EVALUATION OF PERFORMANCE FOR YIELD AND YIELD COMPONENTS OF UPLAND RICE (Oriza sativa) ON THE JOS, PLATEAU

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ABSTRACT
The experiments were conducted during the 2021 and 2022 cropping seasons to evaluate the adaptability, yield and yield components of some Nerica rice varieties at Riyom on the Jos, Plateau. The treatment consisted of four Nerica (1,2,3 and 4) varieties and Sipi as a check. The experimental design was Randomized Complete Block Design (RCBD) with three replications. Plot size was 3.0m x 4.0m. Planting was done by hand dibbling at 20 by 20cm inter and intra row spacing at the seed rate of 60kgha^{-1} respectively. The parameters measured were number of tillers, number of spikes/ m^2, plant height (cm), panicle length(cm), number of days to maturity and grain yield (kgha^{-1}). The results showed that in the first year of study, number of tillers per hill was significantly higher while that of the second year, there was no significant difference in number of tillers per hill among the rice varieties. However, in both years, there was no significant difference among the rice varieties as regards number of spikes /m^2, plant height and panicle length. While the number of days to maturity and grain yield of the Nerica varieties were generally higher compared to the check. Based on the results of these studies, it showed that Nerica rice varieties performed well by producing good components and yields. Also, it indicated that the Nerica rice varieties are adaptable to the Jos Plateau Climate, Soil and Environment.

Key words: Check, Upland Rice, Nerica and Jos Plateau.

INTRODUCTION
Rice (*Oryza sativa L.*) belongs to the family gramineae. It is an annual grass morphologically, one of the most important crops in the world. The crop is grown largely in the tropical and sub-tropical regions of the entire world. Rice is one of the most important agricultural crops of the world and it comes second in terms of annual production after wheat, It constitutes the main staple of half of the world's population (Cregory *et al.*, 2000). More than half of the people in the world depend on rice as the basic food and mostly consumed in the producing countries. Its consumption is very important because of its nutritional qualities and it rises more than the demographic explosion. The cultivation of rice has an ancient origin anterior to the introduction of rice (*Oryza sativa L.*) (Pernes, 1984). Despite the enormous potentials that guarantee self-dependence, Nigeria still lines up with the sub-regional tendency of importing rice.

With the fast-growing population in Nigeria, it is an invitation to look inward on long –term environmentally friendly solutions for a strategic rehabilitation of rice cultivation surfaces for high yields. Hence, the evaluation of some Africans rice (Nerica) varieties at local and regional levels has to be taken into account prior to any sustainable agricultural development operations. However, there is need to step up the production of rice to meet up the demand for food. Therefore, rice yield can be increased by selecting and introducing varieties with promising component yields and attributes to different places to ascertain their adaptability and yield performance. Since the crop is new, there are very few adopted varieties in the country especially in the northern part of Nigeria. Hence, more varieties should be tested for environmental fluctuations are important for the stabilization of the production, (Chabra *et al.*, 2006). The information on genotype by environment interaction can result to a successful evaluation of stable varieties that can be used for general evaluation. The evaluation of genotypes for yield and yield components under varying environment is important to get adaptable and superior genotypes for the Jos Plateau. Therefore, the objective of this study was to evaluate the adaptability, yield and yield components of some Nerica rice varieties on the Jos Plateau.

Materials and methods

The experiment was carried out at the research field of the National Cereals Research institute, Acha substation Riyom, Plateau State. Geographically, the area is located at long 08^0 40^{0}N, latitude 09^0 37'E. The topography of the location is 1, 250m above sea level with a dominant slop of 0.9 – 3.5% in the Northern Guinea Savannah Agro-ecological zone of Nigeria. The soil of the field used had mean properties of pH (5.03), organic carbon (1.62), organic matter (0.65), total nitrogen (0.06) and textural class to be sandy loam. While available phosphorus was 11.93 ppm (Federal College of Land Resource Technology, (Soil Laboratory). The climate of Riyom is made up of five months of dry season (November – March,) with a well distributed rainfall which support good growth of crops. About 80- 90% of the rains fall within six months from April to October with peaks in August and September respectively.

The mean rainfall of Riyom is 1,275.7mm and has a mono-modal pattern. While the maximum and minimum temperatures range between 24.4 – 32.80 and 12.6 - 18.0% respectively. Also, the maximum and minimum sunshine is between 6.7 and 7.2 hours from the weather station of National Root Crop Research Institute (NRCRI), Kuru, Plateau State. Some rice lines including four nerica (1- 4) varieties were collected from National Cereals Research Institute. Badeggi, Niger State and were multiplied at Ganawuri in 2018. The four Nerica (1-4) rice varieties were then plant at the experimental field of the National cereal Research Institute, Acha substation, Riyom in 2021 and 2022 cropping seasons. These Nerica (1-4) varieties were evaluated along with a check (sipi) for adaptability, yield and components.

The trials were laid out in a Randomized Complete Block Design and replicated thrice in the two years. The plot size was 3.0m by 4.00m and 1.0m and 0.5m between replications and plots respectively. The treatments consisted of four Nerica (1-4) varieties and Sipi as a local cluck, and the treatments were assigned to all the plots according to treatments. Planting was done by hand dibbling at 60kg ha^{-1} seed rate, at a spacing of 20cm inter and intra row spacing respectively. A basal application of NPK 15:15:15 fertilizer was applied by broadcasting into each plot at the rate of 30kg ha^{-1} at 4 and 8 weeks after planting (WAP) and Urea was also applied by broadcasting at 20kgha^{-1} in two splits, one at tillering and the second split at panicle initiation. All the recommended agronomic practices were carried out accordingly and all relevant data were collected, analyzed using Cropstat 7.2 and were subjected to analysis of variance. Duncan multiple range test was used to compare the means at 1 and 5% level of significance.

Results and Discussion

Number of tillers per hill: In both years of experimentation, Nerica 2 produce significantly ($P<0.05$) more tillers than the remaining Nerica varieties and the check, but among the remaining Nerica rice varieties and the local check, there was no significant (P< 0.05) difference in terms of number of tillers produced, instead all were at par. It appears that it was only Nerica 2 variety was able to intercept incident solar radiation and partitioning photosynthates into the production of more tillers. This finding is line with Priyanka Gautam, B. Lal, A. K. Nayak. B. B. Panda, R. Tripathi, M. Shahid, U. Kumar,M. J. Baig, D. Catterjee and C. K. Swain (2018) who reported that Photosynthetically active radiation (PAR) is one of the most important environmental factors that determine the productivity, growth and grain quality of crops. While the non-significance in number of tillers among the other Nerica varieties and the local check could be due to lack of their ability to intercept incident solar radiation and partitioning photosynthates into the production of more tillers. This might have been due to continuous rainy days or cloudy weather throughout crop growth especially at critical stages often resulted in great loss of grain quality and yield of rice.

Number of spikes per m^2: In both years of studies, the number of spikes per m^2 was observed to vary in which Nerica 2 consistently produced more spikes per m^2 than the remaining Nerica varieties and the check, but there was no significant difference in number of spikes among all the rice varieties (Tables 1 and 2) and the check. The variations in yield components might be due to differences in environmental and soil conditions. This result is not in agreement with Fofana (2012) who reported that significant variation is the major constraint to achieving high rice productivity in Africa is the increased deficiency of major nutrients and particularly nitrogen.

Plant Height (cm): In tables 1 and 2, plant heights (cm) were observed to differ across all the Nerica varieties and the check in both years of experimentation in which Nerica 4 and 2 recorded taller plants than the remaining Nerica varieties and the check but there was no significance difference in plant height was observed among the rice varieties and the check. This could be due to shortage in supply of nutrition, water supply, light intensity, oxygen carbon dioxide, humidity and temperature that play vital role in crop growth and development. This finding is in line with Kyle (2021).

Panicle length (cm): The results of panicle length per plant of both years of studies for the Nerica varieties and the check is shown in tables 1 and 2. In both tables, it was observed that Nerica 1 and 3 varieties produced longer panicle length over the remaining. Nerica varieties and the check had the shortest panicle lengths. The results obtained indicated that Nerica 1 and 2 had better tillering capacity than the rest Nerica varieties and the check. The differences in panicle lengths could be attributed to varietal differences sand environmental adaptability. Similar finding has been reported by Efisue, Umunna and Orchukwu, 2014).

Number of Days to Maturity: The results for number of days to maturity for the two cropping seasons (2021 and 2022) are presented in Tables 1 and 2. The Nerica varieties and the check exhibited significant (P< 0.01) differences in number of days to maturity (Tables 1 and 2). However, it was observed that in Table 1, Nerica 2, 3 and 4 varieties had significantly (P< 0.01) higher number of days to maturity that were all at par and was followed by Nerica 1 which was also statistically higher than the check variety. While in table 2, Nerica 1 had significantly (P< 0.01) higher number of days to maturity but was not statistically higher than the number of days to maturity recorded by Nerica 2. Also, Nerica 3 and 4 varieties had significantly higher number of days to maturity that were at par (Table 2). All the Nerica varieties in both years of experimentation, the consistently higher number of days to maturity observed indicated that they are late maturing varieties. This could be due to the agronomic and climatic adaptability of the different Nerica varieties and the check. The lateness in maturity indicated that the Nerica varieties may not escape severe water deficit under terminal drought stress conditions. Yirgalem, Henlegebriel, Alem, Redae, Geremedhin, Desalegn, Welegerima, Yowhans, Eyasu, Kiros, Abadi andTesfahun (2019) reported similar findings. While in both years of studies (Tables 1 and 2), the check variety had the lowest number of days to maturity. This indicated early maturing and it suggested that early maturing varieties are adaptable for areas with short rainy seasons and can escape severe water deficit under terminal drought stress. Yirgalem, Henlegebriel, Alem, Redae, Geremedhin, Desalegn, Welegerima, Yowhans, Eyasu, Kiros, Abadi andTesfahun (2019) reported similar findings.

Grain Yield (Kgha^{-1}): The results of the grain yields for the two years of experimentation are presented in Tables 1 and 2. From the results obtained, treatment had significant effect on grain yields. In Table 1, grain yields ranged from 2, 866.67 kgha^{-1} to 1,300 kgha^{-1} in Nerica 1 and the check respectively. It was observed that in the first year of study, Nerica 2 produced significantly (P<0.01) higher grain over the remaining Nerica varieties but was not statistically different from the grain yields obtained from Nerica 1 and 4 that were statistically at par.and was followed by Nerica 3 which was also statistically higher grain yield and the check recorded the lowest grain yield. However, in the second year of study, grain yields also ranged from 1,966.67 kgha^{-1} to 816.66 kgha^{-1} in Nerica 2 and the check respectively (Table 2). Nerica 2 produced significantly (P<0.05) higher grain yield than the remaining Nerica varieties and the check (Table 2).

The grain yields recorded from the remaining Nerica (1, 3 and 4) varieties and the check were not statistically different and the yields were all at par (Table 2). The higher grain yield recorded by Nerica 2 could be attribute to more assimilate partitioning and dry matter production for grain filling and might also be due to its high tillering capacity that resulted in higher grain yield. Similar findings has been reported by Umoh, Sharifai and Isah, 2018).

Conclusion

The results of these studies showed that Nerica rice varieties performed well by producing good components and yields. It also indicated that the Nerica rice varieties are adaptable to the Jos Plateau Climate, Soil and Environment.

Table 1: Mean Growth and Yield Components of Some Nerica rice Varieties and a Local Check in 2021

Treatment	Number of tillers	Number of spikes/ m^2	Plant height (cm)	Panicle length (cm)	Days of maturity	Grain yield (kgha^{-1})
LC	4.53b	139.67	76.31	46.63	101.33c	1,300.01c
N1	5.30b	158.33s	75.77	55.02	105.67b	2,250.00ab
N2	7.40a	168.02	88.39	53.30	120.00a	2,866.67a
N3	5.47b	149.33	88.91	59.99	116.67a	1,516.67bc
N4	5.60b	156.33	91.21	54.71	120.00a	2,250.00ab
SE+	0.56	14.65	47.18	3.25	1.20	230.05
CV (%)	15.7	15.1	8.9	10.0	1.7	20.0

Mean in a column or row of treatments followed by same letter(s) are not significantly different (P< 0.05) level of probability using DMRT

Key: LC = Local check (Sipi), N1 = Nerica 1, N2 = Nerica 2, N3 = Nerica 3 and N4 = Nerica 4.

Table 2: Mean Growth and Yield Components of Some Nerica Rice Varieties and a Local Check in 2022

Treatment	Number of tillers	Number of spikes/ m^2	Plant height (cm)	Panicle length (cm)	Days of maturity	Grain yield ($kgha^{-1}$)
LC	6.63	120.67	66.77	57.30	100.00c	816.67b
N1	6.73	137.67	79.53	65.77	128.67a	1,116.67b
N2	8.17	166.33	87.83	41.80	126.33ab	1,966.67a
N3	7.93	136.67	81.07	59.03	124.33b	1,333.33b
N4	6.90	159.33	86.97	58.73	124.67b	1,100.00b
SE +	0.52	20.97	4.72	8.61	1.16	183.81
CV (%)	11.7	23.2	9.3	24.3	1.5	23.1

Means in a column or row of treatments followed by same letter (s) are not significantly different (P< 0.05) level of probability using DMRT

Key: LC = Local check (Sipi), N1 = Nerica 1, N2 = Nerica 2, N3 = Nerica 3 and N4 = Nerica 4.

REFERENCES

Bihim, D. B. (1987). Irrigation capacity of soils of Ta – hoss area of Plateau State. National Higher Diploma (HND) Thesis. Federal College of Land Resources Technology, Kuru, Jos, Plateau State, pp.7 – 8.

Chabra, D. M., Kashaninejad, and Rafiee, S. (2006). Study and comparism of waste contents in different rice dryers. Proceedings of the 1st National Rice Symposium (NRS'06). Amol.Iro. Asian Journal of Biological Sciences. 11 (12). Doi. 10.3923/JBS:1-5.

Efisue, A.A., Umunna, B.C. and Orchuckwu, J.A. (2014). Effect of yield components on yield potentials of some lowland rice (Oryza *sativa L.*) in coastal regions of southern Nigeria. *Journal of plant breeding crop science*, 6:119-127.

Fofana, B. (2012). More rice with improved Nitrogen Efficiency: In a paper presentation for Trainers of Training program "Urea Deep Placement (UDP) Technology". ACDI/VOCA-NAFAKA Project MOROGORO – Tanzania. IFDC- EAST and Southern Africa. Division. Pp. 1-10, January 10-12.

Gregory, J. P., Ingram, J. S. and Kobayashi, T. (200). Rice production and Global change. Global environ. Res. 2: 71 – 77, Am. Soc. Agron, 23: 388 – 395.

Kyle, P. (2021). Understanding Primary Factory Driving Plant growth. *Country Journal farm, science Review. 19-21*.

Okonji, C. J., Okeleye, K. A. and Oyekanm, A. A. (2007). Performance of growth and yield of rice (oryza sativa L.) varieties in a cassava (Manihot esculentus crant) rice intercrop in the South West Nigeria. International Journal of Agricultural Research, 2 (4), 359 – 367. Doi:10.3923/ijar.2007, 359 – 367.

Pernes, J. (1984). Management of genetic resource. Tome 2 Acct. Manual. Paris. 1984:354.

Umoh, I. J., Sharifai, A.I., and Isah, A.S. (2018). Effect of Urea superganules, Rate and time of application of Biostimulant on rice (Oryza *sativa L.*) yield in sudan savanna. The52nd Annnual Conference Proceedings of Agricultural Society of Nigeria (Abuja 2018), 22-26, October, 2018, pp. 395- 401.

Yirgalem, T., Hanlegebriel, K., Alem, R., Redae, W., Geremedhin G., Desalegn, Y., Welegerima, G., Yowhans, G., Eyasu, A., Kiros, A., Abadi, G. and Tesfahun, M., (2019). Evaluation of performance for yield and yield components of upland rice under rainfed conditions. *Asian Journal of biological sciences, 11:78-82.*