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Farmer's perception of sustainable alternatives to the use of chemical fertilizers to enhance crop yield in Bauchi state Nigeria

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ABSTRACT

The study was undertaken to examine the perception of farmers on the sustainable alternatives to the use of chemical fertilizers to enhance crop yield in Bauchi state. Data were collected from 900 crop farmers spread across the three agricultural zones through the use of structured interview schedule. Multistage random sampling technique was used in selecting respondents. Data were analyzed using descriptive statistical techniques and correlation analysis. The findings showed that majority of the respondents were male (92%), aged less than 50 years (76%) and earn less that ₦500, 000 per annum (68%). Also, majority (84%) of the respondents were not aware of the detrimental effects of chemical fertilizers. The correlation between awareness and practice of sustainable alternatives such as planting of nitrogen fixing legumes (0.474**), use of crop rotation (-0.309**) and conservation tillage -0.149**) were positive. While leaving of crop residues (-0.011), fallowing (-0.131) and permaculture (-0.005) had negative values. It is therefore recommended that Bauchi State Agricultural Development Programme should within the limited resources available to it step up sensitization and enlightenment of farmers in the state on the harmful effects of chemical fertilizers and the need to replace them with sustainable alternatives. It can achieve this through local radio and television programs, demonstration and village enlightenment campaigns.

Keywords: Farmers, Perception, Chemical Fertilizer, Bauchi State

I. INTRODUCTION

Inorganic fertilizers and other chemicals used to enhance crop production have been instrumental to increasing crop yield and performance worldwide beyond any iota of doubt. However, it has become evident that they have many negative consequences and have become beyond the reach of ordinary farmers. For instance, Usman and Dosumu (2007) report that, fertilizers and pesticides contribute greatly to enhancing soil fertility they are also major sources of farmland pollution and contamination by heavy metals. Usman and Dosumu contend that these metals pose a dual threat, directly through their toxic effect on crops and soil organisms and indirectly posing an adverse health risk to human beings and animals who consume the contaminated products.

Environmental pollution is another significant problem posed by using chemical fertilizers. But while most of the focus is placed on polluting industries as the culprits, use of chemical fertilizers and other chemicals used in modern food production are also to blame. Meldora (2013) reports that, far from being life sustaining, our modern chemical-dependent farming methods strips soil of nutrients, destroys critical soil microbes, contributes to desertification and climate change and saturates farmlands with toxic pesticides, herbicides and fertilizers that then migrates into ground water, rivers, lakes and oceans. Repeated applications may result in a toxic buildup of chemicals such as arsenic, cadmium, and uranium in the soil. These toxic chemicals can eventually make their way into your fruits and vegetables. Long-term use of chemical fertilizer can change the soil pH, upset beneficial microbial

ecosystems, increase pests, and even contribute to the release of greenhouse gases (Day, 2008).

Deepali and Gangwar (2000) reported that, increasing use of chemical fertilizers in agriculture makes a country self-dependent in food production but it deteriorates the environment and causes harmful impacts on living beings. Due to insufficient uptake of these fertilizers by plants results, fertilizers reaches into water bodies through rain water, causes eutrophication in water bodies and affect living beings including growth inhabiting microorganism. Groundwater contamination has been linked to gastric cancer, goiter, birth malformations, and hypertension; testicular cancer and stomach cancer. Excessive air and water-borne nitrogen from fertilizers may cause respiratory ailments, cardiac disease, and several cancers, as well as can inhibit crop growth, increase allergenic pollen production, and potentially affect the dynamics of several vector-borne diseases, including West Nile virus, malaria, and cholera. One popular fertilizer, urea, produces ammonia emanation, contributes to acid rain, groundwater contamination and ozone depletion due to release of nitrous oxide by denitrification process. With its increased use and projections of future use, this problem may increase several fold in the coming decades. The excess uses of chemical fertilizers in agriculture are costly and also have various adverse effects on soils i.e. depletes water holding capacity, soil fertility and disparity in soil nutrients.

According to Food Programme, (2014), alternatives to synthetic fertilizer use include compost (decomposed organic matter), animal manure, seaweed, and worm castings. Each of these products can help boost soil health through the introduction and maintenance of healthy soil organisms and micronutrients. Organic fertilizers increase soil biodiversity and have been shown to increase the uptake of nutrients by plants. There is also evidence that use of organic fertilizers improves the nutrient value of the plants themselves. Sustainable crop production is a way of growing or raising food in an ecologically and ethically responsible manner. This includes adhering to agricultural and food production practices that do not harm the environment, that provide fair treatment to workers, and that support and sustain local communities. Sustainable crop production is in contrast to industrial crop production, which generally relies upon mono-cropping (growing only one crop in a large area of land), intensive application of chemical fertilizers, heavy use of pesticides, and other inputs that are damaging to the environment, to communities, and to farm workers. In addition, sustainable crop production practices can lead to higher yields over time, with less need for expensive and environmentally damaging inputs.

II. METHODS AND MATERIAL

A. Problem Statement

Despite the harmful effects of chemical fertilizers, farmers in Bauchi state (as in other parts of Nigeria) rely heavily on the use of chemical fertilizers to increase crop yield because soil nutrients have been depleted due to incessant continuous tillage. This overdependence is still in vogue despite the availability of many better options such as use of bio-fertilizers, fallowing, crop rotation, zero tillage, organic farming and permaculture. The increased use of chemical fertilizers in agricultural production will make the state independent in food production but it is however detrimental to the environment and has harmful effects on living things.

It is in view of these problems that this study seeks to investigate whether farmers in the state are aware of viable and sustainable alternatives to the use of chemical fertilizers to increase crop yield? If yes, what are the challenges inhibiting their adoption and how can the identified constraints be overcome?

B. Purpose of the Study

The main purpose of this study is to identify sustainable alternatives to the use of chemical fertilizers to enhance crop yield in Bauchi state. The study will specifically seek to:

i. Determine whether farmers in Bauchi state are aware of these alternatives
ii. Identify the constraints of using each identified alternative and
iii. Suggest how these constraints can be ameliorated.

C. Hypotheses

1. H_o: Farmers in Bauchi state are not aware of sustainable alternatives to the use of chemical fertilizers to enhance crop yield.
2. H_o: Farmers in Bauchi state are not aware of the harmful effects of using chemical fertilizers to enhance crop yield.

D. Significance of the Study

This research work will be very useful to farmers who have become handicapped in procuring chemical fertilizers for crop production and create awareness on the avalanche of sustainable alternatives that can be successfully adopted. It will also assist extension practitioners especially the Bauchi State Agricultural Development Programme (BSADP) to understand and disseminate technologies that will ease the constant demand by farmers for viable and sustainable alternatives to the use of chemical fertilizers to enhance crop yield in Bauchi state.

Similarly, results of this study can be applied or replicated in other states of the Nigerian federation where similar problems exist. Administrators and policy makers will also benefit from the research work by guiding them to formulate policies aimed at encouraging sustainable alternatives to the use of chemical fertilizers for crop production and reducing the huge amounts expended on buying it which does not even reach the ordinary farmers. Finally, future researches into the issue will find the study a useful reference.

E. Methodology - Study Area

This study investigated whether farmers are aware of and use sustainable alternatives to chemical fertilizers in order to enhance crop yield in Bauchi state Nigeria. The state is located between latitudes $9^0\ 3^{"}$ and $12^0\ 3^{"}$ North and longitudes $8^0\ 50^{"}$ and 11^0 East. According to the National Population Commission Census (2006), the area has a population of 4,653,066 people and a land area of 49,119 Km^2 representing about 5.3% of Nigeria's total mass. The population of the state is however, predominantly rural and agrarian. About eighty percent of the people in most of the Local Government Areas are still dependent on farming comprising of 1,500,000 farm families (BSADP, 2012).

F. Research Design

Descriptive survey research design was adopted for the purpose of this study. Descriptive survey describes what is going on or what exists (Maduekwe and Akinnagbe, 2014). A descriptive study is one in which information is collected without changing the environment (nothing is manipulated). Sometimes these are referred to as "correlational" or "observational" studies. Kumar and Ranjit (2005), define a descriptive study as "Any study that is not truly experimental." In human research, a descriptive study can provide information about the naturally occurring behaviors, attitudes or other characteristics of a particular group of people. Descriptive studies are also conducted to demonstrate associations or relationships between things in the world around us. Descriptive studies can involve a one-time interaction with groups of people (Cross-sectional study) or a study might follow individuals over time (Longitudinal study). Descriptive studies, in which the researcher interacts with the participant, may involve surveys or interviews to collect the necessary information. Descriptive studies in which the researcher does not interact with the participant include observational studies of people in an environment and studies involving data collection using existing records.

This research design was suitable for the research topic which is aimed at describing alternatives to the use of chemical fertilizers for crop production among farmers in Bauchi state. The study also ascertained whether the farmers are aware of and use these better and sustainable alternatives.

G. Sample and sampling procedure

Multi-stage sampling method was employed. Three LGAs were purposively selected from the three agricultural zones of the state to give a total of nine LGAs used. Out of this, five villages were randomly selected from each LGA. Similarly, simple random sampling technique was used to select 20 crop farmers from each of the five villages selected. This gave a sample size of 900 crop farmers' for the study as shown in Table 1 below.

Table 1: Sampling procedure

S/No	Agricultural zones	Sampled LGAS	Sampled Villages	Sampled Farmers
1.	Western zone	Toro	5	20
		Dass	5	20
		Bogoro	5	20
2.	Central zone	Ningi	5	20
		Ganjuwa	5	20
		Darazo	5	20
3.	Northern zone	Jama'are	5	20
		Itas/Gadau	5	20
		Katagum	5	20
Total	**3**	**9**	**45**	**900**

H. Data Collection

Data for the study were collected using structured interview schedule. The variables measured include information on the socio-economic characteristics of the respondents, awareness and level of adoption of the sustainable alternatives to the use of chemical fertilizers and their perceived knowledge on the effects of using chemical fertilizers. Respondents level of awareness and adoption was determined by "yes" or "no" options. While their perception on the effects of the identified alternatives was determined by response options of major effects, minor effects, and no effect, respectively. The researchers employed the services of trained research assistants to collect the primary data from the crop farmers through the use of structured interview schedule.

I. Validation of the Instrument

Validation is the amount of systematic or built-errors in measurement (Nor land, 1990). Validity is established using a panel of experts and a field test. Validity test of the research instrument is necessary to ascertain if the research instrument will be able to measure what it is designed to measure. To ensure that the research instrument was valid, the developed instrument was given to experts in agricultural extension and rural sociology and senior lecturers in the department of agricultural education for proper scrutiny and comments. Based on their comments, the research instrument was modified before being used for the data collection.

J. Reliability of the Instrument

Reliability indicates the accuracy or precision of the measuring instrument (Nor land-Tilburg, 1990). Test-retest method of reliability was used to determine the instrument before final application. Three copies of the research instruments were used to collect information from the respondents. After an interval of two weeks the same respondents originally served with the instruments were interviewed again. The first and second test scores for all the variables considered in the study were then subjected to correlation analysis at 5%.

A correlation coefficient will be obtained and considered if satisfactory enough to conclude that the instrument is reliable. The reliability coefficient (alpha) can range from 0 to 1, with 0 representing an instrument with full error and 1 representing total absence of error. A reliability coefficient (alpha) of 70 or higher will then be considered acceptable reliability and can be used for the study. A reliability coefficient of 85 was obtained which was enough to accept reliability of the instrument used in collecting information from the respondents.

K. Data Analysis

Descriptive statistical technique of frequency count and percentage was used to analyze objectives 1 and 2. Furthermore, Pearson product moment correlation coefficient was used to test the hypotheses. The sample correlation coefficient, denoted **r**, ranges between -1 and +1 and quantifies the direction and strength of the linear association between the two variables. For example, a correlation of r = 0.9 suggests a strong, positive association between two variables, whereas a correlation of r = -0.2 suggest a weak, negative association. A correlation close to zero suggests no linear association between two continuous variables.

III. RESULT AND DISCUSSION

A. Sex of Respondents

Table 1: Distribution of Respondents according to Sex

Sex	Frequency	Percentage
Male	825	92
Female	75	8
Total	900	100

Table 1 show that 92% of the respondents are male, while 8% are female. This confirms that majority of crop farmers in Bauchi state are male. This is not

unconnected with the predominant cultural and religious beliefs in the area; men dominant the spheres of vocations that require a high amount of energy located outside the home. Usman and Dosunmu (2007) and other related studies carried out in Bauchi state also agree that majority of the crop producers in the area are male. Oluwasola (2015); Alam et al, (2013) and Fabiyi et al, (2007) all confirm that men dominate farming activities in Northeastern Nigeria of which Bauchi is a part.

B. Age of Respondents

Table 2: Distribution of Respondents according to Age

Age	Frequency	Percentage
25 – 34 years	176	19.5
35 – 44 years	302	33.5
45 – 54 years	210	23
55 – 64 years	192	21
65 years and above	20	3
Total	900	100

Table 2 shows that 53% of the respondents fall between the ages of 25 to 44 years old, 44% range between 45 to 64 years old, while 3% are above 65 years of age. It can be deducted that the number of active farmers in Bauchi state decline with increase in age; which is a normal trend. It can also be deducted from this result that the most active age group regarding crop production in the study area range between 25 to 44 year olds. This finding is also corroborated by Oluwasola (2015); Alam et al, (2013) and Fabiyi et al, (2007).

C. Marital Status of Respondents

Table 3: Distribution of Respondents according to Marital Status

Marital Status	Frequency	Percentage
Married	893	99.2
Single	07	0.8
Total	900	100

Table 3 shows that 99.2% of the respondents are married, while 0.8% are single. The cultural norms and values of the study area require that their inhabitants get married as soon as they can maintain a family. None of the respondents is below 25 years old and as such this result is also normal and in accordance with social structure of the area.

D. Annual Income of Respondents

Table 4: Distribution of Respondents according to Annual Income

Annual Income (₦)	Frequency	Percentage
100,000 – 250,000	362	40
251,000 – 500,000	256	28
501,000 – 750,000	172	19
751,000 – 1,000,000	91	10
Above 1,000,000	19	3
Total	900	100

Table 4 indicates that 68% of the respondents earn less than Five Hundred Thousand Naira (₦500, 000) annually, 29% of the respondents earn between ₦500, 000 and ₦750, 000 annually, while 3% earn above One Million Naira (₦1,000,000) annually. From this result majority of the respondents and by extension crop farmers in Bauchi state can be classified as poor. An earning of ₦250, 000 per annum which translates to an average of ₦685 per day which is just a little above $3. Okuneye et al (2004) report that poverty in Nigeria is concentrated among the agrarian populace living in rural areas; they contend that low resource or resource poor farmers characterized by a preponderance of small farm units, rain dependent minimum inputs usage and poor yield dominate the Nigerian agricultural sector. The authors concluded that the incidence of poverty is highest among households in which the head is engaged in agriculture as the main source income and recommend that accelerated agricultural growth as the panacea to alleviating poverty in the country.

E. Farming Experience of Respondents

Table 5: Distribution of Respondents according to Farming Experience

Experience	Frequency	Percentage
Less than 10 years	45	5
11 – 20 years	425	47
21 – 30 years	307	34
30 years and above	123	16
Total	900	100

Table 5 shows that 52% of the respondents have been farming for less than 20 years, 345 of the respondents have been farming for between 21 to 30 years, while 16% of the farmers have been farming for more than 30 years. This result indicates that a major cross-section of the respondents have the prerequisite experience in farming to enable them give informed responses to the questions posed to them regarding this research work.

F. Type of Crops Produced by Respondents

Table 6: Distribution of Respondents according to the Type of Crops they produce

Type of Crop	Frequency	Percentage
Cereals	410	45.5
Legumes	258	29.0
Roots and Tubers	176	19.5
Vegetables	56	6.0
Total	900	100

Table 6 shows that 45.5 percent of the respondents mostly cultivate cereals such as maize, millet and guinea corn, 29% of the respondents mostly cultivate legumes such as cowpea, groundnuts, soybeans, bambara nuts and sesame. 19.5% of the respondents cultivate mostly root and tuber crops such as cassava, sweet potatoes and cocoyam, while 6% of the respondents mostly cultivate vegetable crops such as tomatoes, pepper, onions and lettuce especially during the dry season. It was also discovered that all the farmers practice mixed cropping and the wealthy one also have fruit orchards. The fruit crops that thrive in the study area include mango, cashew, guava and watermelon.

G. Awareness of Respondents on the Detriments of Chemical Fertilizers

Table 7: Distribution according to Awareness of the Detriments of Chemical Fertilizers

Awareness	Frequency	Percentage
Aware	144	16
Not Aware	756	84
Total	900	100

Table 7 shows that 84% of the respondents are not aware that chemical or inorganic fertilizers are harmful or detrimental to their crop production practices. 16% of the respondents are aware of the harmful effects of inorganic fertilizers such as the fact that it contaminates ground water, poisonous to human beings, crops, soil and pollutes the environment. 98% of the respondents are not aware that inorganic fertilizers are made from nonrenewable raw materials and therefore unsustainable. This leads us to accept the null hypothesis that farmers in Bauchi state are not aware of the harmful effects of using chemical fertilizers to enhance crop yield.

H. Awareness of Respondents on Sustainable Alternatives to Chemical Fertilizers

Table 8: Distribution according to Awareness on Sustainable Alternatives to Chemical Fertilizers

Awareness	Frequency	Percentage
Aware	782	87
Not Aware	118	13
Total	900	100

Table 8 indicates that 87% of the respondents are aware of sustainable alternatives to the use of chemical fertilizers such as planting of leguminous cover crops, mulching, leaving of crop residues on the farm, use of bio fertilizers such as animal manure and ash, fallowing, composting, crop rotation, conservation tillage and permaculture. 13% of the respondents are not aware of such alternatives and rely completely on inorganic fertilizers to enhance their crop yield. This leads us to

reject the null hypothesis that farmers in Bauchi state are not aware of sustainable alternatives to the use of chemical fertilizers to enhance crop yield.

I. Practice of Sustainable Alternatives to Chemical Fertilizers by Respondents

Table 9: Distribution according to Practice of Sustainable Alternatives to Chemical Fertilizers

Practice	Frequency	Percentage
Practice	352	39
Do Not Practice	548	61
Total	900	100

Table 9 shows that 61% of the respondents do not practice the sustainable alternatives to use of inorganic fertilizers to enhance crop yield enumerated in 4.8. 39% of the respondents do practice some of these sustainable alternatives, especially the use of animal manure, ash and garbage. They identified the following constraints as the major reasons why they cannot effectively utilize these alternatives to enhance crop yield – inadequate knowledge of how to use these alternatives as a consequence of inadequate agricultural extension coverage, lack of capital, land tenure system, unavailability of and expensive inputs. They particularly identified permaculture as totally new to them.

J. Perception of Farmers on Use of Sustainable Alternatives to Chemical Fertilizers

Table 10: Distribution according to Perception on Use of Sustainable Alternatives to Chemical Fertilizers

Perception	Frequency	Percentage
Positive	882	98
Negative	18	2
Total	900	100

Table 10 indicates that 98% of the respondents perceive that using sustainable alternatives to chemical fertilizers is a good development while 2% believe the opposite is true. According to Kiratu et al (2014) perception relates to the interpretation of data that is from one's environs. Thus the perception that farmers have towards a technology is determined to a great deal by the data they have gathered about it through experience, learning or training. The exposure that a farmer has on a technology therefore determines his/her perception towards it and consequently the adoption or use of that technology. In a similar study carried out by Nnamonu and Ali (2013) on the perception of farmers on agrochemical use and organic farming in Benue State of Nigeria; 56% of the respondents had a positive perception towards organic farming while 38% of the respondents had a negative perception. 6% of the respondents were undecided. Idku et al (2015) also reported that extension agents in Cross River State of Nigeria had an overwhelming positive perception towards the use of bio-fertilizers, crop rotation and planting of leguminous cover crops as viable to the use of inorganic fertilizers that have become expensive, unavailable and insufficient.

K. Correlation Analysis between Awareness of Sustainable Alternatives and their Practice by Respondents

Table 11: Correlation between Awareness of Sustainable Alternatives and their Practice

Variable	Coefficient of correlation
Planting of Nitrogen fixing legumes	0.474**
Leaving of crop residues	-0.011
Using bio-fertilizers	0.234**
Crop rotation	-0.309**
Conservation tillage	-0.149**
Fallowing	-0.131
Permaculture	-0.005

** Correlation is significant at the 0.01 Level (2-tailed)

Table 11 indicates that the correlation between awareness and practice of sustainable alternatives such as planting of nitrogen fixing legumes, use of bio-fertilizers, crop rotation and conservation tillage are positive, while the correlation between awareness and practice of sustainable alternatives such as leaving of crop residues, fallowing and permaculture are negative. This result implies that if constraints preventing the practice of sustainable alternatives to the use of chemical fertilizers to enhance crop yield such as inadequate knowledge of how to use these alternatives as a consequence of inadequate agricultural extension coverage, lack of capital, land tenure system,

unavailability of and expensive inputs are removed; farmers in Bauchi state are willing to put them into practice.

IV. SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

This research work investigated the perception of farmers towards the use of sustainable alternatives to replace chemical fertilizers used to enhance crop yield in Bauchi state. It also investigated whether farmers are aware of and use these sustainable alternatives to enhance crop yield in Bauchi state Nigeria. Descriptive survey research design was adopted for the purpose of this study while multi-stage sampling method was employed in selecting the sample. Questionnaires and interviews were used to collect data from the three LGAs purposively selected from the three agricultural zones in the state to give a total of nine LGAs used. Out of this, five villages were randomly selected from each LGA. Similarly, simple random sampling technique was used to select 20 crop farmers from each of five villages selected. This gave a sample size of 900 crop farmers.

It was discovered that 98% of the respondents perceive that using sustainable alternatives to chemical fertilizers is a good development while 2% believe the opposite is true. 84% of the respondents are not aware that chemical or inorganic fertilizers are harmful or detrimental to their crop production practices. 16% of the respondents are aware of the harmful effects of inorganic fertilizers such as the fact that it contaminates ground water, poisonous to human beings, their crops, and soil and pollutes the environment. 98% of the respondents are not aware that inorganic fertilizers are made from nonrenewable raw materials and therefore unsustainable. This led to the acceptance of the null hypothesis that farmers in Bauchi state are not aware of the harmful effects of using chemical fertilizers to enhance crop yield. Similarly, the results show that 87% of the respondents are aware of sustainable alternatives to the use of chemical fertilizers such as planting of leguminous cover crops, mulching, leaving of crop residues on the farm, use of bio fertilizers such as animal manure and ash, fallowing, composting, crop rotation, conservation tillage and permaculture. 13% of the respondents are not aware of such alternatives and rely completely on inorganic fertilizers to enhance their crop yield. This leads us to reject the null hypothesis that farmers in Bauchi state are not aware of sustainable alternatives to the use of chemical fertilizers to enhance crop yield.

Finally, the correlation between awareness and practice of sustainable alternatives such as planting of nitrogen fixing legumes, use of bio-fertilizers, crop rotation and conservation tillage are positive, while the correlation between awareness and practice of sustainable alternatives such as leaving of crop residues, fallowing and permaculture are negative. This result implies that if constraints preventing the practice of sustainable alternatives to the use of chemical fertilizers to enhance crop yield such as inadequate knowledge of how to use these alternatives as a consequence of inadequate agricultural extension coverage, lack of capital, land tenure system, unavailability of and expensive inputs are removed; farmers in Bauchi state are willing to put them into practice.

Conclusion

It can be concluded from the findings of this research that although crop farmers in Bauchi state are aware of sustainable alternatives to the use of chemical fertilizers to enhance crop production, they are constrained to using them because of inadequate land, funds and knowledge. Inadequate extension coverage and unavailability of essential inputs also contribute to low adoption of these alternatives.

The study also proved useful in sensitizing farmers on the need to start adopting these sustainable alternatives since the raw materials for manufacturing chemical fertilizers are fast dwindling and thereby unsustainable. This is coupled with the fact that inorganic fertilizers are detrimental to human and environmental health.

Recommendations

In view of the findings of this research work, it is hereby recommended that:

1. The Bauchi State Government should as a matter of urgency look into the issue of revamping the activities of the Bauchi State Agricultural Development Project (BSADP) which is the apex extension agency in the state. It should place special focus on adequate funding and staffing of extension

agents to cover all the nooks and crannies of the state.

2. The BSADP should within the limited resources available to it step up sensitization and enlightenment of farmers in the state on the harmful effects of chemical fertilizers and the need to replace them with sustainable alternatives. It can achieve this through local radio and television programs, demonstration and village enlightenment campaigns.
3. Researchers are enjoined to look further into cost effective means of empowering farmers to adopt these sustainable alternatives and increasing their output in an environmentally friendly and sustainable manner.

V. REFERENCES

[1] Alam, M.K. Aboki, E. Gidado, E.H. and Buba, D.D. (2013). Economic analysis of cotton production in selected local government areas of Taraba State, Nigeria. Journal of Agricultural Science 4(1) pp. 27-31

[2] Bauchi state Agricultural Development Programme (BSADP) (2012): 2000 Bauchi farmers get free sesame seeds. Blueprint (2012). Available at http://printing.com/new/2012/07/2000-bau. 17/06/2013

[3] Day, J. (2008). The debate over organic vs chemical fertilizers. Retrieved 7th July 2015 from http://www.todayshomeowner.com/debate-over-organic-chemical-fertilizers/

[4] Deepali, A. and Gangwar, K. (2000). Bio-fertilizers: An eco-friendly way to replace chemical fertilizers. Retrieved 8th July 2015 from www.krishisewa.com/images/biofert.html

[5] Deepanjan, M. and Navindu, J. (2000). Nitrate pollution of groundwater and associated human health disorders. Retrieved 7th July 2015 Sustainable Baby Steps http://www.sustainablebabysteps.com/effects-of-chemical-fertilizers.html

[6] Fabiyi, E.F. Danladi, B.B. Akande, K.E. and Mahmood, Y. (2007). Role of women in agricultural development and their constraints: A case study of Billiri local government area, Gombe State, Nigeria. Pakistan Journal of Nutrition 6(6) pp. 676-680

[7] Food Program (2014). Sustainable Crop Production. Retrieved 19th October 2015 from http://www.sustainabletable.org/249/sustainable-crop-production

[8] Idku, O.F. Aboh, C.L. Ijogu, B.J. and Wonah, C.O. (2015). Extension Agent's perception of constraints to fertilizer use by rural farmers in Cross Rivers State Nigeria. International Journal of Research in Agriculture and Food Sciences 2(10) pp. 11-24

[9] Kiratu, N.M. Ngigi, M. and Mshenga, P.M. (2014). Perception of smallholder farmers towards the Kilimo Plus Subsidy Program in Kenya. Journal of Agriculture and Veterinary Science 6(6) pp. 28-32

[10] Maduekwe, M.C. and Akinnagbe, O.M. (2014). Identifying and defining research problems in agricultural extension. A guide to research in agricultural extension. AESON

[11] Meldora, D. (2013). How Organic Farming could release us from the curse of fertilizer. Retrieved 7th July 2015 from http://articles.mercola.com/sites/articles/archive/2013/07/02/fertilizer.aspx

[12] Nnamonu, L.A. and Ali, A.E. (2013). Perception of agrochemical use and organic farming in Makurdi, Benue State. International Journal of Environmental Protection 3(8) pp. 48-52

[13] Norland-Tilburg, E.V. (1990). Controlling errors in evaluation instruments. Journal of Extension 28(2). pp. 11-23 available at www.joe.org/joe/1990summer/tt2/html

[14] Okuneye, P.A. Fabusoro, E. Adebayo, K. and Ayinde, I.A. (2004). The Nigerian agriculture and poverty incidence: The need for private sector empowerment. Being a paper presented at the Farm Management Association of Nigeria Conference, held in Abuja, Nigeria.

[15] Oluwasola, O. (2015). Vegetable production, livelihood diversification and employment generation in Oyo State, Nigeria. Journal of Agricultural Science 7(8) pp. 165-174

[16] Usman, O.A.S. and Dosumu, O.O. (2007). Cadmium analysis in fertilizers and groundwater samples in Dass Local Government Area of Bauchi State, Nigeria. Centerpoint (Science Edition)14(1&2) pgs. 208-213