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Introduction of Faro – 52 (WITA – 4) Rice Variety as A Measure of Solving Low Yield Problem among Farmers in Yola-North Local Government Area of Adamawa State, Nigeria

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ABSTRACT

The study was conducted at Jambutu, Jimeta, Yola – North Local Government Area of Adamawa State, Nigeria, in 2015 to solve low yield problem among farmers using FARO – 52 (WITA – 4) rice variety. FARO-52 (WITA-4) rice variety; fertilizer (NPK 15;15;15, Urea); hoe; shovel; rake; rope; pegs; measuring tape; water pump; measuring scale; basin; tarpaulin; empty drum and bag were used as experimental materials. The study comprises two treatments. The first treatment consists of an improved rice variety (FARO-52) with best agronomic practices, while the second treatment consist of farmers' local variety which were retained seeds by the farmers. Data collected were presented in percentage performance over that of farmers. The result revealed that the major yield components in rice are number of tillers per plant, number of grain per panicle, panicle weight and individual grain weight express as 1000 – grain weight. FARO - 52 was observed to have significantly outperformed the local variety in numbers of tillers per plant, panicle length, number of grain per panicle, panicle weight, 1000 – grain weight and grain yield. Thus, the study recommends that inputs such as improved rice variety of FARO – 52 should be made available in time at subsidized rate to farmers by government. Effective extension services should also be extended to the study area to intensify the use of FARO – 52 by farmers for rice production, and agricultural policies should be directed toward provision of farming inputs such as FARO – 52 improved rice variety for efficient agricultural productivity.

Key words: FARO-52, Low yield, Introduction, farmers, rice variety

INTRODUCTION

Rice is an important commodity, contributing a significant proportion of the food requirements for the Nigerian population, and is cultivated in almost all the agro-ecological zones in Nigeria (Adeola *et al.*, 2008). In recent years, rice production had been on the increase, but not sufficient enough to meet the demand of growing population and thus the need for importation of rice to make up for the shortfall. By any estimate, the bulk of the food and fibre produced in Nigeria is from the rain-fed agriculture (Ingawa, 2007). Although irrigated farming accounts for only about 18% of the cultivated area in developing world, it produces about 40% of the value of agricultural output (Cai *et al*., 2001). Irrigation therefore, holds the key for sustainable farming practice to meet our food self-sufficiency and security needs. However, in spite of the giant stride in irrigation development in Nigeria, its performance leaves a lot to be desired. This finds expression in lack of effective harnessing of this key variable with a view to stepping down, to the barest minimum, the devastating effects of drought prevalent in the northern part of Nigeria (Gani and Omonona, 2009).

In the past, the main impetus to the growth recorded in domestic rice production was due to area expansion. However, recent strategies through research system sought to increase production through increased productivity. This is pivoted on intensification, involving the development and dissemination of improved rice varieties and other modern inputs as a composite package to rice farmers.

Reports from research stations (on-station and on-farm trials) showed that the adoption of the technologies and improved management practices should lead to substantial yield increases in rice production. This invariably underscores the significant role that technology stands to play in attaining the much needed growth in the rice sub sector (Oyekanmi *et al.*, 2008; Nwite *et al.,* 2008).

Over decades, rice has occupied a prominent position as a strategic crop for food security and economic development of nations of the world. FAO (2000) classified the crop as the most important food on which over 50 per cent of the world population depends on for about 80% of their food needs. Due to the growing importance of the crop and the increasing challenges of attainment of food security, it has been estimated that annual rice production needs to increase from 586 million metric tones from 2001 to meet the projected global demand of about 756 million metric tonnes by 2030 (FAO, 2002). Recent global trend in the rice industry however, shows that there is a growing import demand for the commodity in Africa, as evidenced from pressure on world supply and the steady increase in the world price of the commodity in the last five years (FAO, 2006). The focus of this research therefore, is introduction of faro – 52 (wita – 4) rice variety as a measure of solving low yield problem among farmers in Yola-North Local Government Area of Adamawa State, Nigeria.

Importance of Rice

Rice has shaped the culture, diets and economy of thousands of millions of peoples. For more than half of the humanity "rice is life''. Considering its important position, the United Nation designated year 2004 as the "International year of rice". Importance of rice is as follows:

a) According to the United States Department of Agriculture (USDA), rice is an important staple food crop for more than 60 per cent of the world people. In 2008, more than 430 million metric tons of rice were consumed World Wide.
b) Rice straw is used as cattle feed, used for thatching roof and in cottage industry for preparation of hats, mats, ropes, sound absorbing, straw board and used as litter material.
c) Rice bran is used as cattle and poultry feed. The defatted bran, which is rich in protein, can be used in the preparation of biscuits and cattle feed.
d) Rice bran oil is used in soap industry. Refined oil can be used as a cooling medium like cotton seed oil or corn oil. Rice bran wax, a by-product of rice bran oil, is used in industries.
e) Rice husk is used as animal feed, as well as for paper making and as fuel source.
f) Ready to eat product, eg popped and puffed rice, instant or rice flakes, canned rice and fermented product are produced.

Faro-52 (WITA-4) Rice Variety

The rice variety selected for this research work was Federal Agricultural Research *Oryza* (FARO), released numbers 52, generally referred to as FARO-52. Unlikely traditional varieties that are typically more than 1metre tall, have a long growth and maturation period (five–six months) and low yield (1.5-2.0) tonnes per hectare. The improved varieties are shorter (less than 50 centimetres) and are responsive to high doses of fertilizer, have a high yield (3.5-5 tonnes per hectare) and are short-duration crops that may provide three harvests.

Yield Response of Faro-52

The remarkable difference in agronomic performance observed among hybrids, interspecific lowland NERICA's and inbred varieties in all the traits studied is an indication that wide genetic variability exists amongst them. This suggests that the genetic potential of hybrids, interspecific lowland NERICA's and inbred depend on their parental lines. This is similar with the finding of Virmani and Kumar (2004), that the highly significant interactions observed between varieties and seasons in all the traits except panicle weight, number of grains per-panicle and 1000 grain weight, show that the genotypes respond differently to different seasons. Further, Yang *et al.* (2008) observed that the number of days to maturity plays a significant role in the cropping system. Early maturity crops are timely handled, early preparation of land, early for the next crops and escape from insect pest attack.

The distinct variation among hybrids, interspecific lowlands, NERICA's, inbred and the interaction with season for maturity is an indication that season and parental combination have significant effect on the number of days to maturity. This can be attributed to high solar radiation during the dry season and their genetic make-up. The result is in consonance with the findings of Yang *et al.* (2008). However, inbred variety IR77674 recorded the shortest days to maturity and also the lowest grain yield. This confirms with the report of Islam *et al.* (2010), that varieties with longer growth duration usually produce more grain yield than the varieties with shorter growth duration. Comparing hybrids, interspecific lowland NERICA's and inbred for plant height, it was observed that hybrids were shorter than the inbred varieties which may be an important character for hybrid to withstand lodging (Malini *et al.,* 2006).

The major yield components in rice are number of panicles per unit area, number of grains per panicles, panicle weight and individual grain weight expressed as 1000-grain weight. Hybrids were observed to have significantly out-performed both inbred and lowland interspecific NERICA's in number of tillers per plant, number of panicles per M^2, panicles weight, number of grains per panicle and 1000 grain weight. This is an indication that the high yield of hybrid rice might be due to these traits. The present observations are in conformity with the findings of Islam *et al.* (2010). Grain yield was significantly higher in the hybrid than in the inbred and interspecific lowland NERICA's in the two seasons but these differences were more prominent in the dry season than in the wet season. This corroborates the heterosis for higher grain yield reported by Ma and Yuan (1982) and Virmani *et al.* (2003). The high grain yield performance of hybrid rice was observed to be due to high number of panicles per M^2, number of grains per panicle, panicle weight and 1000-grain weight. Grain yield is polygenically controlled and also influenced by many yield-contributing component characters. Hence, direct selection is often misleading. Therefore, establishing the extent of association between yield and its attributes is a very useful tool for successful selection. The positive correlation between grain yield, number of panicles per M^2, panicle weight and number of grains per panicle is an indication that they may be the main contributors to grain yield in rice. The results are in conformity with Babar *et al.* (2006) for number of panicles per plant and Ramakrishman *et al.* (2007) for number of grains per panicle.

MATERIALS AND METHODS

The research was conducted in Jambutu ward in Yola-North Local Government Area (LGA) of Adamawa State, Nigeria. It is located within latitude 9º 20'N and longitude 12º 08'E and 12º 30'E. Jimeta-Yola North which is a twin settlement is the administrative headquarter of Adamawa State. History shows that Jimeta was founded in 1931 to serve as administrative center of pre-independent colonial era situated along river Benue. Jimeta has been serving as its administrative center of Yola-North LGA since 1996. Yola-North is located in the Sudan Savannah zone with vegetation consisting of predominantly grasses and scattered trees. The soil type is dominated by clay, sandy loam and sandy type. The occupation of the inhabitants of Jimeta has been trading, fishing and farming. It has an altitude of about 190m above sea level. The town is bounded in the north by Girei LGA and in the south by Yola-South LGA. The population of the study area according to NPC, (2006) stood at 198,247 people. Of this figure, 107,646 were males while 90,601 were females.

Experimental Materials

The experimental materials used in carrying out this research include the following: FARO-52 (WITA-4) rice variety; fertilizer (NPK 15;15;15, Urea); hoe; shovel; rake; rope; pegs; measuring tape; water pump; measuring scale; basin; tarpaulin; empty drum; bag.

Experimental Design

The study comprises of two treatments. The first treatment consist of an improved rice variety FARO-52 with best agronomic practices while the second treatment consist of farmers variety which were retained seed by the farmers.

Experimental Procedure

Establishment of Nursery**:** The nursery bed was prepared 7days before the seeds were sown. Seedbed of 1m-0.5m was constructed and well leveled before the seeds were drilled 10cm apart and covered 2-3cm deep. The nursery bed was watered regularly to keep the soil moist with a drainage outlet.

***Land Preparation*:** The land was cleared using hand hoes, pre-irrigated before ploughing, harrowing and leveled properly. A bund was constructed to retain water using hand hoe. The field was irrigated for about 3days and well leveled again. Drainage outlet was created to control flooding and watering.
***Transplanting and Spacing*:** Seedlings were transplanted 23days after sowing to the main field at the rate of 3 seedlings per hole to a depth of 3-4cm and a spacing of 20cm by 25cm apart.
***Gap Filling*:** The empty spaces were filled 10 days after transplanting using left over seedlings from the nursery.
***Fertilizer Application*:** A well compounded inorganic material of N.P.K 15:15:15 was applied at the recommended rate of 2kg per 10m by 10m (100m²) 10 days after transplanting. Second fertilizer application of Urea at the rate of 1kg was done after 6 weeks to boost the vegetative growth and panicles development; this was done by broadcasting method.
***Weed Control*:** The field to which seedlings was transplanted was prepared and with water well-managed. Weeds problem was minimal. However, some weeds were hand-pulled and heaped on bunds. The bunds were well maintained throughout the growing time and water, fertilizer were effectively utilized
***Harvesting*:** Harvesting was done when rice panicles ripened into a golden brown colour i.e. when the rice panicle was not too dry to avoid shattering, i.e. (2-3weeks after maturity). It was harvested manually by using sickle. The panicles were tied into bundled and laid in an upright position for drying before threshing.
Threshing and Winnowing: Threshing was done to separate grains from panicles on a land surface by beating the grains out from the ears. It was winnowed to separate the chaff and empty grains from well filled matured grains, and was dried to a safe moisture level before the grain was weighed.

Parameters and procedures used:

The following data were measured:
***Fifty percent (50%) flowering*:** Flowering occurs during and shortly after weeding when the florets open is pollinated and close. The number of days to 50% flowering was recorded.
***Days to Maturity*:** The plant took about 116 days to mature.
Plant Height: Plant height was measured from the base of the plant to the last flag leaf of the plant using measuring tape at 30, 45 and 60 days after transplanting and the means recorded.
***Number of Tillers per Plant*:** Number of tillers per plant.
***Number of Productive Tillers*:** Among yield components, productive tillers are very important because the final yield is mainly a function of the number of panicles bearing tillers per unit area; numbers of productive tillers were collected at 16days to 24days after transplanting.
***Length of Panicle*:** The length of panicle was measured with measuring tape at each randomly selected plant.
***Panicle Weight*:** The per panicle weight of was recorded.
***Number of Seed per Panicle*:** The number of seeds per panicle was counted and recorded.
***One thousand (1000) Grain Weight* (g):** The weight of 100 grains was taken and recorded and converted to 1000 grain weight.
***Plot Yield*:** The plot recorded grain yield was from 10m by 10m (100m²) plot size
***Famers Plot*:** All the operation carried out in the experimental site was also done on farmers plot using the same treatment and operations. Grain yield on farmers plot was obtained from 10m by 10m (100m²) plot size.
***Statistical Analysis*:** The data collected from the experiment were analyzed using percentage. The analysis was done to determine the performance of FARO-52 over that of famers.

RESULT AND DISCUSSION

How to increase yield through the use of FARO-52 (WITA-43) rice variety

Demonstration of FARO-52 rice variety alongside farmer's variety (local varieties) was carried out to enable farmers solve low yield problem. Two plots were used to transplant FARO-52 and the local rice variety on the same day, under same conditions. As shown in Table 1, FARO-52 reached maturity at 116 days after transplanting earlier than the local variety which reached maturity at 124 days after transplanting. The yield of FARO-52 was estimated at 6,500 kg/ha (100m^2 gave 65kg) while the local variety was estimated at 5,200 kg/ha (100m^2 gave 52kg). The two varieties were given same treatments from nursery establishment up to harvest period. The result in terms of maturity period, panicle weight 1,000 grain weight and grain yield indicated that FARO-52 rice variety performed better than the local variety.

Table 4: Phenological and Yield Parameters of Faro-52 (WITA-4) and Local Variety of Rice

Treatment	Days to 50% flowering		Days to maturity	Grains per panicle
FARO-52	84	72%	116	186.20
Local variety	92	74%	124	152.10
Percentage performance of FARO-52 to local variety	8.70	-22%	6.45	22.42

Source: Field Observation 2013 – 2014

Result in Table 2 indicates that FARO-52 exhibited plant height of 123.39cm (3.94%) less than the local variety (128.45cm). Further, FARO-52 was shorter in terms of height than the local variety. This is an important character and quality to withstand lodging. This agrees with the findings of (Malini *et al.,* 2006) that one of the good qualities of FARO-52, is the ability to withstand lodging. Furthermore, the result revealed that FARO-52 produced higher number of tillers per plant (17.39%) compared to the local variety and the longest panicle length of 22.50% compared to 18.70 for the local variety. This is a clear demonstration of the superior quality which FARO-52 has over the local variety used by the farmers in the study area.

Table 2: Comparative Percentage Performance of Faro-52 (WITA-4) and Local Variety of Rice

Treatment	Plant height (cm)	No. of tillers per plant	Panicle length (cm)
FARO-52	123.39	40.50	22.50
Local variety	128.45	34.50	18.70
Percentage performance of FARO-52 to local variety	3.94	17.39	20.32

Source: Field Observation, 2013 – 2014

As the result in Table 3 indicates, FARO-52 produced the heaviest panicle weight of 5.88g (29.80%) against 4.53g produced by the local variety. The result further shows that 1,000 grain weight of FARO-52 was 32.34g (13.24%) heavier than the local variety which weighed 28.56g. Furthermore, the grain yield was significantly higher in FARO-52 (65kg per 100m^2) than the local variety (52kg per 100m^2), equivalent to 6,500kg/ha and 5,200kg/ha, respectively. The major yield component in rice is number of grain per panicle, panicle weight and individual grain weight expressed as 1,000-grain weight. FARO-52 was observed to have performed significantly better than the local variety in numbers of tillers per plant, number of grain per panicle, panicle weight, 1000-grain weight and grain yield. This is an indication that high yield in FARO-52 (improved rice variety) might be attributed to its superior qualities. The observations are in conformity with the findings of Islam *et al.* (2010).

Table 3: Performance of Faro-52 (WITA-4) and Local Variety In terms of Panicle Weight and Grain Yield (kg)

Treatment	Panicle grain weight	1000-grain weight	Grain yield
FARO-52	5.88	32.34	65
Local variety	4.52	28.56	52
Percentage performance of FARO-52 to local variety	29.80	13.24	25

Source: Field Observation 2013 – 2014

CONCLUSION

Based on the findings, the problem of low yield of rice was as a result of lack of access to improved rice seed by farmers. Other constraint was inadequate capital, fertilizer and pest infestation. It also realise that FARO-52 rice variety matured earlier than the local variety with a difference of 8 days, the results further indicated that performance of FARO-52 in terms of numbers of tillers per plant, number of grain per panicle, panicle grain height, 1,000-grain height grain yield out performed that of local variety significantly.

The study has shown clearly that FARO-52 (WITA-4) rice variety has superior performance over the local variety. FARO-52 has a huge potential in solving low yield problem among farmers in Jambutu and increasing rice productivity in the study area.

RECOMMENDATION

Farmers should be enlightened on the need to adopt FARO-52 as it has superior quality over the local varieties. Farmers should be encouraged to adopt FARO-52 due to benefits of its superior qualities. More so, it should be made available in time at subsidized rate to farmers to increase productivity, eradicate poverty and subsequently better the living condition of the farmers in the study area.

Concerted effort should be geared toward training and demonstration by extension service agents on correct use of recommended technological packages in order to make significant contribution to rice production. Agricultural policies should be directed toward provision of farming inputs such as fertilizer, herbicides, pesticides, modern implement and effective extension services to the farmers to support the use of improved rice variety (FARO-52).

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