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# Utilization of Indigenuous Knowledge (IK) By Farmers for Sustainable Agricultural Production in Enugu State, Nigeria

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***Abstract*** **– This paper examined the utilization of indigenous knowledge (Ik) by farmers for sustainable agricultural production in Enugu State, Nigeria. A survey research was employed for the study. Five research questions were developed and answered based on the purpose of the study. Also, five null hypotheses were formulated and tested at the probability of 0.05 level of significance. The population for the study was 3,562. The sample for this study is 240. A structured questionnaire was developed and validated by three experts. A reliability coefficient of 0.89 was obtained. The research questions were answered using mean and standard deviation, while ANOVA was used to test the hypotheses. The findings of the study revealed that almost all the Ik practices identified were used in sustainable agricultural production. The result of the hypotheses tested showed that a significant difference existed in the mean ratings of the groups of respondents on the Ik practices used in crop, livestock production and soil conservation. It was therefore recommended that the general farming society be provided with these knowledge practices. Also, research institutes, teachers of agriculture and extension agents should be acquainted with, and then requested to work for successful implementation of these IK practices for a sustainable agricultural production.**

***Keywords*** **– Utilization, Indigenous Knowledge (IK), Farmers, Sustainable Agricultural Production.**

## I. INTRODUCTION

Food is one of the basic human needs that require to be continuously provided for man's nutritional satisfaction. The Universal Declaration of Human Rights was adopted by most nations in 1948. Article 25, paragraph 1 of the declaration stated:

Everyone has a right to standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care, and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control [1].

Underscored here are basically, people's right and access to food, clothing, housing and medical care, among other things. All the basic needs could be obtained if we harness our agricultural systems properly. According to [2], "The agricultural sector plays an important role in Nigeria's economy, contributing 37% of Gross Domestic Product (GDP), and employing 65% of the adult labour". Sadly enough, the author said that agricultural production in the country has since stagnated, partly due to ecological factors such as drought, diseases and reduction in soil fertility. By the mid-90's, export earnings from agriculture had declined to less than 5%. Also over 90% of Nigeria's agricultural output is by small – scale (less than 5ha) resource–poor farmers, who have for centuries sustained national food supply. It is regrettable to note that once an exporter of food to nearby countries, Nigeria now must import food to meet domestic demand.

Nigeria's major crops include oil palm (which produces palm oil), cocoa, rubber, and cotton which were once exported but are now sold mostly locally. Also grown in the country are sorghum, millet, maize (corn), yams, and cassava, all of which were formerly used as food for growers but now widely sold for cash. In order to overcome the situation of agricultural production stagnation in Nigeria, the Federal Government embarked on some laudable agricultural programmes like Operation Feed the Nation (OFN) (1976), Green Revolution Programme (1980), and River Basin Development Authority (1984) [3]. However, these programmes which engaged in or encouraged mechanized agricultural practices could not salvage our declining agricultural production. It follows, therefore, that a sustainable agricultural production becomes a necessity.

In this study, therefore, the concept of sustainable agricultural production refers to that system of production which guarantees a long-term steady supply of crops and animal requirements to satisfy the world's populace without adversely affecting the environment. This form of agricultural production is only obtainable when the necessary arrangements have been made and utilized. It requires the use of a very fertile land, favourable weather and environmental conditions, adequate labour and requisite knowledge in sustainable agricultural production. Here, emphasis must be laid on the requisite knowledge in sustainable agriculture. This is because there are scientific as well as indigenous knowledge systems. The former involves the use of carefully organised system of mechanised agriculture. This comprises the use of sophisticated machines like tractors, harvesters, improved inputs like fertilizers, pesticides and herbicides; information communication technologies (ICTs) such as computers, satellite, which help farmers to forecast varying weather conditions, study and determine the soil texture, soil fertility and so on. Indigenous knowledge refers to concepts, ideas, values and beliefs which have been utilized by the natives over the ages and have been confirmed successful in agricultural production.

Utilization of scientific knowledge in agricultural production has numerous advantages, since it increases

productivity and enhances production of improved varieties of crops and animals. However, it has been noted that scientific knowledge system alone cannot be sufficient in tackling the issues of sustainable agriculture, which aims at guaranteeing food security for this millennium and generations yet to come. This insufficiency or inadequacy is as a result of many factors. The system is foreign, as such; some farmers may not understand its techniques so as to make proper use of it. For example, pest and diseases are becoming more resistant to chemical treatments, food production increases through technology packages have not necessarily benefited the very poor, and other technological advances have led to pollution and environmental degradation. In short, scientific knowledge, by itself, does not sufficiently accommodate all the realities of those affected [4, 5]. [6] Stated that scientific agriculture profoundly affects many ecological systems. According to the author, negative effects of current scientific agricultural practices could be observed in the decline in soil productivity which can form due to exposure of topsoil by wind and water erosion. The author also noted that there could be loss of soil organic matter, decline of water holding capacity and biological activity, stressing that there is Stalinization of soils and irrigation water in fertilized irrigated farming areas. Desertification due to overgrazing is a growing problem especially in parts of Africa. The author further stated that the therapeutic use of antibiotics in animal production poses potential health hazards, while pesticides and nitrate contaminate our water and food. The author also observed that certain human and animal diseases have developed resistance to currently used antibiotics. Owing to the negative effects and inadequacies in scientific agricultural knowledge regarding the long-term sustainability of production, the use of indigenous or local system of production becomes a necessary alternative.

Indigenous knowledge refers to those ideas, techniques and system which are local and natural to a people. The local farmers which include crop growers and animal rearers have certain systems which they have been using over the ages that developed out of their norms, customs and traditions. [7] defined indigenous knowledge as the local knowledge which is unique to a given culture or society. This knowledge system is used by the local people to eke out a living in a particular environment. The author posited further that indigenous knowledge is the basis for local-level decision making in agriculture, health-care, food preparation, education, natural resources management and a host of other activities in rural communities. [8] conceptualized indigenous knowledge as ideas, beliefs, values, norms and rituals, which are native and embedded in the minds of the people. These knowledge systems represent mechanisms to ensure minimal livelihoods for local people. Indigenous knowledge systems often are elaborate and adapted to local culture and environmental conditions tuned to the needs of local people and quality and quantity of available resources. The authors asserted further that, in traditional Africa, farmers have planned agricultural production and conserved natural resources with the instruments of indigenous knowledge systems. For centuries, these indigenous knowledge systems have been used by communities to protect natural resources from unsustainable exploitation, thereby averting disasters that may have occurred from such exploitation. They stressed that indigenous knowledge systems are used by all farmer categories. [9] pointed out the relevance of indigenous practices in agriculture by stating that agriculture probably comprises the largest collection of indigenous practices worldwide. Farmers and pastoralists grew crops and kept animals in the humid, boreal, arid or temperate locations, developing production systems that were well adapted to these locations, and the gradual development of these systems to respond to changes in the environment.

In the area of the study, it was observed by the researchers that most agricultural practices in agricultural school curriculums are mechanized. It was also observed that even where indigenous knowledge is included in the curriculum; most teachers tend to emphasize mechanized agricultural practices at the expense of indigenous knowledge in agriculture. This situation has lasted long in the educational system that one would begin to wonder if present farmers practice any indigenous knowledge in animal production, crop production and soil conservation.

## II. Statement of the Problem

The key problem of the study is that indigenous knowledge systems which were known to have led to sustainable agricultural production in the past have since been ignored by practitioners. Some of these indigenous knowledge practices are irreplaceable and can still lead to sustainable agriculture irrespective of scientific agriculture. But the custodians of this indigenous knowledge are fast passing away, and their rate of transmitting it to newer generations is very slow or does not exist.

Moreover, not much of these indigenous agricultural knowledge systems are part of our agricultural education and training. In other words, they are hardly found as part of the curriculum in any level of Agricultural Education. Therefore, it becomes necessary to identify those indigenous knowledge practices presently applied in the areas of crop production, livestock production and soil conservation by farmers.

## III. Purpose of the Study

The main purpose of the study is to investigate the various dimensions indigenous knowledge is applied in agricultural production in Enugu State of Nigeria. Specific objectives of the study were to identify indigenous knowledge practices utilized by farmers in:

1. Crop production.
2. Livestock production.
3. Soil conservation.

## IV. Research Questions

1. What are the indigenous knowledge practices utilized by farmers in crop production?
2. What are the indigenous knowledge practices utilized by farmers in livestock production?
3. What are the indigenous knowledge practices utilized by farmers in soil conservation?

## V. Research Hypotheses

1. There is no significant difference in the mean ratings of farmers, agricultural science teachers and agricultural extension agents on the indigenous knowledge practices utilized by farmers in crop production.
2. There is no significant difference in the mean ratings of farmers, agricultural science teachers and agricultural extension agents on the indigenous knowledge practices utilized by farmers in animal production.
3. There is no significant difference in the mean ratings of farmers, agricultural science teachers and agricultural extension agent on the indigenous knowledge practices utilized by farmers in soil conservation.

## VI. Method

### *Research Design*

The study adopted descriptive survey research design. According to [10], a survey research design is one in which a group of people or items is studied by collecting and analyzing data from only a few people or items considered to be representative of the entire group. Descriptive survey research design is suitable for this study, since the study sought information from teachers of Agricultural Science, crop and livestock production farmers and agricultural extension agents using questionnaire.

### *Area of the Study*

The area of the study was Enugu State which comprises six education zones namely: Agbani, Awgu, Enugu, Nsukka, Obollo and Udi. The six education zones are recognized as three agricultural zones by Enugu State Agricultural Development Project [11] as follows: Awgu, Enugu and Nsukka.

Enugu State is situated in the eastern part of Nigeria. It has an area of 7,161km$^{2,}$ with a population of about 3,257,298 [13]. The state is replete with traditional knowledge systems in many spheres of development. In agricultural production, the people adopt various indigenous knowledge practices such as mixed cropping, shifting cultivation and fallow system. They also grow some traditional crops like cowpea, rice and cocoyam. Therefore, the state is considered very suitable for conducting this study.

### *Population for the Study*

The population for this study is 3,562 from the six education zones of the state comprising 484 teachers of Agricultural Science [14], 38 Agricultural Extension agents and 3,040 registered crop and livestock farmers in the state [11].

### *Sample and Sampling Techniques.*

The sample for this study is 240 consisting of 50 teachers of Agricultural Science, 38 Agricultural Extension agents and 152 crop and livestock farmers. Sample for the study was drawn using quota sampling technique. Quota sampling according to [15] is a non probability method which aims to make the sample representative of the population by setting quota controls. Eleven percent of teachers of agricultural science in secondary schools from each of the educational zones were sampled.

The random sampling technique (balloting) was used to select the 11 percent individually from each zone for the study. That is eight from Agbani, nine from Awagu, 6 from Enugu, 10 from Nsukka, eight from Obollo-Afor and nine from Udi respectively. The total of 50 teachers was used for the study. Since the population of the extension agents was small, therefore the entire population was involved in the study. Five percent of crop/livestock farmers from each of the three agricultural zones were sampled. This was to allow a fewer comparison of the opinions of the three groups (teachers, extension agents and crop/livestock farmers) when testing the hypothesis of no significance difference using ANOVA that accommodate very close sample size.

The random sampling technique (balloting) was used to select five percent individually from each zone. That is 56 from Awgu, 32 from Enugu and 64 from Nsukka respectively. The total was 152 crop/livestock farmers for the study.

### *Instrument for Data Collection*

A questionnaire was the instrument used for the collection of data in this study. The questionnaire was divided into two parts. Part one sought biographical data of the respondents while part two elicited information from the respondents concerning the IK practices used in crop production, livestock production and soil conservation for sustainable agricultural production.

The questionnaire items for part two have a 4-point response scale of: Frequently Used (FU) 4, Moderately Used (MU) 3, Slightly Used (SU) 2 and Not Used (NU) 1. The same set of questionnaire was used for teachers, farmers and extension agents.

### *Validation of the Instrument*

In subjecting the instrument for face validation, copies of the initial draft of the questions containing 113 items were validated by three experts from Agricultural Education unit of the Department of Vocational Teacher Education, University of Nigeria, Nsukka. Their suggestions and corrections were incorporated into the final draft of the questionnaire.

### *Reliability of the Instrument*

Fifteen copies of the questionnaire were administered to fifteen respondents, five of which were selected from each of the farmer, agricultural science teacher, and extension agent groups respectively. The respondents were drawn from Anambra State of Nigeria. This was used to test the reliability coefficient of the instrument. The data collected

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were analyzed using Cronbach formular. A reliability of 0.86 was obtained.

*Method of Data Collection*

The data for study was collected with the use of the questionnaire. A total of 240 copies of the questionnaire were administered on the Agricultural Science teachers in Senior Secondary Schools, the extension agents and the crop/livestock farmers by the researcher with the help of six research assistants. The administered copies of the questionnaire were likewise retrieved.

*Method of Data Analysis*

The data collected from respondents were analyzed using both descriptive and inferential statistics. The mean ratings and standard deviation were used to describe the data and answer the research questions, while Analysis of Variance (ANOVA) was used to test the null-hypotheses of no significance difference at probability of 0.05 level of significance. The mean rating value of the four – point scale of requirement level was set as a cut – off point. . In taking a decision, the real limits of numbers were used to obtain the mean value of each item as Frequently used = 3.50 – 4.00, Moderatly used = 2.50 - 3.49, Slightly used = 1.50 - 2.49 and Not used = 1.00 – 1.49.

Any item with a mean value of 1.50 or above was regarded as practices used while any item with a mean value below 1.50 was regarded as practices not used. The null hypotheses for any item were rejected when the f– calculated is greater than f – table value of 3.11 (f – calculated $\geq$ f – table) at 0.05 level of significance.

## VII. Results

The results of the study were obtained from the research questions answered and hypothesis tested.

*Research Question I*

What are the indigenous knowledge practices used in crop production?

Table 1 presented the data for answering research question 1.

*Hypothesis 1*

There is no significant difference in the mean ratings of farmers, extension agents and agricultural science teachers on indigenous knowledge practices used in crop production in Enugu State.

The data for answering research question 1 and testing hypothesis 1 were presented in the table 1.

Table 1: Mean ratings and ANOVA scores of crop/livestock farmers, extension agents and agricultural science teachers on indigenous knowledge practices utilized by farmers in crop production. (N = 240).

| S. No. | Indigenous Knowledge Items | $\overline{X}$ | SD | F-CAL | SIG | RMK |
|---|---|---|---|---|---|---|
| 1 | Making ridges, heaps, or mounds using hoe | 3.89 | 0.31 | 9.966 | .000 | FU,S |
| 2 | Planting different types of crop in rotation. | 3.57 | 0.589 | 21.885 | .000 | FU,S |
| 3 | Planting different types of crop together on the same piece of land. | 3.90 | 0.307 | 32.630 | .000 | FU,S |
| 4 | Planting only one crop type | 2.14 | 1.00 | .949 | .389 | SU,NS |
| 5 | Rotating annual crops with biennial pasture. | 3.10 | 0.854 | .618 | .540 | MU,NS |
| 6 | Allowing a farm land to fallow before going back to it. | 3.22 | 0.604 | 5.806 | .003 | MU,S |
| 7 | Integrating livestock and food crops on the same land | 2.08 | 1.134 | 15.564 | .000 | SU,S |
| 8 | Cleaning the farm house properly | 3.60 | 0.591 | 8.918 | .000 | FU,S |
| 9 | Burning and smoking of insect pests | 3.29 | 0.913 | 15.807 | .000 | MU,S |
| 10 | Using of disease/pest resistant crop varieties. | 2.53 | .882 | 3.458 | 0.33 | MU,S |
| 11 | Intercropping food and pest repellent crops. | 2.84 | 0.863 | 20.287 | .000 | MU,S |
| 12 | Rouging of diseased plants and leaves | 2.86 | 1.060 | 2.982 | .053 | MU,NS |
| 13 | Using plants as insect repellent/or attractant. | 3.10 | 0.935 | .346 | .708 | MU,S |
| 14 | Dusting planting materials with ashes | 3.63 | 0.679 | 43.565 | .000 | FU,S |
| 15 | Dusting planting materials with sand | 2.07 | 1.189 | 21.667 | .000 | SU,S |
| 16 | Hand picking and squashing of the pests. | 2.99 | 0.858 | 75.692 | .000 | MU,S |
| 17 | Selection of viable planting materials. | 3.84 | 0.388 | 56.135 | .000 | FU,S |
| 18 | Use of beneficial pest like ladybird to destroy other pests | 2.94 | 0.896 | 14.662 | .000 | MU,S |
| 19 | Use of traps | 3.30 | 0.762 | 2.549 | .080 | MU,NS |
| 20 | Sprinkling of mixture of ash and human urine on plant leaves. | 2.70 | 0.985 | 36.934 | .000 | MU,S |
| 21 | Application of cow dung on the leaves | 2.10 | 0.947 | 13.854 | .000 | SU,S |
| 22 | Harvest by hand picking | 3.81 | 0.412 | 2.257 | .07 | FU,NS |
| 23 | Digging up of tubers and bulbs with hoe | 3.94 | 0.243 | 18.671 | .000 | FU,S |
| 24 | Cutting of vegetables and rice stalk | 3.90 | 0.301 | 20.164 | .000 | FU,S |
| 25 | Pulling of groundnuts and guinea peas | 3.61 | 0.567 | 5.478 | .005 | FU,S |
| 26 | Pluck oranges with go-to-hell | 3.25 | 0.954 | .743 | .477 | MU,NS |

| | | | | | | |
|---|---|---|---|---|---|---|
| 27 | Cut banana and heads of oil palm with matchet. | 3.94 | 0.378 | 13.841 | .000 | FU,S |
| 28 | Store crops under shade | 2.97 | 1.107 | 15.883 | .000 | MU,S |
| 29 | Leaving cassava and cocoyam in the field or ground. | 3.23 | 0.795 | 12.089 | .000 | MU,S |
| 30 | Store yam and other tubers in barn | 3.95 | 0.278 | 13.693 | .000 | FU,S |
| 31 | Store grains in thatched house or pottery | 3.10 | 0.860 | 6.283 | .002 | MU,S |
| 32 | Pit storage of cocoyam | 3.78 | 0.487 | 16.405 | .000 | FU,S |
| 33 | Store grains in containers like drums and cans. | 3.75 | 0.547 | 3.276 | 0.039 | FU,S |
| 34 | Store kola nuts in clay pot | 3.21 | 0.976 | 16.757 | .000 | MU,S |
| 35 | Store palm oil in drum and pot | 3.87 | 0.434 | 16.112 | .000 | FU,S |
| 36 | Store dried vegetables in sacks | 3.13 | 0.691 | 1.533 | .218 | MU,NS |
| 37 | Sun drying of grains and vegetables | 3.94 | 0.234 | 6.383 | 002 | FU,S |
| 38 | Smoking of maize cobs | 3.91 | 0.317 | 20.844 | .000 | FU,S |
| 39 | Home canning of tomatoes | 2.37 | 1.066 | 6.359 | .002 | SU,S |
| 40 | Coating seeds with plant ashes | 2.34 | 1.043 | 5.741 | .004 | SU,S |
| 41 | Fermenting of cassava | 3.80 | 0.545 | 12.327 | .000 | FU,S |
| 42 | Use of anthill | 2.10 | 1.014 | 13.263 | .000 | SU,S |
| 43 | Add insect repellant to silo before storage. | 2.36 | 1.073 | 11.786 | .000 | SU,S |

X=mean, SD=standard deviation, F-VALUE=3.11, F-CAL=f-calculated, RMK=remark, FU=frequently used, MU=moderately used, SU=slightly used, S=significant, NS= not significant.

The data presented in Table 1 revealed that 35 out of the 43 IK practices identified for successful crop production had mean scores ranging from 2.53 to 3.95, while 8 practices had mean scores of 2.07 to 2.37 indicating that not all the practices on the table were used. The 35 practices used had their mean score within the range of 'frequently used' and 'moderately used' much above the cutoff point of 2.50, while the 8 practices not used had their mean ratings within the range of 'slightly used' which was below 2.50.

The standard deviation of the IK crop practices ranged from 0.234. to 1.189. This showed that the respondents were not close to one another in their responses owing to their professional experiences.

The opinion of the farmers, extension agents and agricultural science teachers on the IK practices utilized by farmers in crop production on Table 1 were compared using ANOVA. The data revealed that the ANOVA f-calculated for 35 out of the 43 practice items ranged from 3.276 to 75.692, which were greater than the f-table value of 3.11 at 0.05 level of significance and 239 degrees of freedom. Although 8 practice items indicated that there was no significant difference, 35 other practices were rated as significant because their ratings were less than the 0.05 alpha coefficient that measured the level of significance. Therefore, there is a significant difference in the ANOVA scores of the three groups of respondent on the IK practices utilized by farmers for sustainable crop production.

Consequent upon this, the alternative hypothesis of significant difference was upheld. This alternative indicated that each of the farmer, extension agent or agricultural science teacher groups differed from the other with respect to their opinion on the identified practices. This difference in their views could be that the farmers mighty be more inclined to practical skills, after all, they are the people that use these IK practices. As the custodians of indigenous knowledge, the farmers should always uphold the practices that they have tested and adopted. The extension agents and the agricultural science teachers might be more interested in theoretical issues (abstract concepts) regarding these practices. These latter groups might also have good practices since they are the ones to conduct researches and organize seminars for farmers.

*Research question 2*

What are the indigenous knowledge practices utilized by farmers in livestock production?

*Hypothesis 2*

There is no significant difference in the mean ratings of farmers, agricultural science teachers and extension agents on the indigenous knowledge practices utilized by farmers in livestock production in Enugu State.

The data for answering research question 2 and testing hypothesis 2 were presented in table 2.

Table 2: Mean ratings and ANOVA scores of crop/livestock farmers, extension agents and agricultural science teachers on indigenous knowledge practices utilized by farmers in livestock production (N =240).

| S. No. | Indigenous Knowledge Items | $\overline{X}$ | SD | F-CAL | SIG | RMK |
|---|---|---|---|---|---|---|
| 1 | Keeping and feeding poultry in the cage. | 2.20 | 1.083 | 15.604 | .000 | SU,S |
| 2 | Housing but allowing animals to roam about in the day. | 3.25 | 0.753 | 10.535 | .000 | MU,S |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | Allowing animals to roam extensively | 3.09 | 0.808 | 27.384 | .000 | MU,S |
| 4 | Addition of supplements like groundnut cake and blood meal to animal feed. | 2.10 | 1.087 | 26.784 | .000 | SU,S |
| 5 | Positioning eggs near fire to aid brooding | 2.45 | 1.098 | 17.189 | .000 | SU,S |
| 6 | Tethering pregnant ruminant near fire for easy delivery. | 2.05 | 1.089 | 10.368 | .000 | SU,S |
| 7 | Use of leaves of cowpea to aid parturition | 2.65 | 1.068 | 3.083 | .048 | MU,NS |
| 8 | Use of water, salt and leaves like *isikara* to aid disengagement of placenta after delivery. | 3.18 | 0.838 | 2.979 | .053 | MU,NS |
| 9 | Feeding ruminants with salt and banana peels to increase milk production. | 2.18 | 0.984 | 15.821 | .000 | SU,S |
| 10 | Castrating male ruminants using sharp razor. | 3.26 | 0.793 | 13.728 | .000 | MU,S |
| 11 | Deworming the animals against endo-parasites using potato leaves. | 2.30 | 1.015 | 7.703 | .001 | SU,S |
| 12 | Rotating animals from one pasture land to the other over time. | 2.84 | 1.102 | .013 | .987 | MU,NS |
| 13 | Rotating cattle from one shed to another after a period of time. | 2.40 | 1.120 | 48.543 | .000 | SU,S |
| 14 | Lighting fire in the kraals of poultry | 2.76 | 0.817 | 2.216 | .111 | MU,NS |
| 15 | Cut and burn the affected parts with hot metal. | 2.13 | 0.972 | 2.009 | .136 | SU,NS |
| 16 | Press affected area with hot metals | 2.30 | 1.009 | 7.801 | .001 | SU,S |
| 17 | Prick fleas wit h a needle | 2.37 | 0.862 | 20.059 | .000 | SU,S |
| 18 | Treat ailments with local herbs/leaves | 2.98 | 0.926 | 2.648 | .073 | MU,NS |
| 19 | Proper sanitation | 3.35 | 0.815 | 14.212 | .000 | MU,S |
| 20 | Use of improved breeds | 2.90 | 0.948 | 16.928 | .000 | MU,S |
| 21 | Spray ash in the farm house at intervals. | 3.12 | 0.810 | 2.683 | .070 | MU,NS |
| 22 | Burn tyre/palm fronds or old cloth near the farm house to keep away pests | 3.22 | 0.852 | 58.250 | .000 | MU,S |
| 23 | Treat wounds with mixture of millet and paraffin. | 2.05 | 1.036 | 31.267 | .000 | SU,S |
| 24 | Inject sick animal with mixture of ash, ground pepper and water. | 1.76 | 0.936 | 16.601 | .000 | SU,S |

X=mean, SD=standard deviation, F-value=3.11, F-CAL=f-calculated, RMK=remark, FU=frequently used, MU=moderately used, SU=slightly used, S=significant, NS= not significant.

The data presented in Table 3 above revealed that 12 out of the 24 practices identified for successful livestock production were used since they had mean scores ranging from 2.65 to 3.35 while 12 practices were not fully used as their mean scores were 1.76 to 2.45. The 12 practices used had their mean scores within the range of 'moderately used' which was above the cutoff point of 2.5, whereas the 12 practices not used had their mean scores within the range of 'slightly used', below the cutoff point of 2.5.

The standard deviations of the practices ranged from 0.763 to 1.120. The range showed that the respondents were not close to one another in their responses and that they were not very far from the mean.

The opinion of the farmers, extension agents and agricultural science teachers on the IK practices applied in livestock production on Table 4 above were compared using ANOVA. The data revealed that the ANOVA f-calculated values of 17 out of the 24 practices ranged from 7.703 to 58.250, which were far greater than the f-table value of 3.11 at 0.05 level of significance and 239 degrees of freedom. The data revealed further that 17 out the 24 practice items had the ANOVA scores rated as significant because they were below alpha 0.05 coefficient, while only 7 items showed that there was no significant difference. It is proper to conclude therefore, that there is a significant difference among the ANOVA scores of the three groups of respondents on the IK practices utilized by farmers for sustainable livestock production.

Owing to this difference, the alternative hypothesis of significant difference was upheld. This is an indication that each of these groups of respondents (farmers, extension agents and agricultural science teachers) varied from the other on their opinions regarding the identified practices. The difference in their views could be that the farmers who really rear the livestock are more interested in practical skills that were proven to be effective, while the agricultural science teachers are more inclined to theorizing about the principles of animal production. The teachers might even have better ideas of the IK practices which they try to transfer to the farmers. On their own part, the extension agents might battle with theories that they got from these teachers and the practical challenges they observed in the farm while relating to the farmers.

*Research Question 3*

What are the indigenous knowledge practices utilized by farmers in soil conservation?

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*Hypothesis*

There is no significant difference in the mean ratings of farmers, agricultural science teachers and extension agents on the indigenous knowledge practices utilized by farmers in soil conservation in Enugu State.

The data for answering research question 3 and testing hypothesis 3 were presented in table 3.

Table 3: Mean ratings and ANOVA scores of crop / livestock farmers, extension agents and agricultural science teachers on indigenous knowledge practices utilized by farmers in soil conservation (N=240).

| S. No. | Indigenous Knowledge Items | $\overline{X}$ | SD | F-CAL | SIG | RMK. |
|---|---|---|---|---|---|---|
| 1. | Change in colour of soil from dark to reddish | 3.05 | 1.050 | 3.930 | .021 | MU,S |
| 2. | Loss of crumb Structure | 2.83 | 1.048 | .806 | .448 | MU,NS |
| 3. | Increased number of stones in the soil | 1.85 | 1.017 | 1.054 | .350 | SU,NS |
| 4. | Reduction in water holding capacity | 2.80 | 0.940 | 16.950 | .000 | MU,S |
| 5. | Decline in crop yield | 3.90 | 0.421 | 9.182 | .000 | FU,S |
| 6. | Growth of specific weeds like spear grass | 2.76 | 0.981 | 17.577 | .000 | MU,S |
| 7. | The type of soil in an area e.g sandy soil | 3.08 | 1.030 | 5.429 | .005 | MU,S |
| 8. | The amount of earthworm cast | 2.83 | 0.930 | 3.679 | .027 | MU,S |
| 9. | Allowing the soil to remain uncultivated for a period of time | 3.77 | 0.567 | 13.315 | .000 | FU,S |
| 10. | Planting local legumes | 2.94 | 0.57 | 7.495 | .001 | MU,S |
| 11. | Constant covering of soil surfaces with leaves and other materials | 2.85 | 0.959 | 2.259 | .107 | MU,NS |
| 12. | Adding compost obtained from dead leaves | 3.39 | 0.706 | 23.548 | .000 | MU,S |
| 13. | Shifting cultivation | 3.55 | 0.682 | 34.942 | .000 | FU,S |
| 14. | Addition of ashes to the soil | 3.28 | 0.956 | 3.435 | .034 | MU,S |
| 15. | Intercropping legumes with other crops | 3.16 | 0.915 | .176 | .839 | MU,NS |
| 16. | Addition of animal dung to the soil | 3.82 | 0.405 | 4.549 | .012 | FU,S |
| 17. | Pull and burn the weeds | 3.85 | 0.426 | 32.021 | .000 | FU,S |
| 18. | Suffocating weeds with other plant materials | 2.60 | 0.942 | 2.853 | .046 | MU,NS |
| 19. | Shifting cultivation and fallowing | 2.08 | 1.101 | 18.701 | .000 | SU,S |
| 20. | Hand weeding | 3.95 | 0.210 | 26.460 | .000 | FU,S |
| 21. | Shallow cultivation to prevent weed growth | 2.27 | 1.118 | 14.777 | .000 | SU,S |
| 22. | Plant cover crops. | 3.04 | 0.850 | 4.500 | .012 | MU,S |

X=mean, SD=standard deviation, F-value=3.11, F-CAL=f-calculated, RMK=remark, FU=frequently used, MU=moderately used, SU=slightly used, S=significant, NS= not significant.

The data presented in Table 3 above revealed that 19 out of the 22 indigenous knowledge practices used in soil conservation had mean scores ranging from 2.60 to 3.95, while only three practice items had their mean scores of 1.85 to 2.27, indicating that not all the practices identified in the table were used for successful conservation of soil. The data further showed that 19 practices were used while only three practices were not used. The mean scores of the practices used were within the range of 'frequently used' and 'moderately used' with real limit of number above the cutoff point of 2.5. The mean scores of the practices not used were within the range of 'slightly used' with real limit of number below the cutoff point of 2.5. The standard deviation of the soil indigenous knowledge practices ranged from 0.210 to 1.118 indicating a wide difference in the responses of the respondents which is not far from their means.

The opinions of the farmers, extension agents and agricultural science teachers on the IK practices in Table 3 above were compared using ANOVA. The data revealed that the F-calculated for 19 out of 22 practice items ranged from 3.435 to 34.942, which were greater than the F- table value of 3.11 at 0.05 level of significance and 239 degrees of freedom. The data also showed that the ANOVA sores of 19 practice items were rated as significant because they were below the 0.05 alpha level of significance; whereas only 3 practices showed that there was a point of convergence in the ANOVA scores of the respondent groups. It is fitting for us therefore, to conclude that there was a significant difference among the ANOVA scores of the three groups of respondents on the IK practices used in conserving the soil for agricultural purposes.

As a result of this difference, the alternative hypothesis of significant difference was upheld. This hypothesis meant that the views of farmers differed from those of the extension agents and the agricultural science teachers in respect of the practices identified. This divergence in their views could be that the farmers who really work on the soil were more interested in practical skills. They seem to understand these practices better and also to observe various changes on the soil. The extension agents too, sometimes have clear understanding of the soil thereby suggesting what they considered better practices to adopt. On their own, the agricultural science teachers might be

more inclined to theories of soil conservation. Better still, they might have good ideas of how to conserve the soil for sustainable agricultural production.

## VIII. Discussion of Findings

The findings of the study revealed that the respondents agreed that some indigenous knowledge practices are required for sustainable agricultural production. These IK practices include those used in the areas of crop production, livestock production and soil/land conservation. Scholars like [16] and [17] had earlier recognized the benefit of using these practices in agriculture. [8] noted earlier that indigenous farmers use ash, cow dung among other things to store crops. While supporting the use of IK in agriculture, [18] asserted that Nigerian farmers use it absolutely and that the system has reduced the supposed effects of agriculture on our environment. [9] had earlier submitted that agriculture probably had the largest number of indigenous practices in the world.

With regard to crop production, various practices were considered to be highly effective in methods of farming, pest and disease control, harvesting of crops, storage and preservation of those crops. It was found out that 36 indigenous methods were used in crop production, while only 7 practices were either slightly used or not used at all. The respondents' ratings of the level of usage of these IK practices varied a lot. The used practices were rated above the cutoff point of 2.5. The highest rated method of farming is ''planting different types of crop together on the same pieces of land'' with a mean of 3.90. This was followed by 'making rideges, heaps or mounds using hoe'' which had a mean of 3.89.

Concerning the indigenous methods of pests and disease control, "Selection of viable planting materials'' was rated highest with a mean of 3.84; followed by ''Dusting planting materials with ashes'' which had a mean of 3.63 ''Digging up of tubers and bulbs with hoe'' and ''cut banana and heads of oil palm with matchet'' were rated highest method of harvesting with a mean of 3.94 on either side, while ''store yam and other tubers in barn'' and ''store palm oil in drum and pot'' were rated as the highest methods of crops storage with the means of 3.95 and 3.87 respectively.

On the methods of preserving crops, ''sun drying of grains and vegetable'' was rated highest with a mean of 3.94; followed by ''smoking of maize cobs'' which was rated at 3.91. It is worthy of note that there was a slight level of variance in the mean ratings of all the IK practices used in crop production. There were few items that were rated as either slightly used or not used. These include ''integrating livestock and food crops on the same land'' with a mean of 2.08 which was rated the least. This method of intensive farming should be improved on because of its obvious advantages. Other practices not used ranged from ''Application of cow dung on the leaves'' with a mean of 2.10 for pest control, then to ''Home coming of tomatoes'' with mean of 2.37 as a crop preservation method. The essence of the overall finding is in line with the views of [19] who enumerated various indigenous crop practices adopted by farmers to include mixed cropping and monocropping; crop rotation [20]; fallow system [21], and introduction of spiders and ants to control pests and diseases [22].

It was also found from the test of hypothesis 1 that there was a significant difference in the mean ratings of farmers, extension agents and agricultural science teachers on the IK practices used in sustainable crop production in Enugu State. This is a pointer to the fact that the respondents rated the practices from various perspectives. This made for adoption of the alternative hypothesis of significant difference. The difference in their views might be that the farmers were more interested in practical skills since they use the farm, while the extension agents might dangle from practical knowledge to theories. The agricultural science teachers, on their own, might have greater interest in theoretical work since they use the classroom more than the school farm.

The findings of the study also revealed that the respondents agreed that some indigenous knowledge practices were used for successful production of livestock. These IK practices were categorized as method of rearing the livestock and control of diseases and pests. On the whole, 12 out of 24 practices were rated about the cut of point of 2.5. This indicated a wide variance in responses showing that the number of practices used equalled the ones not used. In their ratings, ''casting male ruminants using sharp razor'' with a mean of 3.26 was rated highest as a method of rearing livestock. It was followed by ''Housing but allowing animals to roam about in the day'' with a mean of 3.25. Regarding the indigenous method of controlling the pests and diseases of livestock, ''Proper sanitation'' was rated highest with a mean of 3.35, while ''Burn tyre/Plam fronds or old cloth near the farm house to keep away pests'' followed with a mean of 3.22. The next important practices was ''Spray ash in the farm house at intervals'' with a mean of 3.12.

It was however observed that some practices items were rated below the cutoff point of 2.5, an indication that such items were regarded as not used in livestock production. Such practices ranged from ''Inject sick animal with mixture of ash, ground pepper and water as a method of diseases and pest control, with a mean of 1.76, as the least rated through ''Treat wounds with a mixture of millet and parafin'' to control diseases, and ''Tettering pregnant ruminant near fire for easy delivery'' as a practice of rearing animals, each with a mean of 2.05, and then to ''Positioning eggs near fire to aid brooding'' with a mean of 2.45 as a method of rearing livestock. The closeness in the mean ratings of these practices not used showed to 2.5 cut off point showed that some of these practices may, after all, be slightly used.

The identified practices are in tune with the views of [23] that producing livestock involves the integrated application of numerous IK practices of the principles of animal breeding, feeding, housing, organisation and disease control. [8] also supported the above when they asserted that mashed cannabis is added to water and fed to chicken to treat coccidiosis. The authors who reported the

use of sharp razor to castrate male ruminants also recognized that farmers regularly make fire inside the livestock houses to keep pests away.

From the findings on the test of hypothesis 2, a significant difference was revealed among the responses of farmers, extension agents and agricultural science teachers' groups regarding the IK practices used in livestock production. This difference indicated that the respondents rated the practices from respective fields of interest. This variance necessitated the upholding of the alternative hypothesis of significant difference. As a matter of fact, the difference in the opinions of the respondent groups could be that the farmers stuck to practical knowledge which they use with the livestock, while the agricultural science teachers incline to theoretical knowledge (abstract concepts). The extension agents could be more inclined also to practical work since they visit different farms at intervals.

With regard to the IK practices use in sustainable conservation of soil, the respondents agreed that 19 out of the 22 practice items were used since they were rated above the cutoff point of 2.5. Various practices were considered very effective in areas of detecting infertile soil, maintaining soil fertility and controlling weeds. In their ratings, ''Decline in crop yield'' with a mean of 3.90, and ''the type of soil in an area of sandy soil'' with the mean of 3.08 were the highest methods of detecting infertile soil. On the maintenance of soil fertility, ''Addition of animal dung to the soil'' was rated highest with a mean of 3.82. It was followed by ''Allowing the soil to remain uncultivated for a period of time with a mean 3.77. As for methods of controlling weeds, ''Hand weeding'' with a mean of 3.95 was rated highest; followed by ''Pull and burn the weeds'' with a mean rating of 3.85. The next most important practices rated at 3.04 was ''Plant cover crops''. They only 3 practices rated as not used ranged from ''Increased number of stones in the soil with a mean of 1.85, to ''Shallow cultivation to prevent weed growth'' with a mean of 2.27, both for detecting infertile soil and controlling weeds respectively. The benefits of using these IK practices are not far from [16]'s observation that repeated failure of efforts to combat soil erosion in Burkina Faso were because local people were not involved. The study showed that a majority of farmers used mostly their indigenous soil conservation techniques rather than newly introduced ones. The IK practices used in soil conservation include mixed cropping, cover cropping and shifting cultivation [20]; [24]; [2002]; and [26]. Also supporting the above is [8] who emphasized that farmers adopt various indigenous methods of improving or maintaining soil fertility.

The findings on the test of hypothesis 3 revealed that there was a significant difference in the mean ratings of farmers, extension agents and agricultural science teachers on the IK practices used in sustainable soil conservation. The respondents' rating of the practices showed that they were biased to various aspect of interest. The ANOVA scores of 17 practices indicated a significant difference while only 7 practices revealed no significant difference responses. As a consequence of this difference, the alternative hypothesis of significant difference was upheld. The reason for these divergent views could be that the farmers who till the land might be interested mainly in practical skills. The extension agents who equally understudy the soil might incline to practical ways of tilling the soil, whereas agricultural science teachers might be bent on their theoretical work.

## IX. Recommendations

Based on the findings of the study and their implications, the following recommendations were made.

1. Farmers within the state should be trained and re-equipped with relevant indigenous knowledge. This will enable them to triumph in the fight to resuscitate sustainable agriculture in Enugu State.
2. The policy planners should make efforts to incorporate IK in the national agricultural policy. This becomes necessary going by the relevance of IK in sustainable agriculture as identified in Enugu State.
3. Educational curriculum planners should equally provide for IK in the syllabuses. They should make for teachers of agricultural science to use the school farm as an instructional material to complement the classroom theoretical lessons.

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