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Survey on Vermitechnology Practice by Farmers for Organic Crop Production and for Food Security in Rivers State

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Abstract: *This study examined vermitechnology practice by farmers for organic crop and food security in Rivers State. Two objectives and two research questions were formulated to guide the study. While two hypotheses were postulates and test at 0.05 level of significance. The study adopted research survey design and the population of the study comprised of all the crop farmers in the study area. The sample size for the study was 54 using multi-stage sampling technique. Instrument for data collection was self-structured questionnaire titled "Vermitechnology Practice for Organic Crop Production" with 4 point rating scale. The instrument was subjected to reliability test using Cronbach Alpha and reliability coefficient index of 0.92 was obtained. The instrument which was 54 in number, were administered to the respondents and all were equally retrieved, immediately after completion. Data were analysed using mean and standard deviation as statistical tool while hypothesis was tested using z-test. Result from the findings showed that the farmers were of low extent on the awareness of the vemitechology for organic crop production and food security, while material selection skills required in vermitechnology for organic crop production and food security were of high extent. However, it was recommended that government through Ministry of Agriculture and Non-government Agencies in the state should organize training for farmers in order to increase their awareness on the knowledge and skill requirements in vermitechnology for organic crop production in the state.*

Keywords: Vermitechnology, Organic Crop Production & Food Security

Introduction: Nigeria is one of the nations that depends on agriculture production for food security and foreign exchange earning thereby bridging the nutritious gap of her citizenry and boasting the Gross Domestic Products (GDP) of the country. However, agriculture production practice involves rearing of livestock and cultivation of crops for the purpose of food and raw materials for man's use either through direct consumption as food or industrial material utilization for value addition. The agricultural production also demands practices that will guarantee healthy environment and food as output in the process of rearing animal and cultivation of food crops. The output of agricultural produce in terms of healthy and high nutritional values is determined by the materials inputs used at the production stages especially food crops. Hence, food crops when cultivated needs the support of soil amendments through the use of fertilizers application, pesticides for control of pests and diseases attack on the crops and herbicides for the control of weeds among growing crops in order to reduce soil nutrient competition which would have direct impact on the growth and quality of yield of the farm produce.Therefore, these inputs used could be organic or inorganic materials. When it organic, is it implies that no synthetic materials are required by the farmers in every stages of the cultivation till harvest. The output is then referred as organic farm produce. In support of this, view Huber and Schneider (1982) in Rajiv et al., (2011) affirmed that organic farming is geared towards producing fertilizer that are biological based (bio-fertilizer), and bio-control of pests and diseases (bio-pesticides) with the intention of restoring biologically active disease suppressive fertile soil with beneficial microbes, and nematodes that are capable of protecting plant health, while promoting growth. Organic farming system according to the authors has the capac to support nutritive bio fertilizers like earthworm vemicor st that gives high food productivity with significantly h.gher nutritional quality while also improving the physical, chemical and biological properties of soil when compared with synthetic fertilizers or inorganic manure.

Earthworm vermicompost is highly nutritive and powerful plant growth promoter and protector, with crop produce (organic food) that guarantees and protect human health, even against colon cancer and breast cancer (Olsson, 2006). The concept of using earthworm especially the red earthworm for composting is derived from its behavioural pattern. Earthworm feed on a variety of organic materials and produce "vermicatings" in its natural habitat. This vermicast contain more micro-organisms, organic matter and inorganic materials in the form that it can be used by the plant (Kaladhar, 2017). Hence, when earthworm are culture for the purpose of producing manure is referred as vermiculture while vermicomposting demands the use of earthworms to convert organic materials into a humus like material. The concept of growing earthworm for the purpose of composting organic materials through interactions between earthworms and microorganisms, under aerobic conditions enhances the release of nutrients which is been converted into soluble form according to Ndegwa & Thompson (2001) in Jayanta, (2015) provides macro-nutrients such as nitrogen (N), soluble potassium (K), exchangeable calcium (Ca), phosphorus (P), magnesium (Mg) and microelements such as iron (Fe), zinc (Ze) and

copper (Cu) that is can easily be taken up by the plant (Edward & Fletcher, 1988 in Jayanta, 2017).

The process by which earthworms are used to decompost organic materials especially *eudrillus eugeniae, eisenia foetidae, perionyx excavates, lampito mauritii and dravida willsil* are cultured and intentionally used for decomposting of diverse range of organic residues or waste which yield rich vermicompost for crops production and enhancement of soil fertility is referred as vermitechnology (Kaladhar, 2017).

Vermitechnology according to Jambhheka, (2002) in Kaladhar (2017) uses the following materials; breeder worms, like red wigglers, a wooden bed or concrete bed and organic wastes. The bed should be of desired length of about 75cm high x 120cm wide, while worms should be introduced to every part of the waste. The author recommended other steps in process of vermitechnology practice which include: Sieving and shredding skill implies that decomposting can be accelerated by shredding of raw materials into small pieces such as fresh green plant waste; Blending skill this requires the combination of carbonaceous substances such as saw dust, paper and straw mixed with nitrogen rich materials such as sewage sludge, biogas, slurry and fish scraps to obtain a nearly optimum carbon and nitrogen (C:N) ratio. This mixture produces good quality compost, rich in macronutrients and micronutrients; Half digestion skill: application demands that the mixed materials should be kept in piles under temperature ranged between 50-55^{oc} for ten days; Maintaining moisture, temperature and P^{H}: The skills enhances the optimum moisture level required for aerobic condition which is 40-45 percent. This can be achieved by mixing fibrous with nitrogen rich materials, while the temperature of the piles should ranged between 28-30^{oc}. Higher or lower temperature reduces the activity of micro flora and earthworms. The height of the bed is an added advantage in controlling of temperature. Similarly, the P^{H} of the raw materials should not exceed 6.5-7. Hence, the compost is ready after about granular, high weight and humus rich (Jambheka, 2022) in Kaladhar, 2017. In order to facilitate the separation of worms from the compost, watering should cease two to three days before emptying the beds because this will force the entery of the earthworms to the bottom of the bed (Kaladhar, 2017). The author added, that the remaining worms can be removed for the next production stage while the vermicast or vermicompost can be used for field to enrich the soil, thereby supporting crop/plant growth and yield and discouraging the use of inorganic fertilizer.

However, the adoption of vermitechnology for organic crop production by farmers is affected by their level of awareness on the skills required. Hence, the use of bio-fertilizers and bio-pesticides in crop production on the part of the farmers is referred to organic crop production (Twarawi & Ranjan, 2006). The adoption of organic crop farming will enhance soil quality, high yield, and improved income to the farmer and protection of the environment which will guarantee healthy food therefore contributing to food security. Food security according to Food and agricultural Organization (2001) refers to a situation where all individuals, irrespective of their social class at all times have physical, social and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

Nigeria as nation depends on agriculture for food and raw materials and farmers are saddled with the responsibility of accomplishing this noble task. The quality and quantity of food produce by farmers is dependent on the agronomic practices that is they are exposed to in the cultivation process. The farmers most times in attempt to increase yield, control pest and diseases including weed in their farms, resort to the use of synthetic fertilizers, pesticides and herbicides. These farm inputs significantly contaminate food stuff long after they are taken away from farm for human consumption (Sinha et al., 2009). The author indicated that consistent use of residual pesticide in soils of crop lands such as phosphamidon, DDIP, methyl parathion, malathion, chlorpyriphos when absorbed by plant will contaminate the food crops with toxin or heavy metals that is detrimental to human health. Reported by Lloyed, (2011) showed that persistent toxic chemicals in the US food supply, daily exposes consumers to organic pollutants such as dioxins through their food.

Regrettably, most crop farmers in Rivers State that cultivate crops in their farmland have adopted the use of inorganic chemical for the control of pests and diseases, herbicide for control of weeds while inorganic fertilizers are used for soil amendment in order to increase yield of their crops as against organic bio-fertilizer and bio-pesticides. The pertinent question is that does the farmers really utilized vermitechnology concepts for crop production in order to produce high quality food crops free from toxin? Answer to this question, emanated this study on the utilization of vermitechnology practice by farmers for organic crop production and food security in Rivers State. The aim of the study is to determine the level of utilization of vermitechnology practice by farmers for organic crop production and for food security. Specifically, the objectives are to; determine the awareness of vermitechnology practice by farmers for organic crop production and food security in Rivers State; ascertain material selection skills required by farmers in vermitechnology practice for organic crop production and food security in Rivers State.

Research Questions: To what extent does the farmers are aware of vermitechnology practice for organic crop production and food security in Rivers State?**:** To what extent does the farmers require vermitechnology skills for organic crop production and food security in Rivers State?

Hypothesis: 1. There is no significant difference in the mean rating on male and female farmers on the extent of awareness on vermitechnology practice for organic crop production and food security; 2. There is no significant difference in the mean responses of male and female farmers on the required vermitechnology skills for organic crop production and food security.

Methodology: The study adopted descriptive survey design while population of the study comprised all the crop farmers in the Rivers State. However, using multi-stage sampling techniques, entire state were clustered into three groups according to the senatorial districts Rivers South East.

Purposively, two local government were selected from each districts while, randomly, 4 male farmers and 5 female farmers were selected from each local government as respondents. Instrument for data collection is titled: Vermitechnology practice for organic crop production questionnaire (VSQCPQ). However, instrument was designed using 4-point rating scale and response attached to the items were Very High Extent (4), High Extent (3), Low Extent (2) and Very Low Extent (1). Instruments were also subjected to a reliability test and reliability coefficient of 0.92 was obtained using Cronbach Alpha. Although, all the instrument which are 54 copies were administered to the respondents and were all retrieved, and used for data analysis. Data were analyzed using descriptive statistics of mean and standard deviation in answering the research questions while hypotheses were tested using z-test statistics at 0.05 level of significance. Mean rating weighed 2.50 and above were considered high extent and those weighted below 2.50 were considered low extent. Z-test for the hypotheses were rejected when the z-cal $\geq$ z-crit and accepted when z-cal $\leq$ z-crit.

Result Presentation and Discussion of Findings:
Research Question One: To what extent does farmers are aware of vermitechnology practice for organic crop production and food security in Rivers State?: Data analyzed in table 1, shows the level of awareness of farmers in vermitechnology with mean values that ranged between 2.15 to 2.49 in research item one to seven. However, with the grand mean values of 2.10 and 2.36 for both male and female farmers showed, Low Extent on the level of awareness by farmers on vermitechnology practice for organic crop production and food security in Rivers State. Therefore, with standard deviation that ranged between 0.35 to 0.72, and grand standard deviation of 0.62 and 0.54, showed closeness in the opinions of the respondents.

Research Question Two: To what extent does the farmers require vermitechnology skills in organic crop production for food security?: Table 2, shows data analyzed on the vermitechnology skills required by farmers for organic crop production. The mean values obtained ranged between 2.99 – 3.61 from item 8 to 17. The grand mean values of the male and female farmers were 3.25 and 3.24 which indicated High Extent on the required vermitechnology skills by farmers for organic crop production and food security in Rivers State. Similarly, with the standard deviation that ranged between 0.61 – 1.03 and a grand standard deviation of 0.84 and 0.79, showed closeness in the opinions of the respondents.

Hypotheses Test

The null hypotheses were tested at 0.05 level of significance using z-test.

1. There is no significant difference in the mean rating of the male and female farmers on the extent of awareness in vermitechnology practice for organic crop production and food security in Rivers State.

Discussion of Findings: Findings in research question one in table 1, revealed that the farmers are of Low Extent on the awareness of vermitechnology practice for organic crop production and for food security in Rivers State. The study further revealed Low Extent on the following items: knowledge of vermicompost as organic manure source, awareness on role of earthworm in convertion of organic materials to nutrients, knowledge of soil nutrients derived from vermitechnology, information on toxin found in food crops after harvest due to inorganic chemicals, awareness of materials required in vemicomposting, knowledge of various steps in vermitechnology and awareness of residual effect of inorganic chemicals presence, in soil after persistent use. This implies that crop farmers lack information that would have created awareness on the benefits of vermitechnology practice among them for organic crop production and food security in Rivers State. The study supports the findings of Sinha et al (2009), they indicated that consistent use of pesticides in India soils of crop lands such as DDVP, methyl, parathion, malathion, chlorpyriphos when absorbed by plant contaminate the crops with toxin that is detrimental to human health. In the same vein, Llyoyd (2011) reported that persistent toxic chemicals in U.S. food supply, daily exposes consumers to persistent organic pollutants such as Dioxins through food that will impact negatively on human health. Hence, the findings of Ndegwa and Thompson (2001) in Jayanta (2015) stressed that the purpose of growing earthworm is to convert organic materials into humus like materials under aerobic condition. This enhances the release of macro nutrients such as nitrogen; soluble potassium, exchangeable calcium and micronutrient such as zinc, copper, iron among others in which farmers are not aware in the study area. Findings in research question two in table 2, showed that the farmers were of High Extent on the vermitechnology skills required in organic crop production for food security in Rivers State. The study further indicated that farmer required skills to construct vemicomposting bed with right dimension, materials selection for vemicomposting, sieving and shreeding skill in vermitechnology, blending skill, moisture and temperature maintenance among others. The study supported the sumbissions of Jambhheka (2002) in Kaladhar (2017) who outline skills required in vermitechnology for organic crop production practice which include skill to breed earthworms like red wigglers, construct wooden bed for organic waste composting, sieving and shredding skill, blending skill by combining nitrogen rich materials with carbonaceous substances, half digestion skills and skill in maintaining moisture, temperature and P^H at optimal level. Hence, skill is required for vermitechnology for organic crop production by farmers in the study area.

Conclusion: The study examined vermitechnology practice by farmers for organic crop production and food security in Rivers State. Based on the data analyzed and findings from the study, it is concluded that farmers in River State are not fully aware of vermitechnology practice and they also lack basic skills required in vermitechnology. Hence, this enhances the use of inorganic fertilizers for the enrichment of the soil nutrients, use of chemical pesticides for control of

pests and disease that are highly detrimental to the environment and human health.

Recommendations: The Government of Rivers State through Ministry of Agriculture in partnership with NGO\s that are into agriculture, should promote organic crop production by creating awareness on the benefits of organic farming through vermitechnology among farmers in the state.**;** Training and demonstration workshop should be organized for the farmers by Rivers State Ministry of Agriculture on skills required for vermitechnology practice for organic crop production in the State.

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Table 1: Data analyzed on the awareness of farmers on vermitechnology

S/N	ITEMS	Male Farmer N = 24		Female Farmer N = 30		Remark
		$\bar{X}^2$	SD[1]	$\bar{X}^2$	SD[2]	
1.	knowledge of vermicompost as organic manure source	2.46	0.63	2.35	0.57	Low Extent
2.	Awareness on role of earthworm especially red wiggers for convention of organic material to nutrients.	2.49	0.71	2.44	0.60	Low Extent
3.	Knowledge of soil nutrients derived from vermitechnology such as macro and micro nutrients.	2.48	0.60	2.39	0.55	Low Extent
4.	Information on toxin found in food crops after harvest due to the inorganic chemicals	2.40	0.56	2.46	0.61	Low Extent
5.	Awareness of materials required in vermicomposting	2.47	0.72	2.45	0.62	Low Extent
6.	Informed knowledge of the various steps in vermitechnology.	2.42	0.49	2.30	0.49	Low Extent
7.	Awareness of residual effect in organic chemicals presence in soil after consistent use.	2.44	0.60	2.15	0.35	Low Extent
	Grand Mean	**2.10**	**0.62**	**2.36**	**0.54**	**Low Extent**

Field Report, 2025

Table 2: Data analyzed on the vermitechnology skills required by farmers for organic crop production among farmers and food security

S/N	ITEMS	Male Farmer N = 24		Female Farmer N = 30		Remark
		$\bar{X}^1$	SD[1]	$\bar{X}^2$	SD[2]	
8.	Capacity to construct vermicomposting bed with right dimension	3.54	0.65	3.59	0.95	High Extent
9.	Skill of material selection for vermicomposting	3.70	0.89	3.13	0.71	High Extent
10.	Ability to identify the right time to introduce earthworms	3.04	0.81	3.09	0.89	High Extent
11.	Sieving and shreeding skill in vermitechnology	3.05	0.84	3.61	1.03	High Extent
12.	Blending skill of carbonaceous substances and nitrogen rich materials	3.14	0.90	3.63	0.79	High Extent
13.	Knowledge of half digestion skill in vermitechnology	3.12	0.89	3.20	0.92	High Extent
14.	Moisture and temperature maintenance skill in vermitechnology	3.06	0.72	3.10	0.83	High Extent
15.	Knowledge of the required level of vermicomposting	3.41	0.92	2.99	0.88	High Extent
16.	Duration of vermicomposting processes before use in field	3.36	1.03	3.54	0.93	High Extent
17.	Skills to culture and manage earthworm before and after vermicomposting	3.03	0.78	3.09	0.70	High Extent
	Grand Mean	**3.25**	**0.84**	**3.24**	**0.79**	**High Extent**

Field Report, 2025

Table 3: Z-test on awareness of vermitechnology practice by farmer

N = 54	$\bar{X}$	SD	df	Sig.	Z-cal	Z-crit	
Male Farmers	2.10	0.62	52	0.05	1.56	1.96	Accepted
Female Farmers	2.36	0.54					

The z-test in table 3 was tested at 0.05 level of significance at df of 52, while z-cal is 1.56 and z-crit 1.96. Hence, the null hypothesis that state there is no significant difference in the mean rating of the male and female farmers on the awareness of vermitechnology practice for organic crop production for food security in Rivers State was upheld.

Table 4: Z-test on vermitechnology skill required by farmers

N = 54	$\bar{X}$	SD	Df	Sig.	Z-cal	Z-crit	
Male Farmers	3.25	0.84	52	0.05	1.72	1.96	Accepted
Female Farmers	3.24	0.79					

The Z-test in table 4 was tested at 0.05 level of significance at df of 52 while z-cal is 1.72 and z-crit 1.96. Since the z-cal was less than z-crit, the null hypothesis was accepted. This shows that there is no significant difference in the mean rating of the male and female farmers on the vermitechnology skills required for organic crop production and food security in Rivers State.