Mean of Agricultural Education Graduates, X_2= Mean of Agricultural Extension Agents, σ_1=Standard Deviation of Agricultural Education Graduates, σ_2= Standard Deviation of Agricultural Extension Agents, *Required and **Not Required*

Source: *Field Survey, 2024*.

Table 4 showed that all the 9 items had mean values ranging from 2.95 to 3.44; which are all above the cut off mean of 2.50. This implies that all the 10 items are casing compost material skills for mushroom production in North-Central Nigeria. Also, the standard deviation ranged from 0.72 to 0.85. This shows that the responses of the respondents are not far from each other and from the mean, implying that the opinion of the respondents are not far from each other. Further, the Table showed that all the items had their calculated value ranged from

0.22 to 1.17, which are all above the Table value of 1.96. This means that there is no significant difference in the mean response of respondents on casing compost material skills for mushroom production in North-Central, Nigeria.

DISCUSSIONS OF RESULTS

Research question one sought to find out the agripreneurial skills required by agricultural education graduates in composting compost materials. A close observation of the analysis revealed that the respondents agreed to all the ten (10) items. These items: were mix manure using garden fork with rice straw and gypsum very well to utilize a carbohydrate source with protein source, make piles of 1.5m high and 1.8m wide for easy mixing of substrate materials, make piles of 1.5m high and 1.8m wide for easy mixing of substrate materials, make piles of 1.5m high and 1.8m wide for easy mixing of substrate materials, add as much water as possible without run-off to mix the substrate materials very well for composting, use boards to ensure vertical sides for easy composting, compress the top to make the heap compact and leave for three days, make the first turn and add lime (gypsum) and reduce the width of the compost pile but maintain the height for good pile, make the second turn after three days to ensure adequate mixture of substrate, turn the compost pile the third time to ensure adequate turning and mix with garden fork very well adding water and reduce width to 1.5cm to get a fine texture for pasteurization.

These findings are in agreement with Onwubuya, et al., (2015) who found out that in composting poultry or animal manure (decomposed), and cassava or yam peels (decomposed), the cassava peels and poultry manure are thoroughly mixed and put in a jute bag/sack, should be tied at the top lightly watered until contents ferment as this will serve as the substrate media which is spread on an already cleared. The findings are also in agreement with Chang (2018) who found out that paddy seed, maize, sorghum, and paddy grain are also materials used in composting.

With reference to the second research question, the study sought to identify the agripreneurial skills required by agricultural education graduates pasteurizing compost materials. A close observation of the analysis revealed that the respondents agreed to all the eleven (11) items. These items were: pasteurize using heat source like firewood in tunnel to eliminate ammonia, eggs and larvae of harmful insects, pasteurize using heat source like firewood in drum to eliminate ammonia, eggs and larvae of harmful insects, steam at 60-70^{0}C for 3-6hours to ensure adequate heat in the pasteurizing tunnel, place a wooden platform about 15-20inches tall inside tunnel heat chamber or drum to compress the substrate materials, fill water to about a quarter of the tunnel heat tunnel, chamber or drum to about 5 inches below the wooden platform to allow for penetration of heat, pack substrates using spade into heat resistant porous bags to allow for penetration of heat to destroy ammonia and creating a suitable climate for specific organisms to eliminate eggs and larvae, cover the drum with cover tightly to hold steam, provide heat under the drum to boil producing steam that seeps into the substrates in the bags within the drum, and keep the bags of the substrate to cool in sterilized environment before being dispensed into plastic bags for inoculation. This findings is in consonance with Gamage and Ohga (2018) that pasteurization using heat source like firewood in drum eliminates ammonia, eggs and larvae of harmful insects. The findings is also in agreement with Sandor, et al., (2016) who said pasteurization of compost materials helps spawning and casing of mushroom.

Research question three (3) was on agripreneurial skills required by agricultural education graduates in spawning compost materials. The respondents agreed to all the twelve (12) items. These items were: propagate mycelium (thin, thread-like cells) vegetatively from germinated spores for spawning, multiply culture of spawn by sub-culturing onto medium on petri dishes for neat culture production, sterilise a mixture of millet grain with rye and wheat from germ infestation, shake mycelium 3times at 4-day intervals over a 14-day period for active mycelial growth, refrigerate spawn at -20^{0}C for 2 minutes and freeze dry in a freeze drier for about 7days for preservation, encapsulate micro-droplets of mushroom compost at spawning to overcome the limitations of delayed release of supplements for mushroom culture, stimulate mushroom yield at spawning with Micromax®, mix spawn thoroughly using spade and garden fork, add spawn to the sterilized/pasteurized substrate under hygienic conditions in an enclosed space, remove a portion of the substrate colonized by the mushroom spawn from the new crop using it for spawning the following crop, chop rice straw with sharp small knife (or water hyacinth leaves) into pieces about 2 to 3cm (1inch) long and soak in

water for 4-12 hours for good spawn, and sterilise to kill all the microbes for at least an hour at 121^0C before inoculating with mother spawn.

The findings is in line with Mishra, et al., (2022) who said spawning should be done in a pre-fumigated room (48 h with 2% formaldehyde), the spawn should be mixed at 2 to 3% of the wet weight of the substrate. One spawn bottle of 200 g is sufficient for 8 kg of wet substrate or 2 kg dry substrate and 10 to 15 small holes (0.5-1.0 cm dia) should be made on all sides especially two to four holes in the bottom for draining excess water among others. The findings is also in agreement with Maheshwari (2013) who said proper spawning helps composting and cropping of mushroom.

With reference to the fourth research question, the study sought to identify the agripreneurial skills required by agricultural education graduates in casing compost materials. A close observation of the analysis revealed that the respondents agreed to all the nine (9) items. These items were: mix peat moss using spade and garden fork with ground limestone to maintain a moist surface for easy casing, supply as much water as possible to the casing without leaching into underlying compost to provide the greatest yield of mushroom, sundry partially milled peat before packaging to remove the moisture content in it preventing spoilage, transport wet-dug peat in saturated form for its high water holding capacity, sterilize mixture of peat, vermiculate and wheat bran for colonized mushroom mycelium to kill contaminating moulds insects, mix using spade and garden fork peat, vermiculate, wheat bran and case to decrease cropping cycle time for improved uniformity of mushroom distribution over the bed to decrease cropping cycle time and improving uniformity of mushroom, eradicate using formalin or chloripin weed moulds, nematodes and pathogens in the compost when supplementing at casing to enhance proper mushroom growth, Case Farm Yard Manure (FYM) 1part and loamy soil 1Part for top dressing of perfect mushroom formation and sterilize casing soil with chemicals like formalin or chloripin using FYM to eradicate unwanted organisms like contaminating moulds. This findings are in agreement with Royce and Beelman (2014) who said casing should be done to decrease cropping cycle time for improved uniformity of mushroom distribution over the bed to decrease cropping time and water should be supplied as much as possible to the casing without leaching into underlying compost to provide the greatest yield of mushroom. The findings of the authors cited above helped to strengthen the validity of the findings of this study.

CONCLUSION

1. Ten (10) agripreneurial skills were required in composting compost materials for training agricultural education graduates in *A,bisporus* production in North-Central, Nigeria.
2. Eleven (11) agripreneurial skills were required in pasteurizing compost materials for training agricultural education graduates in *A,bisporous* Production in North-Central, Nigeria.
3. Twelve (12) agripreneurial skills were required in spawning compost materials for training agricultural education graduates in *A.bisporus* production in North-Central, Nigeria.
4. Nine (9) agripreneurial skills were required in casing compost materials for training agricultural education graduates in *A.bisporus* production in North-Central, Nigeria.

RECOMMENDATIONS

The following recommendations have been made based on the findings of the study:

i. All the identified agripreneurial skills required for training agricultural education graduates in white button mushroom should be given more emphasis when training the graduates or people interested in going into white button mushroom production.

ii. All the identified agripreneurial skills should be packaged as training manual by skills acquisition centres to train agricultural education graduates and other set of graduates who are interested in going into white button mushroom production.

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