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The Effect of Different Sowing Methods on Seed Yield Of Rice (Oryza Sativa) in Makurdi Local Government Area of Benue State, Nigeria

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ABSTRACT

In a field experiment carried out in 2012 growing season, 3 upland rice varieties were planted with three different methods of seedling. The total combination of rice varieties to sowing methods give a total of 9 treatments, each treatment was replicated thrice and the treatments were randomly planted. Number of tillers, panicle weight and number of seeds per 3 panicles were measured with an electronic weighing balance and analysis statistically in a fractional order under a randomized complete block design (RCBD). Showed that there was significant variety and method interaction on the effect of different sowing methods on seed yield of rice, the 3 upland rice varieties that the only trait affected by sowing methods was the Dibbling method, similarly, yield of all other yield component were significantly affected by the variety. The non- significant method of seedling and variety interaction effects on most of the parameters of evolution and the significant seedling method effects on panicle producing tillers were also discussed. A case was made for more investigation on number of seeds per 3 panicles.

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Introduction

Rice is the seed of a monocot plant, *Oriza sativa*. It belongs to the family Poaceae; as a cereal grain, it is the most important staple food for a larger part of the world's human population especially in Asia, the Middle East, Latin America, West Indies and Africa. It is one of the world's three most produced grains along with wheat and maize (corn) (Chandler, 1979; Erebor, 1998 and Eleanor, 1975).

Rice is a short day summer crop grown under diverse climatic and edaphic conditions. It grows well in humid tropical regions with high temperature, plenty of rainfall and sunshine in heavy clay or clay loam soils (Javaid *et al*., 2012). It is tolerant to a range of soils with pH from 4.5 to 8.5 and can be grown successfully on saline or sodic soils (Anonymous, 2002).

Rice has a number of energy rich compounds such as carbohydrates, fat, protein and reasonable amount of iron, calcium, thiamine, riboflavin and niacin are found in rice (Juliano., 1993). It is an important staple food crop for nearly half of the global conditions and is a short day summer crop. It grows well human population and a number of energy rich in humid tropical regions with high temperature and compounds such as carbohydrates, fat, protein and sunshine in clay to clay loam soils. It is tolerant to a range reasonable amount of iron, calcium, thiamine, riboflavin of soils with pH from 4.5 to 8.5 and can be grown (Juliano., 1993).

Besides to its importance for food security, it is becoming a good source of income and employment opportunity. Rice can be prepared in different types of food staffs. The flour can be made into 'Enjera, favorite and long stay food in Ethiopia', bread, porridge and 'Tela, traditional drink' (Abadi., 2013).

Ninety percent of the world's rice is produced and consumed in Asia, where irrigated and rainfed rice ecosystems form the mainstay of food security in many countries (Wassmann et al., 2009).The direct-seeded rice area in Asia is about 29 million ha, which is approximately 21% of the total rice area in the region. (Dawdi and Chaudhary, 2013).

The crop constitutes one of the major crops produced in Nigeria. According to Babafada 2003, rice is the fourth major cereal crop in Nigeria after sorghum, millet and maize, in terms of output and cultivated land area. It is a major staple and most popular cereal crop of high nutritional value grown and consumed in all ecological zone of the country (Ohaka et al.,

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2013; Omotesho et al., 2010; Raufu, 2014; Ohajianya and Onyenweaku, 2003; Ajah and Ajah, 2014 and Abdullahi, 2012).

Yuguda (2003) and Ohaka et al. (2013) are of the view that before the advent of crude oil, Nigeria produced almost enough rice for local consumption. However, with the discovery of petroleum in the 70's, its production declined steadily over the years in relation to consumption with the result that lately, rice importation takes away huge sums of money from country's hard earned foreign exchange.

Rice production is dependent on mainly climatic factors, but the most detrimental is availability of soil moisture. However, production and productivity of the crop is also determined by soil fertility, planting methods, and other biotic and abiotic factors which either directly or indirectly affect its growth and development. (Abadi., 2013).

There are different rice planting methods, but the most common ones are transplanting and direct sowing. Transplanting of rice seedlings in the traditional way is a laborious, time consuming and causes drudgery. Whereas, direct sowing of rice crop may be prone to late moisture stress in Dry land areas; where, late onset and early withdrawal of rain prevail. In rice crop production, the planting methods have an impact on the growth and yield besides cost of cultivation and labor requirement 0. (Abadi., 2013)

The first three channels suggested as the means of improving yields and all directly related to improved and better agronomic characters, one may still obtain high yield from the available seeds by giving the best environmental conditions to the growth and the development of the growing crops. Another type of such treatments is planting methods. The aim of this experiment therefore is to assess the effect of different sowing methods on the seed yield of rice.

Materials and Methods

The trial was carried out at the experimental Research and Teaching Farm of the University of Agriculture, Makurdi. The location falls within the latitude 7.14˚N and longitude 8.37˚E which lies in the southern guinea savanna belt of Nigeria.

The site is generally sloppy while the soil is sandy clay with a sub soil which is imperious to water.

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A factorial experiment in randomized complete block design was used for the trial. The experiment contained three blocks each block contains 3 plots. Treatments were assigned to each plot at random. Each treatment was replicated three times. Three upland rice varieties were used. They are Sippi, Faro15 and China. Three different methods were used for the sowing. They are Dibbling, Drilling, and Broadcast respectively. 3 blocks were marked out bearing a furrow space of 1m between each block and another. Each block was further divided into 3 plots. Each plot had an area of 3m x 3m and the length wise and the breath wise distances between each plot were also a meter furrow respectively. The whole area under cultivation was 11m x 11m ($121m^2$).

The land was cleared using glyphosate at 10ml per 20litres of water, herbicide and cutlass. This was done a month before cultivation of the land through the use of hoe (manually). Seeds were sown between 16^{th} -17^{th} of June, 2012 at the rate of 50kg/ha which is an equivalent of $125g/25m^2$.

On each Dibbling plot, seeds were first sown on a lawn in a nursery, and two weeks later the seedlings were uprooted from the nursery and transplanted to the main plot at 1 seedling per hole at spacing of 25cm.

On each Drilling plot, 15lines were drill and the spacing between two lines was 25cm. Seeds were evenly sprinkled along each line after which they were covered with soil.

On each Broadcast plot, the seeds were broadcast and raked in so as to ensure even distribution and partly buried under the soil for good germination.

NPK 15:15:15 fertilizer was applied preplanning at the rate of 15g/plot. The plot was top dressed with ammonium sulphate fertilizer when the rice was twelve and a half weeks old. The fertilizer was also applied at the same rice

Selective, post-emergence herbicide, Propanil was sprayed when the crops were 3 weeks old (21days), this gave a good weed control for 4 weeks after which hand weeding commenced at 3 weeks interval until the time of harvesting.

Ten stands in each plot were selected for collection of data during ripening. At harvest, number of tillers per stand was counted; weight of panicle per each tiller was also taking before number of seeds per three panicles was determined.

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The analysis collected on all the parameters was statistically analyzed using Genstat software. Where significant differences were obtained, means were separated using the Fishers heart significance (LSD).

Results and Discussion

The analysis of variance for the number of tillers at 3 different planting methods (Broadcast, Dibbling and Drilling) showed significant differences for source of variation. Mean square for 3 upland rice varieties planted to 3 seedling methods are presented in table1.

The analysis of variance for number of tillers at 3 different upland rice varieties (Sippi, Faro15 and China) showed that there were significant differences observed.

The analysis of variance for the number of tillers at 3 different planting methods (Broadcast, Dibbling and Drilling) showed significant differences for source of variation. Mean square for 3 upland rice varieties planted to 3 seedling methods are presented in table1.

The analysis of variance for number of tillers at 3 different upland rice varieties (Sippi, Faro15 and China) showed that there were significant differences observed between Sippi and Faro15, between Sippi and China, but there were no significant difference between Faro15 and China varieties at 5% level of probability. The numbers of tillers at 3 varieties are shown in table1 identified Sippi variety as the one with the highest number of tillers, this was followed by Faro15 variety while China had the least number of tillers.LSD test ranked Sippi 9.19 > Faro15 7.44 > China 6.56 respectively.

Planting cmethod × varieties for the number of tillers at Broadcast method, there were no significant difference observed among the 3 varieties, at Dibbling method, significant difference existed between Sippi and Faro15, between Sippi and China, but does not exist between Faro15 and China, at Drilling method, there is no significant differences observed between Sippi and Faro15 but significant differences were observed between Faro15 and China, between Faro15 and China at 5% level of probability are shown in table2 respectively.

In the analysis of variance for panicles weight in each 10 tillers at 3 different sowing methods showed significant differences among the 3 methods, the mean square for 3 upland rice varieties planted to 3 different sowing methods are presented also in table1.

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The analysis of variance for weight of panicles at 3 upland rice varieties revealed that, there were no significant differences observed between China and Faro15, but there were significant differences observed between China and Sippi, between Faro15 and Sippi at 5% level of probability. LSD test ranked the varieties as Sippi 18.38> China 16.54 > Faro15 15.24 are shown in table1 respectively.

Planting method × Varieties for weight of panicles at Broadcast method revealed that there were no significant differences observed among the 3 varieties, at Dibbling method significant differences were observed among the 3 varieties, at Drilling method, significant differences were observed between China and Faro15, between Faro15 and Sippi, but there were no significant difference observed between Sippi and China at 5% level of probability as shown in table2 respectively.

The analysis of variance for the number of seeds/3panicles, at 3 different planting methods showed significant differences among the 3 methods of planting for 3 upland rice varieties are presented in table1 respectively.

The analysis of variance for number of seeds/3panicles at 3 upland rice varieties showed that there were significant differences observed among the 3 varieties at 5% level of probability are shown in table1 identified Sippi variety with the highest number of seeds, this was followed by Faro15 variety while China had the least number of seeds.

Planting methods × Varieties for number of seeds at Broadcast method revealed that there were significant differences observed between China and Faro15 but does not existed between Faro15 and Sippi, at Dibbling method there were significant differences observed among the 3 varieties, at Drilling method there were also significant difference were observed among the 3 upland rice varieties at 5% level of probability as shown in table2 respectively.

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Table 1: Variations in number of tillers, panicle weight, and number of seeds/3 panicles produced by 3 different upland rice varieties when 3 methods of planting were used

Planting methods	No of tillers	Panicle weight	No of seed/3 panicles
Dibbling	8.44[b]	21.95[a]	101.1[b]
Drilling	10.00[a]	17.36[b]	133.7[a]
Broadcast	4.74[c]	10.58[c]	75.3[c]
LSD	0.73	1.78	9.36
Varieties			
Sippi	9.19[a]	18.38[a]	143.3[a]
Faro15	7.44[b]	15.24[b]	99.2[b]
China	6.56[c]	16.54[b]	67.4[c]
LSD	0.73	1.78	9.36

a, b, c: Figures with the same letters are not significantly different from each other.

Table 2: Interaction effects on planting methods x varieties on numbers of tillers, panicle weight and number of seeds/3 panicles of 3 upland rice varieties

Varieties	Planting methods	No of tillers	Panicle weight	No of seeds/3 panicles
Sippi	Broadcast	5.44[c]	10.20[c]	89.3[c]
	Dibbing	10.67[b]	26.85[a]	150.0[b]
	Drilling	11.44[a]	18.08[b]	191.0[a]
Faro15	Broadcast	4.44[c]	10.01[c]	82.0[b]
	Dibbling	7.67[b]	21.45[a]	95.3[b]
	Drilling	10.22[a]	14.28[b]	120.3[a]
China	Broadcast	4.33[c]	12.34[b]	54.7[b]
	Dibbling	7.00[b]	17.54[c]	58.0[b]
	Drilling	8.33[a]	19.74[a]	89.7[a]
LSD		1.26	3.08	16.22

a, b, c: figures with the same letters are not significantly different from each other.

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The number of tillers in 3 varieties was fair to good, the lack of significant response of varieties to methods of sowing might be due to the single seed rate (50kg/ha) used as well as the nature of varieties. The flowering patterns of the different varieties indicated that they were really different. The superiority of Sippi over the two varieties (Faro15 and China) in number of tillers at Broadcast method lost to Faro15 at post heading period. One would have expected that tillers would terminate at heading stage but all the varieties exhibited increased tillers number at post heading with having Sippi superiority over the other varieties. It is suggested that the issue of number of tillers producing panicles be investigated further because of the implications it has on soil nutrition to feed additional tillers.

The significant differences observed between Drilling, Dibbling and Broadcast methods, and the non-significant differences observed between China and Faro15, and the significant differences observed between Sippi and Faro15, between Sippi and China for number of tillers, weight of panicles in each 10 tillers, and number of seeds/3 panicles might be due to the fact that Drilling and Dibbling methods lead to the establishment of seedling that were well spaced, while there is no such good spacing among the seedling in the case of Broadcast method. The tillering ability of plant was suppressed by the clustering of plants in a group and this in turn reduces the overall tiller numbers in each group. This is agreement with the finding of Arraudeau and Vergara (1988), which showed that too many seeds per hill reduce the number of tiller per plant and that tillers number determined the number of panicles and that this was a very important factor in seed yield. This means that the higher the tiller numbers, the higher the number of panicles that will be formed. Hence, since Drilling and Dibbling methods give rise to high tiller numbers, it should be expected that they also gave rise to more panicles number than those produced from Broadcast method.

Based on the above discussion, it was reported that tiller number at Broadcast, Drilling and Dibbling were due to the variation among varieties and therefore one could expect that the weight of tiller producing panicles should also have been due to the variation in varieties. This is reasonable expectation however, the aim of any trial is to know the reality, and the reality in this experiment is that there are effects of different sowing methods on seed yield of rice.

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The non-significant interaction effects of varieties and seedling method on seed yield of rice might be due to the same trend of response exhibited by the varieties of the seedling methods. This superiority yield of Sippi variety over Faro15 and China might be due to varietal characteristics. This might be explained by the performance of this varieties in yield determine traits such as number of tillers, panicle weight and number of seeds per 3 panicles. The superiority of Sippi variety might also be due to comparative higher weight.

Conclusion

Most of the yield parameters were found to be influence by the various methods of sowing. The yield itself revealed that there was significant effect among the seeds establishment in the methods planting.

According to the various statistical analyses, all the yield parameters was affected by the sowing methods, though this is the case, the number of traits that were affected by varietal source of variation was more than the only one trait that responded to the methods of seed establishment of this crop. Moreover, those traits that responded to the varietal source of variation were stronger in their effect upon yield than the production of panicles. This is because it might be possible that a plant headed but the inflorescences were sterile. However it was not possible for seed weight to be measured without the seed itself not being produced after flowering, and this trait such as number of tillers producing panicles, panicle weight, number of seeds per 3 panicles, and the interaction effects of planting methods × varieties are some of the important yield determine factors that responded to the varietal source of variation not to sowing method.

Nevertheless, at 1% and 5% levels of probability respectively, the effect of sowing methods was significant on the effect of the planting method. The reason that may be accountable for the above phenomenon is that during the yield improvement programmed of these varieties, they all acquired the ability to respond to their respective genetic potential for good yield irrespective of the kind of method used in planting any of them.

Recommendations

Based on the results obtained, I would recommend that, preference should be given to the drilling method of planting for these three varieties of rice. Furthermore, the Sippi variety was found to be more promising than the two varieties considered in this study

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