EFFECTS OF FARMER FIELD SCHOOL APPROACH ON RURAL CROP FARMERS IN ADAMAWA STATE, NIGERIA

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ABSTRACT

The research assessed the effect of famer- field school extension approach on rural crop farmers in conflict-affected communities in Adamawa State, Nigeria. The study used multi-stage, purposive and random sampling to select five Local Government Areas (LGAs), three communities and 150 beneficiaries for the study. A similar procedure was also used to select 150 non-beneficiaries to serve as a control group. Descriptive statistics, average treatment effect (ATE) and statistical test (t-test) were employed for the data analysis. Findings revealed that all the technologies introduced recorded over 50% adoption except for seed germination test, disease control and ploughing. A total of 91.3% adopted land selection and 80.7% adopted seed selection, while only 30.0% adopted seed germination test. The findings also revealed that increases in farm size, output, and income were significant at P <0.05 *among the beneficiaries compared to non-beneficiaries. Also, the beneficiaries had significant improvement in consumption expenditure and social cohesion at* P <0.05 *compared to the non-beneficiaries. In conclusion, participation in FFS has achieved a significantly positive effect on the livelihood of rural crop farmers in the study area. It is recommended that considering the huge impact of the approach on the beneficiaries within a short period of time, the programme should be extended to other LGAs in the state for wider coverage of the benefits.*

Keywords: Adamawa, farmer-field school, rural crop farmers

INTRODUCTION

Over the years, Nigeria has tried different agricultural extension approaches to help farmers realise increased productivity and subsequently better livelihood. Some of the approaches adopted to better the lots of farmers include; the Ministry-based extension approach, the integrated development approach, the Training and Visit extension approach, the Commodity-based development approach, the National Accelerated Food Production Programme, Operation Feed the Nation, the River Basin Development Authority, and the Green Revolution among others. Most of these traditional extension approaches did not record much impact largely due to the top-down (service-oriented) approach adopted in implementations (Birner *et al.*, 2006 cited in Anaeto *et al.,* 2019). The previous approaches did not meet their expectations due to the inadequate involvement of farmers in the development and generation of technologies and practices appropriate to their situations. Thus, extension service delivery in some African countries did not make a significant contribution to the development of agriculture (Anderson, 2008).

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The foregoing has made it necessary for authorities and other stakeholders to look for more participatory approaches that could enable self-learning among the farmers and also allow authorities (extension agents, facilitators, government officers etc.) and agricultural researchers to co-learn with farmers (Anaeto *et al.,* 2019).

Nigeria and other developing countries have attempted to facilitate departure from service-oriented to participatory extension approaches due to the failure of the previous agricultural extension approaches to meet its intended goals (Ajayi and Okafor, 2016). Some of the participatory approaches tried in Nigeria include Farming System Research (FSR) and Community Development (CD) approach, among others. A more recent and popular approach is the Farmer-Field School (FFS) approach. The approach which is designed to teach and disseminate information among groups of adult farmers, is sometimes considered as 'schools without walls' where facilitators use experimental learning to 'co-learn' with farmers.

FFS is implemented in Adamawa State, Nigeria, by the International Rescue Committee (IRC), with the aim of improving the productivity, income and livelihoods of smallholder farmers. The idea was conceived specifically to assist in post-conflict recovery by supporting affected communities in their transition to sustainable peace and development. The effectiveness of the FFS has been by several studies in Africa. For instance, Nathaniel (2015) has reported the significant role of FFS in enhancing the exchange of information and knowledge among cowpea farmers in Zimbabwe. In the same vein, Simpson and Owens (2018), have noted a diffusion of information among farmers during an assessment of FFS programme in Ghana and Mali. Further, this was consolidated by Kwaja and Ademola (2018) who attested to the significant contribution of FFS in enhancing farmers' knowledge in Nigeria, particularly in the control of cocoa diseases. These findings have shown repeated communication of information among participants of FFS, resulting in wider sharing of agricultural information among farmers.

Conversely, some studies have provided a conflicting conclusion on the effectiveness of the Farmer Field School programme. For instance, Tripp *et al.* (2015) have reported a lack of significant evidence on the effectiveness of the FFS approach, despite huge investment in Asia. Additionally, a study in Indonesia has concluded insignificant impact of the FFS approach on National Integrated Pest Management (Feder *et al.,* 2017). The effect of the FFS approach has largely been debated. From the available literature, much has not been done on the assessment of Farmer Field School to gauge its performance in the northern part of Nigeria and in particular, Adamawa State. It is against this backdrop that this study titled: "Effect of FFS Approach on Rural Crop Farmers in Conflict Affected Communities in Adamawa State, Nigeria", became necessary to gauge its performance. The research is particularly important as the approach was recently implemented by (IRC) in the State. The research specifically assessed farming practices adopted by the crop farmers and the effect of the FFS approach on farm size, output, income, consumption expenditure and social cohesion among the beneficiaries.

METHODOLOGY

The Study Area

This research was conducted in Adamawa State. The State is situated in the North-eastern part of Nigeria. It lies between latitude 7^0 15'N and 10^0 58'N of the equator and longitude 11^0 09'E and 13^0 47'E of the Greenwich Meridian. The State shares a border with Borno State in the north, Taraba State

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in the south and the west with Gombe State. Further, the State has a border with the Republic of Cameroon in the eastern flank. Adamawa State has a population figure of 4,504,337 based on the 2016 projected national population figure and covers a land mass of about 39,972 square kilometres (Adebayo, 2012).

The State has a mean monthly temperature ranging from 26.7ºC to 30.81ºC in the north and northeastern parts respectively. The mean annual rainfall ranges from 700mm in the northwest to 1600mm in the southeast (Adebayo *et al.,* 2012). The major food crops cultivated in Adamawa State are; sorghum, maize, and rice. However, cowpea, groundnut, soya beans, yam, cassava, sugar cane and sweet potato are prominent cash crops grown.

Population of the Study

Five Local Government Areas (LGAs) participated in the FFS approach implemented by IRC in Adamawa State in the year 2018 and 2019. The beneficiaries of the FFS approach were the main target of the research. However, since the major thrust of the research was to gauge the effect of the FFS scheme, non-beneficiaries who share similar characteristics with the participants were identified and considered to serve as a comparison or control group. In order to determine the effect of FFS on the beneficiaries, a total figure of 300 participating farmers and non-participants was used for the study.

Sampling Technique and Sample Size

As mentioned earlier**,** FFS was implemented in five (5) LGAs in Adamawa State. All five (5) participating LGAs (Mubi North, Mubi South, Hong, Maiha and Michika) were purposely selected for the study. The second stage of the sampling process involved a random selection of three communities (villages) in each LGA selected. Finally, 10 beneficiaries were also selected in each village, resulting in the selection of thirty (30) beneficiaries at 10% in each of the five (5) LGAs selected. A total figure of 150 respondents out of 1500 FFS beneficiaries were selected for interaction. A similar procedure was followed to select non-beneficiaries alike. Five (5) LGAs (Gombi, Mayo Belwa, Lamurde Song and Yola South) were selected, out of which 150 non-beneficiaries were selected to serve as a control group. In all, a total of 300 participants and non-participants were selected for the study.

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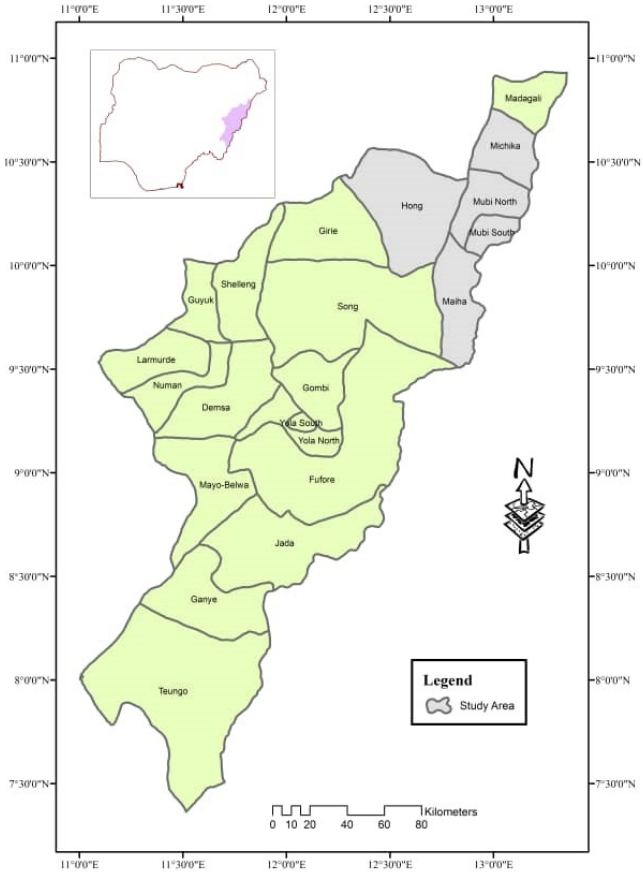

Figure 1: Map of Adamawa State showing study area (five LGAs)

Method of Data Collection

Both primary and secondary data were used in the research. Primary data were collected from the beneficiaries of the FFS approach and non-beneficiaries alike. Structured questionnaires were employed in the collection of the data. However, oral interview was used where the respondents could not read or write. Data collection focuses mainly on the effect of the programme on its beneficiaries. To determine the effect, data on farm sizes, output, income consumption expenditure and social cohesion were sought. Data collection was done with the help of trained enumerators under the supervision of the researcher. The data collection lasted for 12 weeks.

Method of data analysis

In this study, both descriptive and inferential analysis techniques were carried out. The data analysis involved two stages. All the close-ended response options were coded and analysed, while the open-ended response options were listed and then specific categories were developed to capture the various types of responses.

Descriptive statistics including frequency counts, percentages and means were used. However, inferential statistics which involved average treatment effect (ATE) and comparability tests for difference (t-test) were also used to determine the actual effect of the FFS approach on the rural crop farmers in the study area.

Impact studies normally face major challenges such as establishing a viable expected outcome in the absence of the project, in other words, what would have happened to the beneficiaries if they had not

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participated in the programme, and crediting the effect to a programme or project; (Madu, 2013). ATE is the difference between estimated outcomes earned by beneficiaries while participating in the programme and the expected outcome the beneficiaries would have recorded if they did not participate.

$ATE = E(Y_1/p=1) - E(Y_0/p=0)$

Where ATE = average treatment effects, p = participants in the project; p =1, if participated in the project; p = 0, if did not participated in the project, Y_1 = outcome after, Y_0 = outcome if did not participate.

Using ATE in this study provides a summary measure of the impact of a FFS programme, and assists in understanding the overall effectiveness of FFS intervention in the study area. Quasi-experimental methods which select project beneficiaries and non-beneficiaries with similar socio-economic characteristics is Propensity Score Matching (PSM). The difference in outcomes between the two matched groups can be considered as the effect of the intervention on the participants (Smith and Todd, 2001). This technique was used to determine the average ATE of FFS on incomes, outputs, farm sizes, consumption expenditure and social cohesion among the participants. The PSM method matches project beneficiaries with comparable non-beneficiaries using a propensity score, which is the estimated probability of being included in the programme. The study only used participants and non-participants with comparable propensity scores to determine the ATE. This method has an advantage over econometric regression methods as it can compare only similar observations and does not count on parametric assumptions to net out the effects of projects (Heckman, *et al*., 1998, cited in Madu, 2013)

Further, comparability analysis between the beneficiaries (treated) and non-beneficiaries (control) groups was carried out using a balancing test (t-test), This technique tests for statistically significant differences in the means of the explanatory variables between the matched groups (beneficiaries and non-beneficiaries). A T-test was used to determine the effects of the FFS approach on the beneficiaries in the study area. The research employed a t-test due to its suitability and applicability in assessing effect by comparing responses of the beneficiaries and non-beneficiaries alike.

RESULTS AND DISCUSSION

Farming Practices (technologies) Adopted by Rural Crop Farmers through FFS Training

Table 1: Farming Practices Adopted by Rural Crop Farmers through FFS

Variable type	Frequency	Percentages	Rank order
Land selection	137	91.3	1st
Seed selection	121	80.7	2nd
Land preparation	105	70.0	3rd
Pesticides handling	101	67.3	4th
Spacing	94	62.7	5th
Fertilizer application	89	59.3	6th
Ridging	87	58.0	7th
Seed dressing	80	53.3	8th

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Weeding	77	51.3	9th
Disease control	75	50.0	10th
Ploughing	72	48.0	11th
Insects control	71	47.3	12th
Earthen up	62	41.3	13th
Seed germination test	45	30.0	14th

Multiple Responses Recorded.
Source: Computed from field data (2024)

Participation in training is expected to facilitate the ability of the rural crop farmers to acquire knowledge on the importance of innovative agricultural technologies. Farmers' participation in FFS activities has enhanced their capacities to adopt various agricultural practices. For instance, 91.3% of the rural farmers have adopted land selection as a result of participation. This means that the majority of the beneficiaries have seen land selection as the most important technology introduced by the FFS. The fact that almost all rural crop farmers adopted land selection demonstrates their level of understanding of land selection as key to the success of agricultural production. Land selection is closely trailed by seed selection (80.7%) as the most important practice used by farmers. The findings further revealed that 70.0% of the participating crop farmers adopted land preparation (Table 1). Pesticide application and handling, fertilizer application, ridging, seed dressing, weeding and disease control have accounted for slightly above 50% adoption among the beneficiaries of the FFS approach. However, earthen-up, insect control, seed germination test and ploughing accounted for less than 50% adoption rate among the beneficiaries. The seed germination test was not widely accepted practice, as only 30% of the benefiting rural crop farmers adopted it.

The foregoing results suggested the importance of proper land selection as the backbone of any agricultural production process. Buttressing this fact, Engler *et al.* (2019) have reported land selection as a fundamental aspect of successful farming. Careful land selection could influence crop productivity and the sustainability of agricultural practices. There is another view that farmers are better positioned to maximise yields if employ proper land selection (Thomas and McWhorter, 2019).Further, Ramankutty, *et al.* (2019), reported that farmers with knowledge of land selection perform better in farming activities. Additionally, Caswell and Fuglie (2020) are of the view that farmers with adequate knowledge of land selection can achieve better yields compared to others.

Another interesting finding in this research is the adoption of seed selection as the second most important technology introduced through the FFS approach. A larger chunk (80.7%) of FFS beneficiaries have prioritised seed selection as one of the most essential practices. This demonstrates an understanding of the importance of using healthy seeds as a means of achieving better yield. Brown and Everard (2018) have also reported a significant effect of seed selection on-farm yield. A similar finding by Fanelli (2020) has attributed crop performance to making better choices of viable seeds. Selecting viable and quality seeds adaptable to local climate and soil conditions is essential for better crop productivity. This suggested that participating in FFS has enhanced farmers' understanding of better seed varieties.

According to Brown (2020), knowledge of seed selection is essential for the successful cultivation of arable crops. Verburg *et al.* (2021) also posited making the right choice of seed can significantly

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influence adaptation to local conditions. Thus, farmers with knowledge of seed selection usually choose early maturing varieties due to advantages such as early harvest and reduced vulnerability to certain weather conditions.

Other practices adopted by rural crop farmers participating in FFS are; land preparation, pesticide application and fertiliser handling, weeding, seed spacing, and ridging among others. This is an indication that beneficiaries of FFS have adopted various farming practices disseminated among farmers during FFS training. Gimona and Castellazzi (2021) have posited that exposing or subjecting farmers to training enhances their knowledge of farming practices. Similarly, Brown (2020), shared the opinion that training exposes farmers to new and innovative agricultural technologies. FFS training has strengthened the capacities of the beneficiaries to make use of the skills and knowledge gained to make informed decisions on how to improve their practices and achieve long-term success.

Effect of Farmer Field School on the rural crop farmers (beneficiaries)

Table 2: Effect of Farmer Field School on Rural Crop Farmers

Variable Type	Beneficiaries	Non-beneficiaries	ATE	t-test	P-value
Farm Size	9.19 (3.906)	4.67 (3.872)	0.4729	4.940	0.000**
Farm Yields	3203.31 (113.09)	1595.97 (121.61)	1607.34	3.713	0.008**
Income	367511.28 (218.51)	141057.86 (231.41)	14297.91	4.327	0.001**
Household Expenditure	240134.47(1035.99)	101613.67 (1721.38)	12434.07	11.767	0.000**
Social Cohesion	3.97 (0.421)	2.32 (0.981)	0.1639	13.203	0.000**

Note: Numbers in parenthesis are standard deviation of the corresponding means,
** = Significant at p <0.05,
Source, Computed from field data (2024).

The major thrust of this research was to gauge the performance of the FFS approach in Adamawa State. As mentioned earlier, the scheme was introduced by (IRC) in the State to help farmers improve their productivity in the affected communities during the post-conflict period. In order to determine the effect of FFS on the well-being of beneficiaries, data on farm sizes, crop yields, income, consumption expenditure and social cohesion were subjected to ATE and T-test analysis.

Effect on Farm Sizes of the crop farmers in Adamawa State.

It is expected that participation in FFS activities will result in the diversification of enterprise among the farmers and by extension increase in farm size. The effect of the FFS approach on farm size among crop farmers was assessed as presented in Table 2. Farm sizes have increased significantly among the beneficiaries of the FFS approach compared to their counterpart of the non-beneficiaries. The average farm size for the beneficiaries was more (9.19ha) compared to (4.67ha) for the non-beneficiaries. The estimated ATE was positive (4.52), indicating a huge increase among the beneficiaries as a result of participation in the FFS activities. Further analysis was carried out to determine the significant effect of FFS on the farm sizes of the participants. Statistical test (t-test) for the difference between the beneficiaries and non-beneficiaries has shown a significant effect at P <0.05. The increase in farm size

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among the beneficiaries can be attributed to participation in the FFS approach. All things being equal, improved production can be determined by the increase in farm sizes. According to Madu (2019), the effect of an agricultural programme is measured by farm size and output. The findings in this research therefore suggested a significant effect of FFS on farm sizes within a short period of its adoption.

Effect on Output of the Crop Farmers

The major objective of the FFS approach was to increase the productivity of the rural crop farmers and subsequently improve in well-being. Participation in FFS is expected to result in an improved level of productivity which is measured in terms of output. There was a great deal of increase in output among beneficiaries of FFS compared to non-beneficiaries. Findings in Table 2 have shown that the average output (yield) for beneficiaries was 3203.31 kg and only 1595.97Kg for their counterparts of the non-beneficiaries, indicating the huge difference between the two matched groups. The estimated ATE of the programme was positive (1607.34) suggesting a significant difference between the beneficiaries and non-beneficiaries. Statistical test (t-test) for difference has suggested a significant effect of the approach on the output of the rural crop farmers at $P < 0.05$. The major objective of any agricultural programme is improvement in yield using improved innovation which subsequently translates into productivity (Kudi *et al.,* 2008*,* cited in Madu, 2013). The FFS approach has succeeded in improving the productivity of rural crop farmers through training. One of the major activities of FFS is encouraging farmers to adopt crop diversification, which ultimately can lead to better yields (Lussa *et al.,* 2018). Several other studies have also reported the effect of FFS on the yield of the farmers. For instance, Luther *et al.* (2015) have established that farmers trained in seeds selection and proper planting techniques have realised significantly higher yields. It was also observed that participants of FFS were able to minimize post-harvest losses resulting in higher yields. It is hoped that an increase in production will contribute immensely to income increase and consequently improve the well-being of the farmers through the multiplier effect,

Effect on incomes of the crop farmers

There is evidence of a huge increase in the incomes among the beneficiaries compared to the non-beneficiaries as a result of participation in FFS programmes. As mentioned earlier, one of the objectives of FFS training is to improve the productivity of crop farmers. It is expected that an increase in productivity will influence to a large extent, an increase in income. The finding shows an average annual income of N367, 511. 28 naira and N141, 057. 86 for the beneficiaries and non-beneficiaries respectively. The estimated ATE was positive (226,453.42), indicating a significant effect on the beneficiaries. However, further analysis was carried out to determine the actual effect of FFS on the income of the beneficiaries. The statistical difference in Table 2 suggested a significant effect of the approach on income among beneficiaries at $P < 0.05$. The foregoing results suggested that average income has increased more for the beneficiaries than the non-beneficiaries. This is an indication that the FFS approach has succeeded in improving productivity, income and subsequently well-being of its beneficiaries within a short period. As reported by Olaniyan (2000), cited in (Madu) 2013, nonwage income has been an important contributor to well-being in rural areas. The improvement in productivity within a short period can be attributed to the adoption of various technologies introduced by FFS programmes

Effect on Consumption Expenditure of the Crop Farmers

The performance of FFS was assessed by examining changes in the consumption expenditure of the beneficiaries its operations. Participation in FFS programmes has positively changed the consumption

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expenditure of rural crop farmers. For instance, the average increase in household expenditure was more (N240, 134) among the beneficiaries, compared to (N101, 613) for non-beneficiaries. The estimated ATE was positive (N138, 020.), indicating a remarkable increase in consumption expenditure among the rural crop farmers as a result of participating in FFS (Table 2). T-test analysis was further conducted to determine if there is a significant difference between beneficiaries and non-beneficiaries of the FFS approach. As the result shows, an improvement in consumption expenditure was significant at P <0.05. This is suggested that participation has contributed significantly to the increase in the consumption expenditure of the beneficiaries. The beneficiaries have attested to the fact they can now provide for their households what hitherto was not possible. This means that the beneficiaries can now spend more on household welfare activities as a result of participating in FFS programmes. The increase in consumption expenditure of the beneficiaries may be attributed to an increase in outputs (yields), income and subsequently improved well-being Several researchers have reported the effectiveness FFS approach in improving wellbeing in Africa. For instance, Nathaniels (2015), Simpson and Owens (2018), and Kwaja and Ademola (2018) have all attested to the effective contribution of FFS in enhancing farmers' productivity, increased income and subsequently improving wellbeing. It can be concluded from the foregoing, therefore, that FFS has remarkably enhanced the ability of the rural crop farmers to realise significant improvement in consumption expenditure.

Effect on Social Cohesion among the Rural Crop Farmers

Participation in FFS activities has strengthened social cohesion among rural crop farmers. The farmers have demonstrated having shared values, and challenges and seeing themselves as members of the same community. For instance, the findings in Table 2 indicated an average increase in social cohesion of 3.97 and 2.32 for the beneficiaries and non-beneficiaries respectively. The estimated ATE was positive (1.65), indicating the appreciable level of social cohesion among beneficiaries of FFS compared to their counterpart of non-beneficiaries. Statistical test for difference was further conducted to determine the actual difference between beneficiaries and non-beneficiaries. The findings in Table 2 indicated a significant difference between beneficiaries and non-beneficiaries at P <0.05. This means that harmonious relationship exists among rural crop farmers where members see themselves as partners in progress. Such relationships can enhance productivity and a higher standard of living (Mansuri and Rao, 2004, cited in Madu, 2019). The level of community social cohesion is also likely to ensure the sustainability of a programme (Madu, 2019).

CONCLUSION

From the foregoing, it can be concluded that the FFS approach has significantly empowered its beneficiaries. Participation has enhanced the capacities of the rural crop farmers to realise remarkable increases in yield, farm sizes, and income, and subsequently improved consumption expenditure through the multiplier effect. The activities of FFS have also strengthened the capacities of beneficiaries to foster social cohesion among them. The increase in yields and farm sizes can be attributed to the adoption of improved farming technologies introduced during FFS training. The ATE for all the variables assessed were positive and the t-test analysis conducted showed a significant effect at P <0.05, among the beneficiaries compared to the non-beneficiaries. The foregoing results can be attributed to participation in FFS activities with considerable confidence. This is a demonstration of the effectiveness of the FFS approach in empowering crop farmers in conflict-affected communities in Adamawa State. It is therefore absolutely realistic to consider FFS as an effective approach for

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enhancing the capacities of rural farmers to realise improved productivity and subsequently improved well-being.

RECOMMENDATIONS

In order to make these findings part of the existing body of knowledge, the following recommendations are suggested. The findings of the research have proven with a considerable degree of confidence the effectiveness of FFS in changing the lots of rural farmers. This participatory approach is becoming popular as a result of its proven potential to empower farmers to take charge of their development agenda. Authorities in Adamawa State and Nigeria at large, especially those working at the community level should take cognizance of this when planning for effective agricultural programmes. The choice of strategy or approach should be given careful consideration by the authorities.

The approach was by implemented the International Rescue Committee (IRC) in only five Local Government Areas affected by insurgency in Adamawa State. The authorities (state government, NGOs. Facilitators, extension workers) should consider extending the approach to other local government areas for other farmers in the State to also benefit from this laudable achievement recorded in the pilot LGAs.

Seed germination tests, ploughing, disease control and earthen-up were not adopted by a majority of farmers. The importance of such improved agricultural technologies should be emphasised among the farmers to build on the gains of the approach. Specifically, the importance of seed germination tests and disease control should be taken seriously emphasis as the two can seriously influence yield to a large extent.

Further research is also needed to explore the issue of sustainability of the activities among the farmers after a long period, especially as the implementation period of the approach by IRC has elapsed. To determine the effectiveness of this participatory extension approach, a comparative study needs to be conducted between FFS and other long existing service-oriented programmes implemented in the State or the country.

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