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Effective Extension Information Dissemination Methods Used in Disseminating Organic Agricultural Practices as Mitigating Strategy for Climate Change in Kogi State - Nigeria

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Abstract
The major objective of the paper was to identify the most effective extension information teaching methods used in disseminating organic agricultural practices as mitigating strategy to climate change in Kogi State. A multi – stage random sampling technique was employed in selecting 270 respondents from the three senatorial districts in the state. Descriptive statistics (frequency, percentage, mean and standard deviation) was used in data analysis. Results show that increase in atmospheric heat ($\bar{x}$ = 4.74), increased Weed growth ($\bar{x}$ = 4.62), reduction in Soil fertility ($\bar{x}$ = 4.59), decreased yield of crops ($\bar{x}$ = 4.52), increase in Pests and Diseases ($\bar{x}$ =4.39), increase in health related issues ($\bar{x}$ = 4.32), decrease in the availability of portable water ($\bar{x}$ = 4.14) are the most common and significant effects of climate change in the study area. The paper also identified group meetings (77.8%), informal personal contacts (72.9%), farm and home visits (70%), training and visits (67%), result demonstration (63.7%), field trips (60.4%), radio programmes (55.2%) and agricultural exhibitions (52.6%) as the most effective extension information dissemination methods employed by extension agents in the state in disseminating organic agriculture. The paper concluded that the disparity between the level of awareness and adoption of recommended organic agricultural practice in the study area is as a result of non frequent contact between extension agents and farmers. It was recommended that extension agents should reschedule their activities and programmes to accommodate frequent contact with the farmers. Government should increase funding on extension programmes and activities and engage more extension personnel in the state.
Keywords: Effective, Information Dissemination, Organic Agriculture, Mitigating Strategy, Climate Change.

1. Introduction

The realities of the effects of climate change to man's earthly inhabitation is not in doubt. Change in weather; rainfall pattern, temperature, biodiversity, drought, erosion, intense heat are evidences of the aforementioned situation. Climate includes patterns of temperature, precipitation, humidity, wind and seasons. "Climate change" affects more than just a change in the weather; it refers to seasonal changes over a long period of time. These climate patterns play a fundamental role in shaping natural ecosystems, and the human economies and cultures that depend on them. Because so many systems are tied to climate, a change in climate can affect many related aspects of where and how people, plants and animals live, such as food production, availability and use of water, and health risks.

For example, a change in the usual timing of rains or temperatures can affect when plants bloom and set fruit, when insects hatch or when streams are their fullest. This can affect historically synchronized pollination of crops, food for migrating birds, spawning of fish, water supplies for drinking and irrigation, forest health, and more.

Some short-term climate variation is normal, but longer-term trends now indicate a changing climate. A year or two of an extreme change in temperature or other condition doesn't mean a climate change trend has been "erased.

The single human activity that is most likely to have a large impact on the climate is the burning of "fossil fuels" such as coal, oil and gas. These fuels contain carbon and burning them makes carbon dioxide gas. Since the early 1800s, when people began burning large amounts of coal and oil, the amount of carbon dioxide in the earth's atmosphere has increased by nearly 30% and average global temperature appears to have risen between 1° and 2°F.

Carbon dioxide gas traps solar heat in the atmosphere, partly in the same way as glass traps solar heat in a sunroom or a greenhouse. For this reason, carbon dioxide is sometimes called a "greenhouse gas." As more carbon dioxide is added to the atmosphere, solar heat has more trouble getting out. The result is that, if everything else stayed unchanged, the average temperature of the atmosphere would increase. As people burn more fossil fuel for energy they add more carbon dioxide to the atmosphere. If this goes on long enough, the

average temperature of the atmosphere will almost certainly rise.

To cushion the effects of climate change in man's environment in preserving the ecosystem and ensuring sustainable livelihood, it is pertinent to explore avenues and practices that will support the restoration of health to agro ecosystem, enhance biological cycles, biodiversity and soil biological activities.

Organic farming works in harmony with nature rather than against it. This involves using techniques to achieve good crop yields without harming the natural environment or the people who live and work in it. This is accomplished by using, where possible, cultural, biological, and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system. An organic production system is designed to; enhance biological diversity within the whole system, increase soil biological activity; maintain long-term soil fertility, recycle wastes of plant and animal origin in order to return nutrients to the land, thus minimizing the use of nonrenewable resources, rely on renewable resources in locally organized agricultural systems and promote the healthy use of soil, water, and air, as well as minimize all forms of pollution thereto that may result from agricultural practice (FAO, 2007).

Further, organic farming ensures increased long-term soil fertility, control pests and diseases without harming the environment ensure that water stays clean and safe, use resources which the farmer already has, so the farmer needs less money to buy farm inputs and produce nutritious food, feed for animals and high quality crops to sell at a good price (HDRA, 1998**).**

Adaptation and mitigation based on organic agriculture can build on well established practice. Organic agriculture is a sustainable livelihood strategy with decades of use in several climate zones and under a wide range of specific local conditions. The financial requirements of organic agriculture as an adaptation or mitigation strategy are low. One envisaged problem associated with organic agriculture is the effective dissemination of the practices to farmers. This study was carried out to ascertain the effective extension information methods used in the dissemination of organic agricultural practices as mitigating strategy to climate change in Kogi State of Nigeria with the view to identifying the climate change factors that affect Agriculture in the study area, determine the level of awareness of the respondents of various organic agricultural practices, identify organic agricultural practices adopted by respondents, and determine the effective extension information methods in disseminating organic agricultural practices in the study area.

1.1 Hypothesis

H_o = There is no relationship between climate change factors and agriculture in the study area

2. Materials and Methods

2.1 The study Area

The study is carried out in Kogi State of Nigeria. Kogi State was created out of Benue and Kwara States on August 27, 1991and presently has 21 local governments Areas. It is located in the North-Central Zone of Nigeria and is popularly called the confluence state because the confluence of Rivers Niger and Benue occurs in its capital; Lokoja. There are three main ethnic groups and languages in Kogi: Igala, Ebira, and Okun (similar to Yoruba) with other minorities like Bassa, a small fraction of Nupe mainly in Lokoja, Gwari, Kakanda, Oworo people (similar to Yoruba), Ogori Magongo and the Eggan community under Lokoja Local Government.

The State is the most centrally located of all the states of the federation and shares common boundaries with Niger, Kwara, Nassarawa and The Federal Capital Territory to the North.

To the East, the state is bounded by Benue and Enugu states, to the South by Enugu and Anambra States, and to the West by Ondo, Ekiti and Edo states. The State has a population of 2,099,046 million people (1991 Census) and estimated population of 3,595,789 million people in 2005. It has an area of 29.833km^2 with a coordinate of $7^0$30'N and $6^0$42'E.

Agriculture is the mainstay of the economy and the principal cash crops. There are many Farm produce from the state notably coffee, cocoa, palm oil, cashews, groundnuts, maize, cassava, yam, rice and melon. Mineral resources in the State include; coal, limestone, iron, petroleum and tin.

2.2 Sampling Procedure

A two three sampling technique was used in selecting the respondents. In the first stage, three local governments from each of the senatorial zones were randomly selected. In the second state, three villages were randomly selected from each of the local governments. In the third stage, 30 farmers were randomly selected from each of the villages. A total of 270 respondents were selected for the study.

Table 1: Distribution of Respondents by Senatorial Zones, Local Government Areas and Villages involved in the Study

Senatorial Zones	LGA's	Villages	No. of Respdts	Total
Kogi Central	Adavi	Abagiri	30	
		Ngazi – Eba	30	**90**
		Umuakoro	30	
Kogi East	Ankpa	Acheba	30	
		Emedo	30	**90**
		Uboji	30	
Kogi West	Ijumu	Aiyetoro Gbede	30	
		Kakuma	30	**90**
		Ogidi	30	**270**
		Total	**270**	

2.3 Data Collection

Primary data was collected with the use of structured questionnaires and personal interviews. Secondary information used in the study was obtained from the Lokoja Local Government Authorities, Agricultural Development Project (ADP) office in Aiyetoro Gbede and review of related literatures.

2.4 Analytical techniques

Data obtained were analyzed with descriptive statistics (Percentages and Ranking) and Inferential Statistics (Chi-Square). The effects of climate change on agriculture as reflected in the work were obtained from the review of literatures. Chi-square was used to determine the impact of climate change on agriculture. The calculated Chi-square (χ^2_{cal}) values of the were compared with the Chi-square table (χ^2_{tab}) value of 3.84. Calculated values that are greater than 3.84 ((χ^2_{cal} > than 3.84) were considered to significant impacts and vice verse. The level of awareness and adoption of Organic Agricultural practices were analyzed with frequency and percentage. Objective 4 was analyzed using their mean score. A five Likert – type scale of "not effective, less effective, effective, more effective and most effective" with nominal values of 1, 2, 3, 4, and 5 were assigned. A Mean Score of ($\bar{x} \geq 3.0$) represented effective methods while Mean Score of ($\bar{x} < 3.0$) represented none effective methods.

The precise calculation of Chi-Square (2) is given by:

$$\chi^2 = \sum \frac{(\text{Observed Frequency} - \text{Expected Frequency})^2}{\text{Expected Frequency}} = \frac{\sum (Fo - Fe)^2}{Fe}$$

Where
$\sum$ = Summation
Fe = Expected frequency
Fo = Observed frequency
Fe = (row total X column total) / grand total

3. Results and Discussion

Tables 2 and 3 present the hypotheses testing with the Chi-square statistics. The Chi-square was used to establish relationship between the observed climatic factors and expected effects on agriculture. Table 4 shows the results of the Chi-square statistics. The table reveals that the five major effects of climate change in the study area are increase in atmospheric heat, reduction in soil fertility, decreased yield of crops, increase in pest and diseases and drying of crops due to intense heat. Also, items 6 – 15 have effects on agricultural production in the study area. Items 16 – 20 were observed not prominent in the study area and therefore do not affect agriculture. Ozor and Nnaji (2010) reported in their study that reduction soil fertility, incidence of pests and diseases, lose of vegetation and soil erosion significantly have impact on agriculture. Similarly, (MOE FRN, 2003), reported that increased rainfall will lead to increased growth of weeds, increase in erosion and the incidence of pest and disease as indirect effects. Farmers reported that intensity of rainfall did not reduce but rather increased. This gave rise to increased flood and soil erosion. The effects of these conditions to agriculture and the environment are enormous. Spore (2008) reported that in 2007 alone increased intensity of rainfall resulted to flood which racked havoc in many African countries destroying roads, buildings and washed away hectares of farmland. The concomitant effect of this is low agricultural productivity, reduced farm income, hunger and poverty among farm households. To a nation this will result to increase in capital expenditure in rebuilding roads and erosion control, decrease in gross domestic product (GDP), foreign exchange earnings from agriculture and food insecurity. Decrease in portable water in some communities will result to health problems. This is caused by the drying up of rivers and streams in some communities occasioned by increase in atmospheric heat. Ozor (2009) reported

that the drying up of streams and rivers in some communities due to climate change ultimately lead to their search for water in neighbouring communities with its attendant man hour losses, and the propensity to trigger conflicts and hardships on the people.

3.1 Testing the hypotheses

H_1 = Increase in atmospheric heat affect agriculture

From table 2b, the Chi-Square (χ^2_{cal}) calculated value 29.96 is > (greater) than the Chi-Square (χ^2_{tab}) table value 3.84. Hypothesis one is therefore accepted. Increase in atmospheric heat affects agriculture.

H_2 = Increased weed growth affects agriculture

From table 2b, the Chi-Square (χ^2_{cal}) calculated value 4.18 is > (greater) than the Chi-Square (χ^2_{tab}) table value 3.84. Hypothesis two is therefore accepted. Increase in weed growth affects agriculture.

Similarly, Chi-Square (χ^2) was calculated for each of the climatic change factors identified. The result of the calculation is presented in table 4 below.

Table 5 below reveals that most of the farmers in the study area are aware of the various organic agricultural practices that could be used as mitigating strategies to the effects of climate change. This level of awareness could be attributed the means of extension information dissemination methods used by the extension agents in the area in disseminating organic agricultural practices. In improving Soil fertility practices, the farmers are most aware of the use of green Manures and Legumes (93.7%), Increase in length of Fallow (91.1%), use of Manual Weeding (85.9%), use of recycled and composted crops wastes and animal Manures (84.1%) and the use of grass for Mulching on the Soil surface (77%). In Pests, Diseases and Weed control, the farmers are most aware of the use of cover crop (82.6%), Crop Rotation (77.4%), use of resistant crops/varieties (70%), use of Saw Dust for Mulching on the Soil surface (64.8%) and the use of Saw Dust for termite control (62.6%). Others are; Proper Sun drying of crops before storage (91.9), Good use of irrigation (85.6%) and the use of non chemical in crop storage (81.1%).

Table 6 indicates that some of the farmers adopted less of the organic agricultural practices compared to their level of awareness of these practices. The percentage difference in the highest level of awareness and adoption of organic agricultural practices in the study area is 29.3%. This differences could be accounted for by the number of the farmers who are aware of some of the practices but do not know how to apply them and the extension information dissemination methods used in disseminating these practices to the farmers.

Table 7 shows that the most effective extension information dissemination methods used in the study area to disseminate organic agricultural practices are; group meetings (77.8%), informal personal contacts (72.9%), farm and home visits (70%), training and visits (67%), result demonstration (63.7%), field trips (60.4%), radio programmes (55.2%) and agricultural exhibitions (52.6%).

3.2 Conclusions

The following are the conclusions;

- the climate change factors that are most prevalent in the study area are increase in atmospheric heat, increased weed growth, reduction in soil fertility, decreased yield of crops, increase in pest and diseases, increase in health issues and decrease in availability of portable water..
- the organic agricultural practices that farmers are most aware of in the study area are use of green manure and legumes, proper sun drying of crops, increase in length of fallow, use of manual weeding, good use of irrigation, use of recycled and composted crops wastes and animal manures, use of cover crops, and use of non chemicals in crop storage.
- the organic agricultural practices that the farmers mostly adopted are use of manual weeding, use of green manures and legumes, use of cover crops, increased length of fallow, crop rotation, use of composted crop wastes and animal manures, good cultivation practices and use of mulching on the soil surface.
- the most effective extension information dissemination methods used in the study area are group meeting, informal personal contacts, farm and home visits, training and visits, result demonstration, field trips, radio programmes and agricultural exhibitions.

3.3 Recommendations

The following were recommended;

- extension agents should try reschedule their activities and programmes to accommodate frequent contact with the farmers.
- The government should increase funding on extension programmes and activities and engage more extension personnel in the state.
- constant training and visits should be embarked to expose the farmers on the proper ways of applying

organic agriculture.

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Table 2a: Observed frequencies of hypothesis 1

Questions	Yes	No	Total	%
Increase in atmospheric heat affect agriculture	130`	38	168	62.22
Atmospheric heat is not enough to affect agriculture	40	62	102	37.88
	170	**100**	**270**	**100**

Table 2b: Chi-Square calculation for hypothesis 1

O	E	O – E	$(O - E)^2$	$\frac{(O - E)^2}{E}$
130	105.78	24.23	587.1	5.55
38	62.22	- 24.22	586.6	9.43
40	64.22	- 24.22	586.6	9.43
62	37.78	24.23	587.1	5.55
270	**270**			**29.96**

Table 3a: Observed frequencies for hypothesis 2

Questions	Yes	No	Total	%
Increased weed growth affects agriculture	98	49	147	54.44
Crop yield will not be affected by increased weed growth	67	56	123	45.56
	165	**105**	**270**	**100**

Table 3b: Chi-Square calculation for hypothesis 2

O	E	O – E	$(O - E)^2$	$\frac{(O - E)^2}{E}$
98	89.84	8.17	66.17	0.74
49	57.16	- 8.16	66.59	1.17
67	75.16	- 8.16	66.59	0.89
56	47.84	8.17	66.17	1.38
270	**270**			**4.18**

Table 4: Chi-Square Analysis of the Climatic Change Factors that Affects Agriculture in the Study Area

Impacts of Climate Change	χ^2_{cal} Value
Increase in atmospheric heat	29.958*
Reduction in soil fertility	25.48*
Decreased yields of crops	21.23*
Increase in Pests and Diseases	18.76*
Drying of cops because of increased heat	15.13*
Decay of stored crops because of increased heat	14.94*
Increase in health issue	14.67*
Destruction of wild life ecosystem	14.14*
Increased flood	11.13*
Incidence of erosion in riverside areas	9.91*
Lose of farm land	8.82*
Lose of vegetation	5.41*
Increased mortality rate of livestock	5.12*
Increase in weed growth	4.18*
Decreased availability of portable water	4.21*
Damage of crops by wild wind	3.24
Decrease of Fish population due to salinity, water levels and Ocean current	3.15
Decrease in rainfall	2.97
Changes in the taste of fruits and other crops	2.84
Premature ripening of fruits	2.68

Source: Field Survey, 2010; *significant impact @ 0.05 level; Cut off mark = 3.84 = χ^2_{tab}

Table 5: Multiple Responses of Respondents Level of Awareness of Organic Agricultural Practices in the Study Area

Practices	Frequency	Percentage Scores
Improve Soil Fertility Practices		
Use of green Manures and Legumes	253	93.7
Increase in length of Fallow	246	91.1
Use of Manual Weeding	232	85.9
Use of recycled and composted crops wastes and animal Manures	227	84.1
Use of grass for Mulching on the Soil surface	208	77
Use of mixed farming	196	72.6
Proper crop spacing	103	68.1
Use of proper Soil cultivation methods	173	64.1
Deep planting of seeds and seedlings	168	62.2
Pests, Diseases and Weeds Control Practices		
Use of cover crop	223	82.6
Crop Rotation	209	77.4
Use of resistant crops/varieties	189	70
Use of Saw Dust for Mulching on the Soil surface	175	64.8
Use of Saw Dust for termite control	169	62.6
Good cultivation practices	164	60.7
Proper crop choice	159	58.9
Use of natural pesticides	155	57.4
Use of predators that eats pests	149	55.2
Others		
Proper Sun drying of crops before storage	248	91.9
Good use of irrigation	231	85.6
Use of non-chemical in crop storage	219	81.1
Change in planting dates	206	76.3
Change in harvesting dates	193	71.5
Adherence to weather forecast	174	64.4
Good Animal husbandry	162	60

Source: HDRA (1998) and Ozor and Nnaji (2011).

Table 6: Multiple Responses on Organic Agricultural Practices Adopted in the Study Area

Practices	Frequency	Percentage Scores
Improve Soil Fertility Practices		
Use of Manual weeding	174	64.4
Use of Green Manures and Legumes	163	60.4
Increase length of Fallow	152	56.3
Use of Recycled and Composted Crop Wastes and Animal Manure	143	52.9
Use of Mulching on the Soil Surface	138	51.1
Use of Mixed Farming	119	44.1
Proper Crop spacing	112	41.5
Deep Planting of Seeds and Seedlings	106	39.2
Use of proper Soil Cultivation Methods	97	35.9
Pests, Diseases and Weeds Control Practices		
Use of Cover Crops	156	57.8
Proper Crop Choice	149	55.2
Crop Rotation	142	52.6
Good Cultivation Practices	131	48.5
Use of Resistant Crops/ Varieties	67	24.8
Use of Natural Pesticides	21	7.8
Use of predators that eat Pests	0	0
Others		
Use of non-Chemical in Crop Storage	129	47.8
Proper Sun drying of Crops before storage	118	43.7
Good use of Irrigation	107	39.6
Change in Planting dates	98	36.3
Change in Harvesting dates	63	23.3
Good Animal Husbandry	32	11.9
Adherence to Weather Forecast	11	4.1

Source: HDRA (1998) and Ozor and Nnaji (2011).

Table 7: Multiple Responses of the Effective Extension Information Dissemination Methods Used to Disseminate Organic Agriculture in the Study Area

Methods	Frequency	%	Mean Scores
Group Meetings	210	77.8	4.21*
Informal Personal Contacts	197	72.9	3.67*
Farm and Home Visits	189	70	3.52*
Training and Visits	181	67.0	3.48*
Result Demonstration	172	63.7	3.44*
Field Trips	163	60.4	3.39*
Radio Porgrammes	149	55.2	3.21*
Agricultural Exhibitions	142	52.6	3.08*
Office Call	136	50.4	2.78
Television Programmes	82	30.4	2.48
Newspaper	78	28.9	2.41
Hand Bills	56	20.7	2.36

Source: Field data, 2010; Cut off mark = Mean score of 3.0.

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