EFFECT OF AGRICULTURAL LEARNING PLATFORMS ON MAIZE PRODUCTION IN KANO SUDAN SAVANNA OF NIGERIA

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ABSTRACT

Maize (*Zea mays* L) is a major staple crop in sub-Saharan Africa, contributing significantly to food security and economic development. However, its productivity remains low due to poor soil fertility, climate variability, inadequate extension services, and the limited adoption of improved agricultural practices. This study assesses the effectiveness of two structured agricultural learning platforms, Community Demonstration Plots (CDPs) and Model Adoption Plots (MAPs), compared to traditional Community Practices (CPs) in Kano State, Nigeria. The experiment was conducted in seven locations during the 2020 rainy season using the SAMMAZ 15 maize variety. The study measured key agronomic parameters, including stand establishment, number of cobs per hectare, grain weight per cob, and grain yield per hectare. The results indicate that CDPs and MAPs significantly improved maize yield. CDPs recorded the highest grain yield (5066 kg ha^{-1}), followed by MAPs (4246 kg ha^{-1}), while CPs had the lowest (2954 kg ha^{-1}). The findings presented the importance of structured learning platforms in increasing maize productivity. The study recommends strengthening agricultural extension services and promoting broader adoption of improved farming techniques to enhance food security and sustainable agricultural development.

Keywords: Maize productivity, agricultural extension, Community Demonstration Plots, Model Adoption Plots, Food security, improved agronomic practices.

Introduction

Maize (Zea mays) is one of the most important staple crops worldwide, particularly in sub-Saharan Africa. It serves as a crucial source of food, income, and employment for millions of people, especially in countries like Nigeria. In Nigeria, maize is not only a staple food but also a key commodity for smallholder farmers, who rely on it for their livelihood. Despite its significance, the productivity of maize in regions such as Kano State, Nigeria, remains low, primarily due to several challenges faced by farmers. These challenges include poor soil fertility, limited access to modern farming techniques, and insufficient extension services, which hinder the potential yield of maize and overall crop production (IITA, 2014).

Maize production in Kano State, as well as in other regions of sub-Saharan Africa, has long been hindered by low crop yields and inefficient farming practices. Many smallholder farmers still rely on traditional methods that have not adapted to the increasing pressures of population growth, climate change, and diminishing soil fertility. The limited use of improved varieties, modern fertilization practices, and advanced cultivation techniques further exacerbates the situation. The persistent gap between the potential and actual maize yields can be attributed to a combination of factors, including insufficient knowledge of modern agricultural practices, lack of access to quality inputs such as seeds and fertilizers, and inadequate extension services to disseminate knowledge about better farming methods (Olaitan & Lombin, 2006). The use of open-pollinated local maize varieties, which, although adapted to local conditions, typically produce lower yields compared to improved hybrid varieties. The hybrid varieties, often produced through scientific methods such as controlled cross-pollination, have shown a significant increase in productivity, especially when combined with modern soil management practices (Ibeawuchi & Ofoh, 2010).

Previous research has demonstrated that the adoption of improved agronomic practices, including the use of high-yielding maize varieties, proper soil nutrient management, and effective weed control, significantly enhances maize productivity (Akinyosoye, 2010). However, in response to maize production challenges, various initiatives have been introduced to enhance maize productivity.

Sasakawa's Community Demonstration Plots (CDPs) and Model Adoption Plots (MAPs) are among the notable interventions aimed at improving farming knowledge and promoting the adoption of improved agricultural technologies. These platforms provide hands-on training for farmers, exposing them to best agronomic practices such as the use of improved maize varieties, proper fertilization techniques, and efficient weed management. Hence, empirical studies evaluating the impact of these platforms compared to traditional community practices are limited. This study seeks to bridge this knowledge gap by assessing the effectiveness of CDPs and MAPs in improving maize yields in Kano State.

MATERIALS AND METHODS

Description of the Study Areas

The experiment was conducted during the 2020 wet season in seven different locations. These locations include Sumaila, Gwarzo, Tudun Wada, Rano, Karaye, Garko and Kibiya which falls within Sudan savannah agro ecological zone of Nigeria. The Sudan Savannah agro-ecological zone in Nigeria experiences distinct climatic characteristics that receives seasonal rainfall ranging from 800 to 1,200 mm annually, with a wet season from May to September and a dry season from October to April. It has an average temperature range from 26°C to 30°C but can spike above 40°C during the dry season. Relative humidity is generally low in the dry season and higher during the wet season. The natural vegetation in this zone consists mainly of savannah grasslands and scattered trees adapted to the seasonal rainfall pattern (Adewuyi, 2006; Adefolalu, 2007; Salami *et al*., 2014; Agboola *et al*., 2019).

Treatments and Experimental Design

The experiment comprised of 3 treatments including community demonstration plots (CDP), model adoption plots (MAP) and community practice (CP). These treatments were replicated 7 times by using Sumaila, Gwarzo, Tudun Wada, Rano, Karaye, Garko and Kibiya locations as the replicates. These treatments were combined factorially and laid out in a Randomized Completely Block Design. The total plot area per replicate was 3000 m^2 with each treatment having 1000 m^2.

Varietal Description

The study used SAMMAZ 15 maize variety in the 7 locations. SAMMAZ 15 is an open-pollinated, intermediate-maturing maize variety with a high yield potential of up to 6.9 tons per hectare. Developed by the Institute for Agricultural Research (IAR), Zaria, it is recognized for its resistance to Striga, a major parasitic weed that significantly reduces maize productivity. This variety has been widely recommended for maize production in the Sudan Savanna due to its adaptability and high performance under different climatic conditions (Nigerian Seed Portal, n.d.).

Cultural Practices

The land was cleared and harrowed to a fine tilt. Ridges of 0.75 m apart were constructed. The field area was marked out into plots of the treatments in each location used as replication. Six ridges of 6 m length were used to represent a plot. The seeds treated with apron star seed dressing chemical at the rate of 3 kg of seed to a 10 g sachet. The seeds were sown manually into their respective ridges at the rate of 2 seeds per hole at interval of 0.75 x 0.25m inter and intra row spacing. The weeds were controlled using atrazine pre – emergence herbicide on community demonstration plots and model adoption plots, while community practice was hoe weeded thrice at 2 weeks, 4 weeks and 6 weeks after sowing respectively to keep the experimental plots weeds free, healthy and clean. The dose of NPK 20:10:10 fertilizer was applied at basal for community demonstration plots and model adoption plots at 7 days after sowing at the rate of 8 bags per hectare and top dressed with urea super granules at 2 weeks after sowing at the rate of 100 kg per hectare. While, for community practice basal application was done with NPK 20:10:10 at the rate of 4 bags per hectare and top-dressed grilled urea at 100 kg per hectare.

Data Collection and Analysis

Data were collected and recorded on number of stands at germination, number of stands at harvest, number of cobs per plant, number of cobs per hectare, grain weight per cob, and grain yield per hectare. The data collected for all the measured parameters were subjected to analysis using GENSTAT 17th edition. Treatment means were separated using Student – Newman Keuls Test.

Results and Discussion

The effect of SASAKAWA African association safe learning platform models on number of stands at germination and harvest of maize was presented on table 1. The highest number of stands at germination were obtained from Community Demonstration Plots (45651) which were statistically the same with Model Adoption Plots (43405) and statistically different with Community Practice Plots (24204). However, the number of stands at harvest were found to be of significant differences statistically between Community Practice Plots (24225) and Model Adoption Plots (42662). In contrast, Community Demonstration Plots (44834) were found to be similar statistically with Model Adoption Plots (42662). The higher stand establishment in CDPs and MAPs can be attributed to the use of improved planting techniques, and better soil nutrient management. These results align with previous studies that highlight the role of seed treatment and optimized agronomic practices in enhancing maize germination and survival rates (Ibeawuchi & Ofoh, 2010).

Table 1. Effect of SASAKAWA African Association Safe Learning Platform Models on number of stands at germination and harvest of Maize at Kano Sudan Savanna During 2020 Rainy Season.

Treatments	Number of stands at germination	Number of stands at harvest
Community Demonstration Plots (CDPs)	45651 a	44834 a
Model Adoption Plots (MAPs)	43405 a	42662 a
Community Practice Plots (CPPs)	24204 b	24225 b
p value	0.001	0.001
SE±	4817.9	4501.7

Means followed by the same letter within treatment groups and columns are not significantly different using SNK at 5% level of probability.

The effect of SASAKAWA African association safe learning platform models on number of cobs per plant and hectare of maize was presented on table 2. There were no significant differences statistically between the learning platforms on the number of cobs per plants. However, there were significant differences statistically between the learning platforms model on number of cobs per hectare with community demonstration plots (82229) having the highest numbers which were statistically the same with model adoption plots (74495) and statistically different community practice (58167) that had the lowest numbers of cobs per hectare. The increase in cobs per hectare in CDPs and MAPs is likely due to improved plant nutrition and proper spacing, which optimize plant density and reduce competition for resources. Previous studies have demonstrated that appropriate fertilizer application and plant density management significantly impact cob formation and maize yield (Olaitan & Lombin, 2006).

Table 2. Effect of SASAKAWA African Association Safe Learning Platforms Model on number of cobs per plant and hectare of Maize at Kano Sudan Savanna During 2020 Rainy Season.

Treatments	Number of cobs per plant	Number of cobs per Hectare
Community Demonstration Plots	2.000	82229 a
Model Adoption Plots	1.857	74495 a
Community Practice	1.714	58167 b
p value	0.235	0.004
SE±	0.1579	5729.4

Means followed by the same letter within treatment groups and columns are not significantly different using SNK at 5% level of probability.

The effect of SASAKAWA African association safe learning platform models on grain weight per cob and grain yield per hectare of maize was presented on table 3. There were no significant differences statistically between the learning platforms on grain weight per cob. However, there were significant differences statistically between the learning platforms model on grain yield per hectare with community demonstration plots (5066 $kgha^{-1}$) having the highest weight which were statistically the same with model adoption plots (4246 $kgha^{-1}$) and statistically different with community practice (2954 $kgha^{-1}$) that had the lowest grain yield per hectare. The substantial increase in yield under CDPs and MAPs can be attributed to a combination of factors, including improved soil fertility management, efficient weed control, and the adoption of optimized planting techniques. These results align with previous research indicating that integrating best agronomic practices can increase maize yields by up to 50% compared to traditional methods (Akinyosoye, 2010).

Table 3. Effect of SASAKAWA African Association Safe Learning Platform Model on grain weight per cob and grain yield per hectare of Maize at Kano Sudan Savanna During 2020 Rainy Season

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Treatments	Grain weight per cob (g)	Grain yield per hectare ($kgha^{-1}$)
Community Demonstration Plots	0.5857	5066 a
Model Adoption Plots	0.5186	4246 a
Community Practice	0.4286	2954 b
p value	0.190	0.004
SE±	0.081	503.0

Means followed by the same letter within treatment groups and columns are not significantly different using SNK at 5% level of probability.

CONCLUSION

The study shows that structured learning platforms such as CDPs and MAPs significantly enhance maize productivity compared to traditional farming practices. CDPs recorded the highest yield, followed by MAPs, while CPs had the lowest. These findings indicated the importance of adopting modern agronomic practices to improve food security. Future research should focus on the long-term adoption of these practices and the economic benefits of scaling up improved agricultural technologies.

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