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Needs of Extension Agents on Techniques for Climate-Smart Rice Production in North-Central, Nigeria

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Abstract

The study assessed the competency need of extension agents on Climate-Smart Agricultural Techniques (CSATs) for rice production in north-central, Nigeria. A multi-stage sampling procedure was used in selecting 88 respondents. Data collected with the aid of a questionnaire were analyzed with descriptive statistics and Borich needs model analysis. The result showed that their competencies in specific practices like the ability to promote index-based weather insurance ($\bar{x}$ = 1.00), operating alternate wet and dry technique ($\bar{\bar{x}}$= 1.06), prime seeds with micronutrients ($\bar{x}$= 1.66) were low. Areas of competency upgrade as indicated by the mean weighted discrepancy scores were in teaching farmers about operating alternate wet and dry techniques (MWDS = 4.21), multiple inlet irrigation (MWDS = 2.98), site-specific nutrients managements (MWDS = 2.95), cropping calendar (MWDS= 2.42), climate information services (MWDS = 2.29). Training is needed in areas afore mentioned. Extension organizations should incorporate those areas discovered from the research into extension agents' curriculum activities for adequate training. Extension agents should also be given opportunities to upgrade their competencies by attending intensive seminars and workshops in research institutions while in service.

Keywords: Competency in climate-smart agricultural techniques

Introduction

Rice is one of the cereal crops in Nigeria that has substantially contributed to the agricultural sector, gaining cash crop status, resulting in up to 80% of jobs for residents of the producing area Bello, Baiyegunhi, & Danso-abbeam, (2020). According to Udemezue, (2018), over 8 million tons of rice are consumed annually, with consumption increasing by roughly 6% per year. As of 2017, rice produced locally in Nigeria was estimated at 3.7 million metric tons, and in 2018 there was an increase in production by 300,000 metric tonnes (Kamai et al., 2020). Despite the increase in rice production, Nigeria can only meet 49 percent of its internal demand Udemezue, (2018). This implies that the consumption rate is far greater than the production rate. In Nigeria, rice is a staple ingredient in local cuisine, particularly in the northern region. This implies that there is a high demand for rice consumption in the nation.

Despite the importance of rice production in achieving food security in society, its production faces numerous obstacles among which climate change is the most significant one. Anyaoha et al., (2019) pointed out that most rice farmers are faced with the challenges of changes in rainfall patterns, pest and weed infestation, and flooding which are all attributes of climate change. According to a study conducted by Yakubu et al., (2021), rice farmers in North-west Nigeria expressed concerns about the significant threat posed by climate change to rice production. This implies that rice yield will continue to reduce if farmers do not adopt good agricultural practices to adapt to or mitigate the effect of climate change. Climate-smart agricultural techniques represent practices that aspire to increase production sustainably, enhance resilience (adaptation), wherever possible, reduce/eliminate greenhouse gases GHGs (mitigation), and encourage the attainment of development goals and national food security FAO, (2013). CSA is an agricultural practice that contributes to the achievement of national food security and development objectives (Mutengwa et al., 2023) Examples of such practices include the use of mulching, minimum tillage, urea deep placement (UDP), site-specific nutrient management, proper timing and application of farm operations, soil, and water conservation measures (such as minimum or zero tillage, construction of water-retention structures, among others.

Therefore, it is expedient to note that an increase in production can only be guaranteed through the adoption and accessibility of these practices by farmers, which can be facilitated by an effective agricultural extension platform as they play a non-negotiable role in agricultural development and promoting food security. They were known to be the major forces in charge of making contact with small-scale farmers with the aim and responsibilities of imparting new skills, and knowledge, propagating new technological advances, and implementing them in agriculture (Rickards et al., 2018). Hence, regular training and re-training are crucial for enhancing the skills and knowledge of extension agents in effectively assisting farmers. However, it is essential to recognize that identifying the specific areas of competency needs is necessary before conducting such training. According to Spencer & Spencer (1993), Competency represents a combination of knowledge, skills, abilities, and behaviours an individual possesses and enables them to perform tasks, solve problems, and achieve desired outcomes with a certain level of proficiency.

Suvedi et al., (2018) noted that agricultural development professionals highlighted that core competencies could be acquired through various means, including pre-service, in-service, basic induction, and non-formal training programs. This suggests that regular assessments of extension agents' knowledge, skills, and attitudes are necessary to improve their job performance effectively. Also, Haleem (2018)

emphasize that the lack of adequate information on the training needs of extension agents in developing countries hinders the success of training programs. This implies that for extension agents to effectively disseminate information to farmers, it is crucial to identify specific areas where extension personnel may have inadequate skills, knowledge, and abilities needed for good performance. Discovering such areas will enable extension organizations to provide targeted training to enhance the competence of extension agents in information communication to farmers. Therefore, this study tends to examine the competency need of the extension agents on CSA techniques to enhance their skills and expertise.
The specific objectives of this study were to: assess the competencies of the extension agents in climate-smart agricultural techniques; and examine the competency needs of the extension agents.

Methodology
The study was carried out in North Central, Nigeria. It is one of the six geopolitical zones in Nigeria comprising Benue, Plateau, Niger, Kogi, Kwara, Nasarawa, and the Federal Capital Territory (Abuja). It covers latitude 00'- 30' North of the equator and longitude 00'- 00' East of the Greenwich meridian.

The population for this study consisted of 88 extension agents which were selected using a multi-stage sampling procedure. The first stage involves the purposive selection of Kwara, Kogi, and Niger states out of the seven states in North Central, Nigeria because the states are known for rice farming. The second stage involves the purposive selection of zone B out of four ADP strata in Kwara state, zone A out of three ADP strata in Niger state, and zone D out of four ADP strata in Kogi state, based on their involvement in rice production. The third stage involves the selection of all the extension personnel in each zone due to the small number of extension personnel in the study area which includes 53 from Zone A (Lavun, Edati, and Mokwa), 20 from Zone B (Edu and Patigi) in Kwara state, and 15 from zone D (Ibaji and Idah) in Kogi state which make a total of 88 respondents. Data were collected through the aid of a structured questionnaire. Descriptive statistics which include mean, percentage and inferential statistics were used to analyse the data collected from the respondents.

Personal and Professional Characteristics of Respondents: Age, year of experience, and household size were measured at interval level while educational qualification, marital status, sex, and position of extension agents were measured at the nominal level.

Respondents were provided with a list of perceived 23 items under 5 competency areas which are soil, crop, water, weather and knowledge smart mechanism and they were asked about the degree of importance and competence in each area. These were rated on a three-point Likert's scale thus; high (3 points), moderate (2 points), and low (1 point) to get a mean score of 2 which was used to categorize their importance and competence into high (if greater than 2) and low(if less than 2).

The Borich Needs Assessment model (Olorunfemi et al., 2020; Roberts et al., 2015; Harder et al., 2013) was used to measure the competency needs of the extension agents, through the following steps: discrepancy score (DS) was calculated for each individual for each competency. This involved subtracting the ability rating from the importance rating. Subsequently, a weighted discrepancy score (WDS) was computed for each individual for each professional competency by multiplying the discrepancy score by the mean importance rating. To calculate the mean weighted discrepancy score (MWDS) for each competency, the weighted discrepancy scores were summed up and divided by the number of observations. The larger the Mean Weighted Discrepancy score the higher the competency need of the extension personnel in the climate-smart agricultural techniques.

MWDS = $\sum[(I_{ith} - C_{ith}) \times \bar{X}i/N]$

Where C = competency rating assigned for each task I = importance rating assigned for each task, $\bar{X}i$ = mean of importance rating, N = number of observations.

Results and Discussion

Perceived Competence Level of Extension Agents on Climate-Smart agricultural techniques

Table 1 shows the least possessed competency was water smart mechanism which includes operating alternate wet and dry techniques ($\bar{x}$= 1.06), amultiple inlet irrigation ($\bar{x}$= 1.94), weather smart mechanisms such as index-based weather insurance ($\bar{x}$= 1.00), decision support systems ($\bar{x}$= 1.26), climate information services ($\bar{x}$= 1.43) and the use of ICTs ($\bar{x}$= 1.89). As well as crop smart mechanisms such as micronutrient priming ($\bar{x}$= 1.66), relay cropping ($\bar{x}$= 1.76), site-specific nutrient management ($\bar{x}$= 1.82). This suggests that the possible benefit of using these other techniques to assist farmers in adapting to and mitigating the effects of climate change is still very much underutilized in the study area. This is due to the extension agents' inadequate skills, knowledge, and abilities to use these techniques. Thus, training is needed in these areas. This supports the findings of Olorunfemi et al., (2021), who discovered low knowledge of the use of ICT for transferring information to farmers among the extension agents.

On the other hand, the competencies that were highly possessed by the extension agents were mulching ($\bar{x}$= 2.85), agro-forestry ($\bar{x}$= 2.30), minimum tillage ($\bar{x}$= 2.25), cover crops ($\bar{x}$= 2.22), water harvesting ($\bar{x}$= 2.19), conventional flooding ($\bar{x}$= 2.18), green manure ($\bar{x}$= 2.15), and compost manure ($\bar{x}$= 2.00). The high competence of extension agents in the area shows that they will be able to effectively disseminate the techniques to the farmers and this will also aid quick adoption of the techniques. This aligns with the findings of Olorunfemi et al. (2020) that extension agents' understanding and awareness of innovations are globally regarded as an essential requirement that aids technology dissemination and adoption.

Needs of Extension Agents on Techniques of Climate Smart Agriculture

According to the ranking of mean weighted discrepancy scores, extension personnel needs to be more competent in the following areas; water smart mechanism which include "Ability to operate alternate wet and dry (AWD) irrigation technique (MWDS = 4.21), 'operating the drip irrigation system (MWDS = 2.35), and operate multiple inlet irrigation (MWDS = 2.98)"; Crop smart mechanism which include relay cropping practice (MWDS = 3.42), designing cropping calendar (MWDS = 2.42), and IPM(integrated pest management) (MWDS = 2.13) Soil smart mechanism which include; site-specific nutrient management (MWDS = 2.30), micro-dosing (MWDS = 2.50), 'urea deep placement (MWDS = 2.05), and weather smart mechanism which include: Using Information Communication Technologies (ICTs) such as computers to provide solutions & communicate with farmers (MWDS = 2.69), , 'use of Climate Information services (CIS) to get new weather & climate information (MWDS = 2.29), index-based weather insurance (MWDS = 2.18), ability to assess decision support system for agro-weather information (MWDS = 2.18). This suggests that extension agents in the study area need improvement in the areas listed above. This is because strengthening their expertise in these areas can help them provide more effective support and guidance to farmers regarding various agricultural practices, technologies, and climate-related information that will assist the farmers to adapt to and mitigate the effect of climate change and in total increase their output. This is supported by the findings of Chinenye, Umeh, & Onyeneke, (2023) who noted that the implementation of climate information services (CIS) in the planning of agricultural activities led to a notable rise in rice production in Nigeria.

Table 1: Needs of extension agents on techniques of climate-smart agriculture

Climate-smart agricultural techniques	Mean (S.D) Importance	Mean (S.D) Competence	MWDS
Soil smart			
Micro-dosing: knowledgeable and able to apply small and affordable quantities of fertilizer onto the seed at planting time, or a few weeks after emergence	2.85	1.97	2.50
In using Site-specific nutrient management (SSNM), I have the ability to establish the yield target	2.68	1.82	2.30
Ability to use the urea deep placement method in applying fertilizer after transplanting.	2.64	1.86	2.05
Able to apply a moderate amount of fertilizer (N, P, K)	2.45	2.07	0.93
Possess skills in growing cover crops, and incorporate it into the soil so as to provide nutrients needed for production.	2.58	2.22	0.92
Use of latest techniques and materials used in mulching.	2.24	2.85	0.87
Knowledgeable and skilful in use of quality compost manure using different materials such as fruit scraps, rice husks	2.30	2.00	0.69
Possess skills in producing and using green manures	2.42	2.15	0.65
Agro-forestry	2.52	2.30	0.55
Skills in minimum tillage practice	2.41	2.25	0.39
Crop smart			
Have skills in relay cropping practice such as growing rice together with other crops such as maize	2.93	1.76	3.42
Ability to plant using dry- direct seeded rice method	2.83	1.91	2.60
Ability to identify the cropping calendar and determine when to plant	2.69	1.79	2.42
Posses skills in IPM(integrated pest management): Able to calculate appropriate pesticides/herbicides mixing	2.84	2.09	2.13
Able to plant with wet direct seeded rice method	2.43	1.94	1.19
Possess skills in crop rotation such as effectively rotating rice with leguminous crops such as soy beans	2.30	1.93	0.85
Identification and use identify an improved rice variety(stress-resistant variety, pest and disease-resistant rice varieties, early maturing rice varieties)	2.40	2.07	0.79
Ability to prime seeds with micronutrients such as Zinc.	1.99	1.66	0.66
Ability to prime seeds with water.	2.11	2.01	0.21
Water smart			
Ability to operate the AWD technique	2.65	1.06	4.21
Ability to operate multiple inlet irrigation(MIRI)	2.95	1.94	2.98
Have knowledge and have skills in conventional flooding	2.51	2.18	0.82
Ability to operate canal irrigation	2.41	2.08	0.79
Possess skills in water harvesting during excess rainfall	2.47	2.19	1.58
Operate drip irrigation system	2.35	1.35	2.35
Weather smart			
Ability to use of Decision support system (DSS) to get help (agro-weather information)	2.41	1.26	2.77
Ability to use ICTs such as computers to provide solutions & communicate with farmers	2.84	1.89	2.69
Ability to get and educate farmers on climate information services	2.39	1.43	2.29
Able promote Index-based weather insurance and explain adequately to farmers	2.06	1.00	2.18
Knowledge smart			
Ability to provide necessary market information and off-takers to the farmers	2.77	2.27	1.38
Ability to provide farmers with information on off farm risk management.	2.65	2.26	1.03
Ability to source for seeds from a reliable source for the farmers	2.64	2.27	0.97
Able to educate farmers on source for credits or loans for farmers from reliable institute.	2.22	1.77	0.99

Source**:** Field survey, 2020

Conclusion and recommendation

The extension personnel demonstrated a low level of competence. Irrigation techniques, fertilizer management (micro-dosing, site-specific nutrient management, and urea deep placement), timely agro-weather information, integrated pest management, relay cropping, ICTs, and index-based weather insurance are examples of areas where extension personnel require training due to a lack of competence. The extension organization prioritize consistent annual in-service training and keep in touch with research agencies and institutions on a regular basis in order to learn new techniques and expand their expertise. To build their capacity, extension personnel should also engage in personal development by attending seminars and conferences and pursuing further education.

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