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Mechanisms Needed by Lecturers of Agricultural Education in Biological Fish Feeds Production for Sustainable Food Security

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Abstract

This study identified the mechanisms needed by lecturers of agricultural education in biological fish feeds production for sustainable food security. Three questions were developed and three hypotheses were formulated for the study. Questionnaire survey research design was used for the study. The study was conducted in higher institutions (Universities and Colleges of Education) offering agricultural education in Benue State of Nigeria. The population of the study was 42 lecturers and the entire population was used for the study due to its small and manageable size; as such there was no sampling. Biological Fish Feeds Production Mechanisms Questionnaire (BFFPMQ) was developed and used for data collection. The questionnaire had a four-point response options of highly needed (HN), averagely needed (AN), slightly needed (SN) and not needed (NN) with a corresponding value of 4, 3, 2 and 1, respectively. Three experts validated the BFFPMQ items. Cronbach alpha reliability method was used to determine the internal consistency of the questionnaire items. A reliability coefficient of 0.87 was obtained. The data were collected by the researchers from the respondents with the help of four research assistants who were familiar with the area of the study. A total of 42 copies of the questionnaire were administered and all were retrieved within 5 days of administration. Data collected for the study were analyzed using mean to answer the research questions and t-test analysis to test the hypotheses. It was found that 12 mechanisms in daphnia production, 9 mechanisms in earthworm production and 7 mechanisms in magmeal production were needed by lecturers of agricultural education in biological fish feeds production for sustainable food security in Benue State. Recommendations, among others, were that lecturers of agricultural education should use the identified mechanisms to teach students how to produce biological fish feeds.

Keywords: Agricultural; Biological fish feeds; Earthworm; Poikilothermic; Magmeal

Introduction

There is need for every country to be food secured to enhance development and economic stability among the citizenry. Agricultural education is one of the means through which most countries ensure that agricultural experiences and skills are transferred to future generation for sustainable food security. According to World Bank report (2011), food security entails accessibility of good, quality and safe food at all time that meet up the dietary requirements of all individuals in the right proportions. The organization maintained that, there are three pillars underpinning food security. These are food availability, food accessibility, and food utilization. This means that a nation whose food production level is unable to satisfy these three criteria is said to be food insecure. Food production must be sustainable to ascertain its security.

Sustainable food security as submitted by Kifordu refers to meeting the dietary needs of all individuals at the present without compromising future generation to meet their needs. The author further stressed that the environment should be seen as an assert, a stuck of available wealth because if the present generation spend the wealth without investing for the future, then the world will run short of resources. Sustainable food security therefore, is ensuring that all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. In other to ensure food security, government at many times bought up programmes that support agricultural production such as fishery.

Fish is an aquatic "poikilothermic" animal. It lives in water and the body temperature changes with the temperature of the surrounding environment. Fish is used primarily as human food because it is rich in protein, iron, zinc, magnesium, phosphorus, calcium, vitamin A and C while marine fish is a good source of iodine [1]. Fish like other animals, have requirements for the essential nutrients such as fatty acids, oils, proteins, carbohydrates, vitamins and minerals in their diets, in order to grow properly [2]. Fish products are beneficial to man ranging from the scales, oils, meat to bones. It is because of the benefits derived from fish that they are captured and reared using feeds made by man.

Feeds, according to Helfrich and Smith [3] are all kinds of foods given to domestic animals in the course of husbandry to survive, grow and reproduce, fish feed on organic materials such as plants, other animals, or prepared feeds containing plant and/or animal material [4]. Fish feed therefore is any substance given to fish for survival, growth and reproduction. Fish feeds may include detritus, bacteria, plankton, worms, insects, snails and aquatic plants which are biological in nature.

Biological fish feeds, in the view of Olsen [5] are living organisms given to fish for nutrition and production. In the context of this study, biological fish feeds are those living organisms produced mainly for the purpose of feeding reared fish in ponds, tanks. They are daphnia, maggot and earthworm. According to Ibiyo and Olowosegun [6] biological fish feed resource are known to possess among other attributes such as:

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1. Non-competitiveness in terms of human consumption
2. Relatively low price if at all it commands any price and
3. By-products or waste products from agriculture and agro-allied industries.

Because of the technicalities involved, the production of biological fish feeds is mostly carried out on the fish farms.

Production, as explained by Iwena [7] is a process of combining various material inputs and immaterial inputs (plans, technical know-how) in order to make something for consumption (the output). The author further stressed that, it is the act of creating output, a good or service which has value and contributes to the utility of individuals. It is a rational combination of resources to create goods and services to satisfy human wants [8]. The author further stated that, it embraces all economic activities that aim directly or indirectly to satisfy human needs. Production is a judicious utilization of the factors of production (capital, land, labour and entrepreneur) to create an output. Fish feeds production is an important aspect of fish farming embedded in the curriculum of agricultural education taught in all levels of education including university.

Agricultural education provides knowledge and skills needed by individuals to enter and advance in agricultural careers; and also develop agricultural literacy [9]. According to Egbule [10], Agricultural Education is the type of education that is employed in training learners in the improved Agricultural production processes, as well as in the techniques for the teaching of agriculture. Osinem [11] views agricultural education as a process of imparting knowledge, skills, and attitudes in agriculture to the leaner at any level. It is the totality of education and training given to individuals in agriculture to prepare and develop their abilities for effective production, processing, marketing and storage of agriculture products.

The Federal Department of Fisheries is vested with the statutory responsibility of developing Nigeria's fisheries for attainment of sustainable self-sufficiency in fish production, utilization and resource conservation. The policy strategies of the department are aimed at accelerating the pace of private sector involvement in fish production, processing, marketing, utilization and resource conservation. In line with the stated policy objective, the department has evolved some of the following strategies for project implementation:

1. Provision of appropriate infrastructure to enhance fish production and utilization by the private sector
2. Transfer of modern fisheries technologies to end users and extensionists in linkage with relevant state extension agencies
3. Sourcing and provision of credit to fishermen through collaboration with relevant donor agencies, credit institutions and State Fisheries Departments
4. Collection, collation, analysis and dissemination of fisheries data for fisheries planning and development
5. Re-stocking of lakes, lagoons and reservoirs for enhanced fish production and resources conservation among others.

These objectives are achieved at tertiary institutions of learning by lecturers of fisheries in universities.

A lecturer, in the submission of Abdul [12] is an individual psychologically trained in acquisition of knowledge, promotion of thoughts to bring change in attitudes and behavioural skills in an individual. Lecturers of Agricultural Education therefore, are individuals who are professionally trained (technically and or pedagogically) and teach fishery in the university. In some Universities, lecturers in fishery department are also involved in training students of Agricultural Education in fishery. Therefore in this study, lecturers of Agricultural education and fishery form the respondents. These groups of lecturers are saddled with the responsibility of equipping the students with the mechanisms in fishery for effective teaching and paid or self-employment after graduation.

Mechanism in the view of Houlihan et al. [4] is a process, technique or system for achieving a result. It connotes the techniques used in achieving a result to meet the set standard. In this study, mechanisms are fundamental processes and techniques needed by lecturers in achieving the objectives of the curriculum of agricultural education in fish production which include fish feeds production.

It has been observed by the researchers that, students of agricultural education after graduation depend on conventional fish feeds for feeding fish instead of producing feeds for their fish especially using natural materials that has little cost implication. This is traced to the in ability of the lecturers to teach students fish feeds production. It was based on this view that the researchers were sprouted to identify mechanism in teaching biological fish feeds production so that lecturers can adopt them in teaching the students.

Statement of the Problem

It seems that, the way fish production is taught by lecturers in Universities in north central of Nigeria is not same. Besides, clear analysis of their text books and lecture notes evidenced that they are all devoid of mechanisms in fish feeds production. This might be because of the absence of functional fish farm where the practical aspects of this course is been taught or that the lecturers lack the practical skills in teaching the techniques required for fish production. Meanwhile the objectives of fish production include producing fish at the least possible cost asserts that, the cost of harvesting and processing one kg of biological fish feeds is less than 20% of cost of 1 kg of conventional fish meal [13]. Based on cost, availability, and biological value and feed conversion ratio, biological fish feeds are said to be a viable alternative to all fish meal in the diet of fish. This implies that the utilization of biological fish feeds offers a good opportunity for the development of low cost fish feeds, especially in the developing countries where fish meal is imported very expensively and therefore not readily available.

In Benue state, there are a lot of earthworms as a result of fertile soil and flies as a result of agricultural wastes all over the surroundings which produce maggots that can be cultured and used for feeding fish. This discovery triggered the researchers to identify the mechanisms needed in biological fish feed production. The researchers are on the view that the identified mechanisms be used by lecturers in teaching biological fish feeds production so that the students can after graduation produce and supply these feeds at a cheaper rate compared to the conventional feeds to boost fish production for sustainable food security.

Therefore, the purpose of this study was to identify the mechanisms needed by lecturers of agricultural education in biological fish feed production for sustainable food security. Specifically, the study sought to identify mechanisms in the production of:

1. Daphnia
2. Earthworm
3. Maggot (magmeal)

Research hypotheses

There is no significant difference in the responses of lecturers of agricultural education in Universities and Colleges of education on mechanisms needed in teaching production of:

1. Daphnia
2. Earthworm and
3. Magmeal to students in Colleges of Education

Methodology

Three research questions were raised and answered by the study. Three hypotheses were formulated and tested at 0.05 level of significance. Questionnaire survey design was adopted for this study. This is a design in which a group of people or items are studied by collecting and analyzing data from a few people or items considered to be the representative sample using questionnaire. The design is suitable for the study because questionnaire was used in collecting data from the representative sample of respondents and was generalized on the entire population of the study. The study was conducted in higher institutions (Universities and Colleges of Education) offering Agricultural Education in Benue State of Nigeria. The population of the study was 42 lecturers made up of 31 lecturers of Agricultural Education in Colleges of Education and 11 lecturers of Agricultural Education in university. The entire population was used for the study due to its small and manageable size; as such there was no sampling. Biological Fish Feeds Production Mechanisms Questionnaire (BFFPMQ) was developed by the researchers from literature reviewed and their experiences. The researchers during the process of developing the instrument used R&D process in which they visited fish production farms to find out functional areas in biological fish feeds production. After which the instrument was developed and taken back to the farmers who are experts in the field to certify if the developed instrument was in line with their production system. The questionnaire had a four-point response options of highly needed (HN), averagely needed (AN), slightly needed (SN) and not needed (NN) with a corresponding value of 4, 3, 2 and 1, respectively. Three experts validated the questionnaire items; one from Department of fisheries, one from the Department of Agricultural Education, both from Federal University of Agriculture, Makurdi and one from the Department of fishery, Songai farms, Port Novo, Republic of Benin. The corrections and suggestions of the experts were used to produce the final copy of the questionnaire. Cronbach alpha reliability method was used to determine the internal consistency of the questionnaire items. A reliability coefficient of 0.87 was obtained meaning that the questionnaire was reliable for the study. The data were collected by the researchers from the respondents with the help of four research assistants who were familiar with the area of the study. A total of 42 copies of the questionnaire were administered and all were retrieved within 5 days of administration. Data collected for the study were analyzed using mean to answer the research questions and t-test analysis to test the hypotheses. A mean of 2.50 was used for decision-making. Any item with a mean value of 2.50 and above was regarded as a mechanism that is needed while any item with a mean less than 2.50 was regarded as not needed. In testing the hypotheses, a null hypothesis of no significant difference was not rejected where p-value was greater than the alpha value of 0.05 but rejected where p-value was less than the alpha value of 0.05.

Results

Data in Table 1 revealed that all the 12 items had their mean values ranged from 2.62 to 4.60 which were above the cut off mark of 2.50. The table also revealed that the standard deviations (SD) of the items ranged from 0.10 to 0.97 which indicated that the respondents were not very far from the mean and one another in their responses. This showed that all the 12 items were mechanisms needed by lecturers in daphnia production. The hypothesis tested revealed further that all the 12 items had their t-calculated values greater than the alpha value of 0.05. This indicated that there was no significant difference in the mean rating of the two groups of respondents on the 10 mechanisms needed by lecturers in earthworm production. Therefore, the null hypothesis of no significant difference was not rejected for all the items. Data in Table 2 revealed that 8 out of the 9 items had their mean values ranged from 2.51 to 4.21 which were above the cut off mark of 2.50. It also revealed that 1 (item 1) out of the 9 mechanisms had a mean value of 2.17 which was below the cut off mark of 2.50. The table also revealed that the standard deviations (SD) of the items ranged from 0.11 to 0.72 which indicated that the respondents were not very far from the mean and one another in their responses. This showed that 8 items were mechanisms needed by lecturers in earthworm production and 1 item (item 1) was not needed. The hypothesis tested revealed further that all the 9 mechanisms had their t-calculated values greater than the alpha value of 0.05. This indicated that there was no significant difference in the mean rating of the two groups of respondents on mechanisms needed by lecturers in earthworm production. Therefore, the null hypothesis of no significant difference was not rejected for all the items.

Data in Table 3 revealed that all the 7 items had their mean values ranged from 2.74 to 3.42 which were above the cut off mark of 2.50. The table also revealed that the standard deviations (SD) of the items ranged from 0.02 to 0.83 which indicated that the respondents were not very far from the mean and one another in their responses. This showed that all the 7 items were mechanisms needed by lecturers in

SN	Mechanisms	Mean	SD	t-cal	Remark
1	Make a pond of at least 60 cm high	2.62	0.91	-1.6	NS
2	Add 0.2 kg of lime powder to the sundried sand	3.22	0.1	0.07	NS
3	Fill the pond with water up to 15 cm high	2.54	0.97	0.84	NS
4	Add poultry manual to the pond on the fourth day at the rate of 0.4 kgm^{-3} to promote plankton bloom	2.7	0.41	-2.53	NS
5	Raise the level of the water to 50 cm	4.6	0.59	1.29	NS
6	Add 1 kgm^{-3} of poultry manual	3.01	0.41	0.24	NS
7	Source for daphnia in the market	3.15	0.7	0.93	NS
8	Stock the pond with daphnia on the 15^{th} day at the rate of 10 daphnia per litre	3.39	0.22	0.87	NS
9	Allow daphnia to grow for 14 days	2.91	0.33	0.71	NS
10	Insert a sieve of 0.02 diameter scrupling it up to harvest the daphnia	3.15	0.98	0.52	NS
11	Reduce the amount of water to concentrate the daphnia in an aerated container	3.43	0.21	0.16	NS
12	Feed fingerlings with the harvested daphnia	2.97	0.29	0.02	NS

SD: Standard Deviation; t-cal: t-calculated; t-table: 1.96; df=40; NS=Not Significant.

Table 1: Mean rating and standard deviation of responses on mechanisms in daphnia production.

SN	Mechanisms	Mean	SD	t-cal	Remark
1	Make a bed of 3 × 3 feet wide and 12-24 inches deep	2.51	0.24	1.95	NS
2	Install fine screens over the beds to prevent warms from migrating	2.17	0.73	1.92	NS
3	Spread 12-18 inches layer of organic matter	2.75	0.5	0.28	NS
4	Source for earthworms in the surrounding environment for stocking	3.27	0.35	1.48	NS
5	Stock 1 pound of earth worm per square foot of surface area	3.19	0.11	0.52	NS
6	Allow earthworm for 2-6 months for maturity	2.82	0.42	1.42	NS
7	Keep the bedding moist to allow for maximum growth	4.21	0.38	0.89	NS
8	Harvest matured earthworm for feeding fish	3.74	0.59	0.33	NS
9	Feed fish regularly twice or thrice a week with the harvested worms	4.01	0.12	0.52	NS

SD: Standard Deviation; t-cal: t-calculated; t-table: 1.96; df=40; NS=Not Significant.

Table 2: Mean rating and standard deviation of responses on mechanisms in earthworm production.

SN	Mechanisms	Mean	SD	t-cal	Remark
1	Mix blood and wheat bran	2.93	0.18	-1.52	S
2	Spread on the floor to a thickness of 3 cm	3.51	0.02	1.2	NS
3	Allow flies to lay eggs on the mixture	2.74	0.83	0.85	NS
4	Allow the eggs to hatch within two days	2.99	0.29	0.11	NS
5	Add growth booster and allow for 48 hours to develop further	3	0.74	-3.1	S
6	Harvest the maggots	3.42	0.05	0.5	NS
7	Feed the fish with the harvested maggots	2.87	0.49	1	NS

SD: Standard Deviation; t-cal=t-calculated; t-table: 1.96; df=40; NS: Not Significant; S: Significant.

Table 3: Mean rating and standard deviation of responses on mechanisms in magmeal production.

magmeal production. The hypothesis tested showed that all 7 items had their t-calculated values greater than the alpha value of 0.05. This indicated that there was no significant difference in the mean rating of the two groups of respondents on mechanisms needed by lecturers in magmeal production. Therefore, the null hypothesis of no significant difference was not rejected for all the items.

Discussion of the Findings

The study identified 12 mechanisms in daphnia production, 9 mechanisms in earthworm production and 7 mechanisms in magmeal production that could be used by lecturers in teaching biological fish feed production. The findings of this study are in consonance with the submission of Usoro and Ufot in a study titled capacity building needs of TVET lecturers in collaborative technique for teaching pre-service teachers in Akwa Ibom State-Nigeria. The techniques include: receiving feedback from peers, make procedural suggestions for progress, willingness to build the capacity of others, addressing meaning future issues among others. The findings of the study are also in line with that of Isiwu and Ibeh [13] in a study on capacity building of lecturers of agriculture in colleges of education in teaching farm land survey and farm stead planning in southeast, Nigeria where it was found that lecturers needed capacity building in surveying levels for transferring measure or set of horizontal measure, formulate objectives for farm survey and farm stead planning, supervision of practice teaching in agriculture education among others. The findings also conforms with the study carried out by Asogwa et al. [1] on quality assurance of lecturers of Agricultural Education in teaching composting to students of Colleges of Education for climate change mitigation in North Central, Nigeria where it was found that lecturers identified 16 organic materials used for composting manure, 14 skills in aerobic method of composting manure for climate change mitigation and 22 skills in anaerobic method of composting manure for climate change mitigation [14-17].

On the hypotheses tested, the study found out that there was no significant difference in the mean ratings of the responses of lecturers of agricultural education in colleges of education and in universities on 12 mechanisms in daphnia production, 9 mechanisms in earthworm production and 7 mechanisms in magmeal production that could be used by lecturers in teaching biological fish feed production. The implication of this finding is that the professional experience of the respondents did not influence their responses on mechanisms that could be used by lecturers in teaching biological fish feed production. The findings of the authors cited above help to add validity to the result of this study.

Therefore, the researchers added mechanisms in producing biological fish feeds to the existing body of knowledge in fish production.

Conclusion and Recommendations

It was observed by the researchers that the production of biological fish feed in Benue State has not been given appropriate attention. Meanwhile, based on cost, availability, biological value and feed conversion ratio, feeds of animal origin are said to be viable alternative to all fish meal in the diet of fish. The utilization of maggot meal (magmeal), earthworm and daphnia offers a good opportunity for the development of low cost fish feeds, especially in the developing countries where fish meal is imported very expensively and also not readily accessible to farmers. Biological production of fish feeds has various areas in which the students of agricultural education could embark on to support fish production to enhance food security. Therefore, there was a need to identify the mechanisms needed by lecturers of agricultural education in teaching biological fish feeds production.

The study identified 12 mechanisms in daphnia production, 9 mechanisms in earthworm production and 7 mechanisms in magmeal production. Based on the findings, the following recommendations were made.

1. Lecturers of agricultural education should use the identified mechanisms to teach students how to produce biological fish feeds following these steps.

2. The students of agricultural education after graduation should submit proposals on biological fish feeds production to the ministry of agriculture for approval for loan and subsidy to aid them start production to support low cost fish production for food security.

3. Extension agents should regularly organize seminars and workshops for training of farmers and retraining of graduates to improve their technical efficiency using the identified mechanisms.

4. Government should implement policies that will encourage and support fish feeds production for maximum utilization of the benefits for sustainable food security.

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