HP
JAESR2024
Hummingbird Publications
Journal of Agricultural & Env. Sci. Research
www.hummingbirdjournals.com
© November, 2024
Vol. 6 No. 1

The Performance of Selected Nerica Rice (*Oryza Sativa* L.) Cultivars under a Rainfed Irrigation System in Igboora, Oyo State, Nigeria

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Keywords: Rice, Cultivars, Growth, Yield, Rainfed

Abstract

The growth and yield performance of selected NERICA rice cultivars under rained-fed irrigation at was evaluated. Three cultivars (NERICA 7, NERICA 8 and NERICA 10) of rice were selected for the study. A randomized complete block design was used to arrange the cultivars. The cultivars were established using standard procedure and the growth and yield parameters were examined. Data collected were: plant height, number of leaves, number of tillers, number of days to 50% flowering, panicle weight, number of grains per panicle and weight of grain per plant. All data collected were subjected to Analysis of Variance and significant treatment means were separated by Least Significant different at 5% level of probability. From the result, the rice cultivars showed significant differences in the growth and yield characters considered. NERICA 8 produced the highest weight of grain (2.9 g), followed by NERICA 10 (2.0 g), while NERICA 7 produced the lowest significant grain weight (1.7 g). However, NERICA 10 had the shortest number of days to 50% flowering (75), while NERICA 8 had the longest number of days to flower (95). It was observed that the differences in growth and yield parameters were due to genotypic composition. However, all the cultivars can be cultivated in the study area and thus, were recommended for commercial production to rice farmers.

Introduction

Rice (*Oryza sativa* L.) belongs to the family Graminea, and one of the most important cereals in the world. Rice is the world's second most widely grown cereals crop after wheat and presently more than half of the world`s population depends on it as a staple food. In Nigeria, rice can be grown in all the agro-ecological zones of Nigeria (Olaleye *et al.*, 2008). This includes Mangrove Swamp which contributes 1% to rice production in Nigeria, Deep water (5%), Irrigated lowland (16%), Rain-fed lowland (inland valleys; 48%) and Rain-fed upland (30%; Africa Rice Center WARDA 1996). About 57% of the total rice area in West Africa is planted to upland rice in diverse cropping systems (Johnson, 1996).

Upland rice refers to rice grown on both level and slopping fields that is seeded under dry conditions and depends on rainfall for moisture (De Datta, 1985). It is the dominant ecology in West Africa varieties need specific agronomic and cultural practices (WARDA, 2000). A large proportion of the rice grown in this region and particularly in Nigeria is cultivated by small scale farmers on dry land. Upland rice accounts for more than 60% of the total area given to rice production. Most of the upland rice field in Nigeria are located in areas with annual rainfall of 1200 mm or more, and are mostly grown on unproductive soils. This makes the grain yield to be generally low and highly dependent on the amount and distribution of rainfall. Other constraints to upland rice production are low soil fertility, diseases, pests and cultivars types. Approximately 3.7 million metric tons was produced in 2018. This is about 50% of our local demand as consumption tends to increase to 6.7 million metric tons in 2018.

The cultivation of upland rice under rain-fed conditions is expanding as a result of the introduction of improved rice cultivars called New Rice for Africa (NERICA). NERICA varieties are the product of interspecific hybridization between the cultivated rice species of Africa (*O. sativa*) and Asia (*O. glaberrima*) targeted to smallholder production systems (Dingkuhn *et al*., 1998).

The high cost of fueling for irrigation during the dry season rice production is unprofitable, and National grid power supply is significantly poor in the study area. Hence, it is important to cultivate different varieties of upland rice under a rain-fed irrigation system to evaluate their growth and yield responses.

This necessitated the selection of some of the NERICA varieties for growth and yield evaluation under similar agronomic practices so as to close the gap between production and consumption and make recommendation on their performances. Hence, the objective of this work was to evaluate the growth and yield performance of selected NERICA rice varieties under a rainfed irrigation system.

Materials and Methods

The experiment was conducted at the Teaching and Research Farm of Department of Crop Production Technology, Oyo State College of Agriculture and Technology, Igboora. The experimental field (Latitude 7° 41'085"N, Longitude 3°29'97"E and altitude 464 feet) measuring 45 m x 45 m was cleared and demarcated into 225 experimental plots of 2 m x 2 m each, separated by 1 m apart. There are two distinct seasons in Igboora, Oyo State, Nigeria; the dry season (November to March) and wet season (April to

October). The average high temperature of the region is 33 °C, while the average low temperature is 22 °C. A soil auger (3 cm depth) was used to collect composite soil samples from the experimental field. The samples were subjected to physico-chemical analysis. The soil samples were air dried for 21 days, crushed and sieved to remove debris. The hydrometer method was used to determine sample particle size (Bouyoucos, 1962). The total nitrogen of the substrates was assessed using the macro-Kjeldahl method (Jackson, 1958). The pH was determined with pH meter, while available phosphorus was estimated using the Bray 1 method (Bray and Kurtz, 1945).

Three rice cultivars *(NERICA* 7, *NERICA* 8 and *NERICA* 10) were planted at two seeds per hole at 20 x 20 cm plant spacing to give an average of 200 plants per plot. The cultivars were the treatments, and arranged in a Randomize Complete Block Design in three replicates. NPK 15:15:15 fertilizer was applied at the recommended rate of 60 kg N ha^{-1} in two splits of 20 kg N ha^{-1} 21 days after planting (DAP) and 40 kg N ha^{-1} 55 DAP (Oikeh *et al*., 2008).

The following data were collected: plant height by using measuring tape, number of leaves and tillers by visual counting, days to 50% flowering, weight of panicles, number of grains per panicle and weight of grain. The data collected were subjected to analysis of variance, while significant means were separated using Least Significant Difference at 5% level of probability.

Results and Discussion

Physical and chemical properties of the experimental field

The soil was slightly acidic (6.45) and low in essential nutrients such as nitrogen (0.19%), phosphorus (12.75 mg/kg) and potassium (0.39cmol/kg). The soil textural class was sandy loam, with 89.4% sand, 5.80% silt, and 4.80% clay (Table 1).

Table 1: Physical and chemical properties of soil used for the experiment

Elements	Values
pH (H_2o)	6.45
Exchangeable cations (cmol/kg)	

Ca^{2+}	3.65
Mg^{2+}	0.76
K^{+}	0.39
Na^{+}	0.54
ECEC	5.34
Total N (%)	0.19
Total Org. C (%)	0.87
Av. P	12.75
Particle size analysis (mg/kg)	
Sand (%)	89.4
Silt	5.80
Clay	4.80
Textural class	Sand loamy

Growth evaluation of selected *NERICA* rice cultivars

The *NERICA* rice cultivars showed significant ($P \leq 0.05$) difference in the plant height. The plant height increases from 4th to the 12th weeks after planting (WAP). *NERICA* 7 produced the lowest significant plant height (19.50 cm), while *NERICA* 10 produced the highest significant plant height (29.20 cm) at 4 WAP. Similar trend was observed at 6 WAP, with *NERICA* 10 producing the highest plant height (39.90 cm). However, from the 8 WAP to 12 WAP, *NERICA* 8 produced the highest plant heights (42.20 cm, 56.60 cm and 65.60 cm), while *NERICA* 7 produced the lowest significant plant heights (38.90 cm, 45.70 cm and 52.60 cm) all through the sampling period (Table 2).

Moreover, *NERICA* rice cultivars were significantly ($P \leq 0.05$) different in number of leaves at 6 and 10 WAP. *NERICA* 7 produced the highest significant number of leaves (6.20) at 6 WAP, while, *NERICA* 8 produced the highest significant number of leaves (8.60) at 12 WAP. The lowest significant number of leaves (4.50) was produced by *NERICA* 8 at 6 WAP, while *NERICA* 10 produced the lowest significant number of leaves (7.90) at 12 WAP (Table 2).

Table 2: Growth evaluation of selected *NERICA* rice cultivars under rain-fed irrigation

CULTIVARS	4 WAP	6 WAP	8 WAP	10 WAP	12 WAP
		Plant height	**(cm)**		
NERICA 7	19.50	25.90	38.90	45.70	52.60
NERICA 8	23.90	30.50	42.20	56.60	65.60
NERICA 10	29.20	39.90	40.20	50.50	59.50
LSD 5%	4.80	5.64	2.56	5.60	5.84
		Number of leaves			
NERICA 7	4.90	6.20	7.50	9.50	8.50
NERICA 8	3.70	4.50	7.90	8.90	8.60
NERICA 10	4.00	5.20	7.40	8.00	7.90
LSD 5%	1.30	1.55	0.97	1.20	0.67

WAP – Weeks after planting

Yield evaluation of selected *NERICA* rice cultivars

All the *NERICA* cultivars considered produced significant ($P \leq 0.05$) effect with respect to the yield parameters (Table 3). The highest significant number of tillers per plant (5.00) was produced by *NERICA* 7, followed by *NERICA* 10 (3.00), while, *NERICA* 8 produced the lowest significant number of tillers per plant (2.10). Also, 50 % of *NERICA* 10 cultivars had flowered at seventy-five days. This number was significantly different from number of days to 50% flowering of *NERICA* 7 (80 days) and *NERICA* 8 (95 days). Lowest significant panicle weight (1.40 g) was produced by *NERICA* 10, while *NERICA* 6 produced the highest significant panicle weight (2.00 g), followed by *NERICA* 8 with 1.50 g panicle weight. Moreover, *NERICA* 7 produced the highest number of grains per panicle (45.20), followed by *NERICA* 10 (42.40) and *NERICA* 8 produced the lowest significant number of grains per panicle (41.70). *NERICA* 8 produced the highest significant grain weight per plant

(2.90 g), followed by *NERICA* 10 with 2.00 g grain weight per panicle, while the lowest weight grain per panicle was produced by *NERICA* 7 (1.70 g).

Table 3: Yield evaluation of selected NERICA rice cultivars under a rain-fed irrigation

CULTIVARS	NT/plant	D 50% F	PW (g)	NG/panicle	WG/Plant (g)
NERICA 7	5.00	80	2.00	45.20	1.70
NERICA 8	2.10	95	1.50	41.70	2.90
NERICA 10	3.00	75	1.40	42.40	2.00
LSD	1.71	9.75	0.36	1.82	0.78

NT/plant – Number of tillers per plant, D50%F – Days to 50% flowering, PW – panicle weight, NG/panicle –number of grains per panicle, WG/plant – Weight of grain per plant

Discussion

The number of leaves and plant height differences observed were influenced by the type of cultivars. These differences were inherent and therefore genotypic in nature. The observed result corroborated with the reports of Adigbo *et al*., 2007 and GRISP, 2013 that significant variations do occur among varieties of same crop due to genetic inheritance and environmental conditions. However, the environmental conditions were similar and could have influenced the growth parameters uniformly.

Moreover, the physiochemical properties of rice cultivars vary with respect to the type of cultivars. The difference in physicochemical properties is influenced by the genotypic make-up of the different cultivars which produced variations in the number of tillers of rice cultivars. This findings is supported by Rani *et al*. (2006) who reported that tiller number have significant influence on the genotypic components of the cultivars.

Similarly, *NERICA* 7 with highest number of tillers produced the highest number of grain per panicle, but the lowest weight of grain per plant. This result is in contrast to *NERICA* 8 with the lowest number of tillers but, highest weight of grain per plant.

Conclusion

The performance of *NERICA* was significantly influenced by the differences in their genetic composition. *NERICA* 7 produced the highest number of grain, but the lowest in weight, while *NERICA* 8 produced the lowest number of grain, but highest in weight. *NERICA* 10 fell intermediary. Moreover, *NERICA* 10 had the shortest 50% days to flowering, while *NERICA* 8 had the longest 50% days to flowering. Hence, all the rice cultivars adapted well to the environment, and their production is thus recommended to upland rice farmers in the study area.

Acknowledgments

I acknowledge the grant support of Institutional Base Research (IBR) of Tertiary Education Trust Fund (TETFUND) made available to Oyo State College of Agriculture and Technology, Igboora.

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