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## **Knowledge of Extension Agents on Climate Smart Agricultural Initiatives in South West Nigeria**

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## **Abstract**

*This study examined the knowledge level of extension agents on six classes of climate smart adaptation initiatives (CSAI). A multi-stage sampling procedure was utilized to collect data from 277 agents in South-West Nigeria with the aid of a structured questionnaire. Data were descriptively analysed using frequency counts, percentages and means. The result showed that extension agents were knowledgeable on crop-mix (56.3%) and tillage-smart (53.4%) related initiatives with more than half of them scoring above the mean benchmark. However, they had a low knowledge level on the majority of the water management (59.2%), fossil-burning (94.2%), soil (75.8%), ICT and other adaptive initiatives (98.9%) as the majority of them scored below the mean benchmark for each of these categories. Seminars and workshops should be provided by extension organizations for these agents to upgrade their knowledge on these initiatives, thus positioning them to effectively be able to render needed advisories to farmers. This will equip farmers to be adept in responding adequately to managing climate change risks and also scale-up their use of CSAI.*

**Keywords:** Climate smart agricultural initiatives, extension services, extension agents, knowledge.

## Introduction

Globally, the agricultural and food systems are still facing the threat of climate change. Utilization of climate-smart agricultural initiatives (CSAI) by farmers remains very crucial in adapting and mitigating the effect caused by climate change (Abegunde, Sibanda and Obi, 2019). Climate Smart Agricultural Initiatives involve strategies that help to reduce vulnerability in agriculture and increase resilience and stability thus assisting farmers to adapt to climate change risks (Olorunfemi *et al.*, 2020). However, it has been reported by several research (Tripathi and Mishra, 2017; Ali and Erenstein, 2017), that there is still a low level of use of climate change adaptation and mitigation techniques among farmers which has been attributed to the low level of knowledge and human capacity.

Agricultural extension has been very important in promoting rural livelihood globally. Extension agents are saddled with the responsibility of transferring technology and providing advisory services to rural farming households in many developing countries including Nigeria (Davis 2016; Olorunfemi and Oladele, 2018). More importantly, effective agricultural extension service among other things encompasses the provision of timely information to farmers. The availability of such apt information will allow farmers to immediately respond to problems faced on their farms such as the inimical effect caused by climate change. Thus, it is the responsibility of agricultural extension to disseminate best practices and innovations developed to enhance the adaptive capacity and increased resilience of farming communities to the effect of climate change.

The involvement of agricultural extension systems in playing this role effectively is dependent on several factors crucial among which is the knowledge of extension personnel. According to Afful (2016), extension agents in developing countries require knowledge and competency upgrade on climate change risks and use of adaptation initiatives. This is important to help them play their role effectively in the complex and rapidly changing agricultural environment. In the light of this, therefore this study examines the knowledge level of extension agents on CSAI in South-West Nigeria. Specifically, the study assesses the knowledge level of extension agents on six various classifications of CSAI. These includes water management initiatives, crop-mix related initiatives, tillage-smart initiatives, fossil-burning reduction initiatives, soil related initiatives, and ICT and other adaptive initiatives. This is aimed at providing detailed insight to extension administrators on packaging the needed in-service training that will help upgrade their capacity to effectively provide advisory services to rural farmers in the study area.

## Methodology

The study was carried out in South West Nigeria. The zone lies between Latitude 6<sup>0</sup> to the North and 4<sup>0</sup> to the South and longitude 4<sup>0</sup> the West and 6<sup>0</sup> to the East. The population of the study included all extension agents in South West Nigeria. Sampling of respondents was carried out in two stages as shown in Table 1. The first stage was a random selection of three (3) states namely: Oyo, Ondo and Ekiti. This was followed by a random selection of 104, 71, and 102 extension agents in Oyo,

Ekiti, and Ondo respectively. This makes a total of two-hundred and seventy-seven extension agents utilized as respondents in this study. The data collected was analysed using percentages, means and standard deviation.

**Table 1: Respondents distribution and sample selection in the study area**

<b>1<sup>st</sup> stage Random Sampling</b>		<b>2<sup>nd</sup> Stage Random sampling</b>
Selected States	Number of Extension Agents	Number of Extension Agents Selected (Sample Size)
Ekiti	86	71
Ondo	137	102
Oyo	141	104
<b>Total</b>		<b>277</b>

Data were elicited with the aid of a structured questionnaire on the knowledge of the extension agents. A total of 45 items (cutting across six categories) relating to climate change adaptation and mitigation initiative items that extension agents were supposed to be knowledgeable about were presented to the respondents. They were asked to indicate whether these statements were correct (true) coded 2 or incorrect (false) coded 1. A composite knowledge score was computed for each respondent and a mean benchmark was used to recategorize their scores into whether they have a high knowledge on CSAI for those above the mean score or a low knowledge for those below the mean score. The first category was water management initiatives made up of 9 items with a minimum attainable score of 9 and a maximum score of 18. The second was related to tillage-smart initiatives made up of 8 items with a minimum score of 8 and a maximum attainable score of 16. The third category was on fossil-burning reduction Initiatives made up of 4 items with a minimum score of 4 and a maximum score of 8. Furthermore, the fourth category was on soil Initiatives made up of 10 items with a minimum score of 10 and a maximum attainable score of 20. The fifth category was on crop-mix related Initiatives made up of 8 items with a minimum score of 8 and a maximum attainable score of 16. The sixth category was on ICT and adaptive Initiatives made up of 6 items with a minimum score of 6 and a maximum attainable score of 12.

## Results and Discussion

### Knowledge of Climate Smart Agricultural Initiatives

Table 2 shows that, more than half of the extension agents had a high knowledge score above the mean benchmark in crop-mix (56.3%) and tillage-smart (53.4%) related climate smart initiatives. However, the majority of the extension agents had a low knowledge score below the mean benchmark in fossil-burning reduction (94.2%), soil (75.8%), water management, and in ICT and other adaptive initiatives. This does not bode well for the ability of extension agents in the study area to respond to the

timely provision of relevant information and advisory services on climate change adaptation and mitigation strategies to farmers in the area.

**Table 2: Knowledge scores of the extension agents on CSAI**

<b>Knowledge Score</b>	<b>Percentage %</b>	<b>Mean (SD)</b>
<b>Water management initiatives</b>		
9-13.5 (Low)	59.2	13.7 (1.36)
13.6-18 (High)	40.8	
<b>Tillage-smart initiatives</b>		
8-12 (Low)	46.6	12.4 (1.15)
12.1-16 (High)	53.4	
<b>Fossil burning initiatives</b>		
4-6 (Low)	94.2	5.5 (0.83)
6.1-8 (High)	5.8	
<b>Soil initiatives</b>		
10-15 (Low)	75.8	14.4 (1.45)
15.1-20 (High)	24.2	
<b>Crop-mix initiatives</b>		
8-12 (Low)	43.7	12.1 (1.47)
12.1-16 (High)	56.3	
<b>ICT and other adaptive Initiatives</b>		
6-9 (Low)	98.9	7.6 (0.91)
9.1-12 (High)	1.1	

### **Knowledge of Extension Agents on Climate Smart Agricultural Initiatives**

Table 3 shows that the extension agents were knowledgeable on some of the items under water management initiatives such as “construction of water storage in ponds” (84.1%), “construction of water channels on farmland” (80.1%) and “utilization of drainage systems on farmlands” (69%). These initiatives are related to water distribution and if effectively disseminated to the farmers, they are supposed to positively enhance water availability, curb the problem of erosion which occurs in the area during heavy rains and facilitate optimum soil moisture distribution in the area. However, low knowledge was recorded for “use of flood irrigation” (16.2%), “use of drip irrigation” (13.4%) and “use of canal irrigation” (14.4%) as only few agents selected correct responses. This implies that the extension agents still require a lot of education and training on major irrigation techniques. This is in consonance with Ale *et al.* (2016) who stated that extension agents in South-West Nigeria need more training on Water conservation practices for farm purposes. Expanding irrigation systems in Nigeria would reduce some of the climate change risk currently experienced by farmers (You et al., 2018). Thus, extension agents in the study area need an upgrade of their knowledge on water management initiatives especially as regards various irrigation techniques. This will equip them to be able to effectively

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provide advisory services to farmers especially during the period of fluctuations in rains and intermittent dryness experienced in the area because of climate change.

On tillage smart initiatives, the majority of the extension agents were predominantly knowledgeable by their correct responses to statements such as “use of organic manuring” (85.9%), “zero/minimum tillage practices” (77.6%) and “use of herbicides” (84.8%), while on the other hand, the extension agents had low knowledge on just few of the tillage smart initiatives which were, “land use change” (4.7%) and “use of Soil amendment” (15.2%). The high level of knowledge exhibited by the extension agents on tillage smart initiatives gives an indication of an expected level of adequate dissemination of these initiatives to the farmers. Olorunfemi *et al.* (2020) pointed out that extension agents’ awareness and knowledge of innovations are globally considered a prerequisite that aids the technology dissemination and adoption.

The results from Table 3 show that the extension agents had a wide range of knowledge in fossil burning reduction initiatives. Prominent knowledge statements with correct responses were “use of crop residue” (75.5%) and “forage conservation” (57.0%). This is a good omen as it portends that in line with the recent advocacy by many development agencies of no-burning, all things being equal, extension agents in the area are well-positioned to disseminate these fossils burning reduction initiatives to the farmers. However, only very few extension agents were knowledgeable on initiatives such as “practice of soil blanketing” (10.1%) and “conversion of waste to compost” (13.4%). Adebisi *et al.* (2020) reported the underwhelming use of compost and other organic agricultural strategies among farmers in South-West Nigeria despite the potential benefits. This reveals the need to upgrade the knowledge of extension agents on composting especially because of the technicalities involved so that they can effectively transfer this initiative to farmers in the area.

Furthermore, the findings from Table 3 reveal the knowledge of extension agents on soil Initiatives. The prominent initiatives with correct responses were “planting of cover crops” (79.4%), “use of mulching” (75.5%) and “afforestation/ reforestation” (70.8%). Conversely, extension agents had a low performance on soil Initiatives statements such as “farm fragmentation” (4.0%), “agro-forestry such as alley cropping” (8.7%) and “land reclamation” (11.6%). This implies that extension agents are knowledgeable in some of the soil and Fossil burning reduction initiatives and this is positive indication that the respondents have the required capacity to educate farmers on these initiatives. However, low performance was expressed by the extension agents on some of the important soil and fossil burning reduction Initiatives. This reveals the need for them to acquire the appropriate training in order to be knowledgeable on those initiatives for effective dissemination to farmers.

The results from Table 3 show that the extension agents by their positive responses demonstrated high knowledge on the majority of the crop-mix initiatives. The prominent initiatives among these were “use of crop rotation” (86.3%), “mixed farming” (88.8%) and “pest resistant varieties” (77.3%). This portends that extension agents are expected to be in the forefront of disseminating this initiative and several

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others that they are knowledgeable about to farmers. On the other hand, the extension agents indicated low knowledge by their responses on only few crop-mix Initiatives which were “changes in planting depth of seeds and seedlings” (16.2%) and “crop diversification initiatives” (11.6%). This simply means that the extension agents are well grounded in the majority of the crop-mix initiatives, and this is expected to enhance their dissemination of these initiatives to the farmers. However, the low knowledge exhibited on some of the identified initiatives needs urgent upgrade via training for them to be able to make the expected impact on farmers. This agrees with the findings of Ale *et al.* (2016) that extension agents in the South-West zone of Nigeria needed to be more knowledgeable on diversification practices in crop enterprise for adequate dissemination to the farmers.

The results from Table 3 also reveal that extension agents were knowledgeable on only one of the six ICT/other adaptive initiatives presented to them which is “use of weather forecast” (74.7%). Weather influences all agricultural activities from pre-sowing to postharvest. Thus, the high level of knowledge exhibited by the extension agents is expected to help them to adequately provide weather-based advisories to the farmers. This will help them in planning their day-to-day agricultural operations well in advance. Weather forecast-based advisory service can have a significant influence in minimizing climate change related risks and increase productivity (Oladele *et al.*, 2018).

The extension agents however showed low knowledge on other ICT and other adaptive initiatives such as “timely dissemination of weather information to farmers through ICT” (14.4%), “use of resources conservation technologies” (11.2%) and “farm insurance” (13.7%). This implies that the potential of these other initiatives in helping farmers to adapt and mitigate the effects of climate change is still far from being fully utilized in the study area. This is because, the extension agents who are key players in transferring these technologies to the rural farmers are also not knowledgeable about them. This corroborates the findings of Izuogu *et al.* (2021) that training needs of extension workers for climate resilience in Nigeria among other must include capacity building on ICT usage for information transfer to farmers.

**Table 3: Knowledge level on the potential of using the six categories of initiatives**

<b>Climate Smart Agricultural Initiatives</b>	
	<b>Percentage (%)</b>
<b><u>Water management initiatives</u></b>	
Construction of water storage in ponds	84.1
Utilization of drainage systems on farmlands	69.0
Use of flood irrigation	16.2
Use of drip irrigation	13.4
Use of canal irrigation	14.4
Construction of artificial lakes	56.3
Construction of water channels on farmland	80.1
Water harvesting	14.8
Use of sandbag by riverbank	69.7
<b><u>Tillage-smart initiatives</u></b>	
Zero/minimum tillage practices	77.6
Farm fallowing initiatives	71.8
Changes in planting dates/harvesting dates	65.0
Mechanical weeding	75.8
Use of herbicides	84.8
Land use change	5.8
Use of soil amendments	15.2
Use of organic manuring	85.9
<b><u>Fossil burning reduction initiatives</u></b>	
Use of crop residue	75.5
Forage conservation	57.0
Practice of soil blanketing	10.1
Conversion of waste to compost	13.4
<b><u>Soil initiatives</u></b>	
Contour cropping across hill slopes	54.5
Afforestation/ reforestation	71.1
Lengthened fallow	49.8
Use of mulching	84.5
Planting of cover crops	79.4
Farm fragmentation	4.3
Agro-forestry such as Alley cropping	15.9
Land reclamation	17.0
Zero grazing	23.1
Tree planting	74.0
<b><u>Crop-mix initiatives</u></b>	
Mixed farming	88.8
Changes in planting depth of seeds and seedlings.	16.2
Use of crop rotation	86.3
Use of inter cropping initiatives	70.4
Crop diversification initiatives	11.6
Drought resistant varieties	71.1
Early maturing varieties	75.5
Pest resistant varieties	77.3
<b><u>ICT/ other adaptive initiatives</u></b>	
Use of weather forecasts	74.7
Timely dissemination of weather information to farmers through ICT	14.4
Online internet access of climate related information	15.5
Agro meteorology information	41.5
Use of resources conservation technologies	11.2
Farm insurance	13.7

## **Conclusion and Recommendations**

Extension agents were knowledgeable of crop-mix and tillage-smart related climate smart initiatives; however, they had a low knowledge level on the majority of the irrigation related water management initiatives, soil, ICT and other adaptive related

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initiatives. The potential of these initiatives is still far from being adequately utilized by farmers in the study area. This has implications for educating and training extension agents on CSAI. Seminars and workshops should be provided by extension organizations for these agents to upgrade their knowledge on these initiatives, thus positioning them to effectively be able to render needed advisories to farmers. This will equip farmers to be adept in responding adequately to managing climate change risks and also scale-up their use of CSAI.

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