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Effects of Age at Transplanting on Growth, Tillering and Yield of Swampy Rice in Southern Guinea Savannah Zone of Nigeria

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ABSTRACT: This experiment was carried out in 2012 and 2013 cropping seasons at the experimental field, Kabba College of Agriculture, Horticultural Section (Latitude 7^0 53 N, Longitude 6^0 8 E) in the Southern Guinea Savannah ecology to investigate the effects of age at transplanting on growth and tillering pattern of swampy rice [NERICA 1]. The treatments consist of six different ages at transplanting (6, 10, 14, 18, 22, and 26 days). The treatments were arranged in a Randomised Complete Block Design and replicated three times. Data were taken on agronomic traits such as plant height, leaf area, stem girth and number of tillers per plant. Yield parameters taken were number of grains per panicle, weight of grains per plant and panicle length. Data collected were subjected to analysis of variance (ANOVA) and means were separated using Duncan Multiple Range Test at 5% level of probability. The result obtained from study indicated that delayed seedlings at the nursery (22 and 26 days) were better in terms of growth parameters except in the number of tiller produced per plant. Early transplanting of seedlings at 6 and10 days was superior in grain yield. However, in all the ages considered seedlings transplanted at 10 days recorded the highest number of tillers and grain yield. It is therefore recommended that rice seedlings [NERICA 1] should be transplanted at 10 days in the study area.

Keywords: Rice, seedling, tillering, transplanting age, nerica-1, grain yield

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INTRODUCTION

Rice, *Oryza sativa* is the world's single most important food crop, being the primary food source for more than a third of the world's population and grown on 11% of the world's cultivated area (Khush, 1996). It is an important staple food crops in Africa, Asia, and Latin American in the tropics and subtropics. The world demand for rice is projected to increase by as much as 70% over the next 30 years (Parths, 1996). This projected demand can only be met by maintaining steady increase in production over the years through various ways such as adoption of hybrid rice, using appropriate spacing and maintaining the right age at transplanting.

New rice for Africa (NERICA), developed in 2004 by African rice is a cross between the cultivated *Oryza sativa* (Asian rice) and *Oryza glaberrima* (African rice). It is high yielding, early maturing (75-100 days), drought tolerance, high weed competition, moderately tolerant to iron toxicity, soil acidity, and resistant to major rice pests and diseases in Africa. These attributes have made Nerica rice gained popularity among farmers in Africa. It is often called mother can no longer refuse her children in Republic of Guinea and perfumed high quality rice or rice of hope in Côte d'Ivoire. Rice is widely cultivated in virtually all the agro-ecological zones in Nigeria ranging from the mangroves swamp ecology to the dry zones

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of Sahel where it is intensively cultivated under irrigation. In spite of this cultivation, statistics has shown that Nigeria is the largest rice importers in West Africa with an average yearly import of over two million metric tons USAID (2010).

Tillering is an important agronomic character that determines the number of panicle, and grain yield per unit area of land (Latif *et al*., 2005), and the dynamics depend on the age at transplanting (Pasuquin *et al*., 2008). It determines the number of leaves which produce the photosynthates and the panicle which bears the grains. Hence, any agronomic measures aimed at increasing yield in rice must be directed at the number of tillers produced per plant. Transplanting seedlings need more time to recover from the transplanting shock which is often influenced by the age at transplanting. Transplanting younger seedlings provides more effective tillers/hill, filled grain per panicle, thousand grain weight and yield than older ones in a boro rice cultivar (Ali *et al*., 2013).In a recent similar study, Krishna *et al*., (2008), recorded high grain yield in early transplanting than late transplanting due to reduction in the number of tillers per hill. Mobaser *et al*. (2007) also observed that tillering and growth of rice proceed normally when optimum age of seedlings is transplanted at the right time. In the study, it was noted that when seedlings stay for a longer time in the nursery beds, the primary tiller buds on the lower nodes of the main culm become degenerated leading to reduced tillers production. In view of the importance of age of seedlings on the tillering and yield in rice production there is the need to investigate the appropriate age of transplanting in this new rice culivar that has gained popularity among the farmers in the study area. The objective of the study is to examine the effect of seedling transplanting age on tillering and yield of swamp rice (NERICA 1) in the study area.

MATERIALS AND METHODS

The experiment was carried out at the experimental station of College of Agriculture, Kabba in the Southern Guinea Savannah Ecological zone of Nigeria ($7^0$53 N, $6^0$8 E). Kabba has an average rainfall of about 1,850 mm per annum with average temperature range between 28^0c - 32^0c. The mean relative humidity is of about 59 % and situated at four hundred and twenty seven meters (427 m) about sea level. Rice seeds (Nerica) cultivar was collected at Premier Seed Company; Zaria. The seedlings were raised on a nursery bed of 3 m x 4 m. At the nursery, watering was carried as required and also kept free from weeds. Slight shading was provided with palm fronts to prevent direct impact of sunlight on the seedlings and also to reduce loss of moisture. Cyalothrin was applied at the rate of 1ml/litre of water fortnightly using knapsack sprayer to control insect pests in the nursery. The seedlings were transplanted at 6, 10,14,18,22 and 26 days after planting (DAP). The experimental field plot size of 29 m x 16 m was laid out into three (3) blocks with 1m guard row between the blocks. Each block was sub-divided into six (6) plots of size 4m x 4 m having 0.5 m guard between them. The treatments, age at transplanting (6, 10, 14, 18, 22 and 26 days old) were arranged in a Randomized Complete Block Design (RCBD) in three (3) replicates. Weeding was done manually with hoe and hand pulling at four (4) weeks interval commencing from three weeks after transplanting (WAT). Urea fertilizer was split applied at 3 WAT and at panicle initiation stage at the rate of 280 kg/ha. Birds were scared with cellophane tape and rodent was control with wire net fencing around the experimental trial.

Data collected on tillering commenced at 2 WAT during growth while yield and yield components were collected at maturity from five tagged plants. The parameters taken were as follows; plant height (cm); stem girth(cm); number of tillers produced per plant; internodes' length; panicle length; number of panicles per plant; number of grains per panicle; grain yield per plant (g) and grain yield tons per hectare (tons/ha). Data collected were subjected to analysis of variance (ANOVA) and means were separated using Duncan Multiple Range Test (DMRT) at 5% level of probability.

RESULTS AND DISCUSSION

The growth response of rice to different ages at transplanting is shown in Table 1. Generally, growth parameters; plant height, stem girth, and leaf area were significantly affected by age at transplanting. Rice seedlings at 22 and 26 DAT were better in term of plant height, stem girth and leaf area, when compared with those transplanted at 6 and 10 DAT. Seedling transplanted at 26 DAT was highest in plant height, stem girth and leaf area with values of 113.83 cm, 2.38 cm and 0.41m^2 respectively while the least value was observed at 10 DAT with values of 79.83, 1.76 and 0.36 respectively. No significant difference was observed in internodes length among the treatments. However, internodes length was higher in seedlings transplanted at later dates than those transplanted at earlier dates. Seedlings transplanted at 6 days produced the least internodes length. It was found that seedlings delayed at the nursery were better in plant height, stem girth and leaf area. Plant height is an important agronomic trait that influence yield in crop. The observed superior plant height in seedling transplanted at early stage did not conform to the report of Gani *et al.* (2002). It was reported in the study that rice seedlings transplanted at seven (7) and fourteen (14) days were taller than those transplanted at twenty one (21) days. This discrepancy could be due to

Table 1: Effect of different age before transplanting on growth parameters of rice (NERICA1)

Age (days)	Plant height(cm)			Stem girth(cm)			Leaf area(m$^{2)}$			Internodes length (cm)	
	2012	2013	mean	2012	2013	mean	2012	2013	mean	2012	2013
6	76.41	87.05	81.73^{d}	1.78	2.18	1.98^{ab}	0.32	0.40	0.36^{b}	10.71	10.89
10	82.42	77.23	79.83^{d}	1.62	1.90	1.76^{b}	0.39	0.33	0.36^{b}	12.33	12.67
14	104.6	93.26	98.93^{bc}	1.98	2.24	2.11^{ab}	0.36	0.40	0.38^{ab}	12.78	12.82
18	100.4	81.86	91.13^{c}	2.13	2.09	2.11^{ab}	0.39	0.35	0.37^{ab}	14.80	13.00
22	96.7	115.3	106.0^{ab}	2.44	2,24	2.34^{a}	0.39	0.41	0.40^{a}	14.11	14.29
26	114.1	113.5	113.8^{a}	2.53	2.23	2.38^{a}	0.40	0.42	0.41^{a}	13.04	14.16

Means followed by the same letter in the same column are not significantly different at P<0.05

Table 2: Effect of different age before transplanting on number of tiller produced on rice (NERICA1)

Age (days)	20 days after transplanting			40 days after transplanting			60 days after transplanting		
	2012	2013	mean	2012	2013	mean	2012	2013	mean
6	10.23	8.05	09.14^{b}	23.77	25.29	24.53^{b}	30.41	27.53	28.97^{a}
10	12.41	8.21	10.31^{a}	29.48	27.68	28.58^{a}	29.69	31.23	30.46^{a}
14	11.66	12.88	12.27^{ab}	25.62	21.44	23.53^{b}	24.44	24.94	24.69^{b}
18	13.44	14.82	14.13^{a}	19.44	23.54	21.49^{b}	22.71	26.55	24.63^{b}
22	9.68	11.14	10.41^{ab}	18.53	22.67	20.60^{b}	25.83	23.71	24.77^{b}
26	13.41	11.01	12.21^{ab}	22.78	20.08	21.43^{b}	24.66	27.68	26.17^{b}

Means followed by the same letter in the same column are not significantly different at P<0.05 translocation of photosyntates to stem elongation in the seedlings that stayed longer at the nursery with consequent poor tillering as evident in the results.

The numbers of tiller produced at 20, 40 and 60 DAT were presented in Table 2. Differences in age at transplanting significantly affected tiller production in rice at 20, 40 and 60 sampling dates. Number of tillers ranges between 9.14 to 14.31, 20.60 to 28.58 and 24.63 to 30.46 at 20, 40 and 60 days. Number of tiller produced was highest in seedling transplanted at 10 days at sowing in 20, 40 and 60 days sampling dates. Generally, number of tillers was higher in seedlings transplanted at younger age when compared with those transplanted at older age. Number of tillers produced varied among the treatments, and increased in the treatment up to 60 days after transplanting. Partha and Samsul (2011) studied the effect of seedlings age on tillering pattern and rice yield under system of rice intensification observed similar observation. They reported that number of tiller attained maximum value at 60 days after transplanting and tiller production was highest in younger seedling. This was attributed to profuse tillering during vegetative growth. Low tillers observed in seedlings transplanted at longer days could be attributed to tiller mortality that associated with delayed seedlings at the nursery. Better performance of young seedlings might also be due to ability of the younger seedlings to recover quickly from transplanting shock and ability to establish early than older seedlings (Partha and Samsul, 2011). In another study, Mobaser *et al.* (2007) also reported poor tillering in rice transplanted at longer days due to degeneration of the primary tillers buds on the lower nodes of the main culm.

Table 3 showed the result of yield component of rice as affected by differences in age at transplanting. There were significant differences in number of panicle per plant, panicle weight and number of grains per panicle, but length of panicle was not significantly affected. Number of panicles per plant, panicle weight per plant and number of grains per panicle range from 26.83 to 35.64; 1.83 to 2.31 and 1.07 to 2.44. The result showed that number of panicle per plant and number of grain per panicle were better in seedlings transplanted at 6, 10 and 14 days (31.14, 35.64 and 33.10) when compared with seedlings transplanted at the age of 18, 22, and 26 (29.36, 28.55 and 33.10). Also, seedlings transplanted at early stage performed better in number of grains per panicle than seedlings delayed in the nursery above 14 days. However, seedlings delayed in the nursery had higher panicle weight than those transplanted earlier. In all the treatments, seedlings transplanted at 10 days had the highest values in number of panicles per plant, number of grains per panicles and yield. This observation agreed with the work of earlier researchers (Ali *et al.*, 2003; Mobaser *et al.*, 2007,

Table 3: Effect of different age before transplanting on yield characters of rice (NERICA1)

Age Days	Panicle Length (cm)			Number of panicle per plant			Panicle weight (g)			Number of grains/ panicle			Yield (t/ha)		
	2012	2013	mean	2012	2013	mean	2012	2013	mean	2012	2013	mean	2012	2013	mean
6	26.12	32.80	29.46^{a}	29.84	32.44	31.14^{c}	1.76	1.9	1.83^{b}	204	192	198^{ab}	4.32	5.24	4.78a
10	31.41	28.55	29.98^{a}	38.42	32.86	35.64^{a}	2.04	1.88	1.96^{ab}	236	252	244^{a}	6.41	4.63	5.52a
14	26.89	33.73	30.31^{a}	32.44	33.76	33.10^{b}	2.46	2.16	2.31^{a}	237	215	226^{ab}	3.41	4.55	3.98ab
18	31.51	29.37	30.44^{a}	30.46	28.26	29.36^{d}	2.21	2.01	2.11^{ab}	194	134	164^{abc}	4.01	2.53	3.27b
22	28.66	30.60	29.63^{a}	26.22	30.88	28.55^{dc}	1.98	2.14	2.06^{ab}	136	100	118^{bc}	3.22	3.08	3.15b
26	30.44	26.48	28.46^{a}	30.48	23.18	26.83^{e}	2.11	2.01	2.06^{ab}	104	110	107^{c}	2.51	2.55	2.53b

Means followed by the same letter in the same column are not significantly different at P<0.05

Sanjeewanie and Ranamukhaara, 2011). Transplanting seedlings need more time to recover from the transplanting shock. In rice, growth and tillering proceed normally when the seedlings are transplanted at the appropriate time. Transplanting at ten days appeared to be the most suitable time for nerica cultivar as observed in this study. Thiyagarajan *et al*. (2002) observed highest grain yield in 8-10 days old seedlings. Similarly, Krishna and Biradarpatil (2008) reported highest grain yield (3.25 tones/hectare) in seedlings transplanted at 12 days and that the yield declined at longer days transplanting due reduction in the number of tillers.

CONCLUSION

The results of this experiment indicated that seedlings transplanted at a young age particularly at ten days before transplanting performed better in growth and yield parameters. It is therefore recommended that rice seedlings variety (NERICA 1) be transplanted at ten days after planting in the study area.

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