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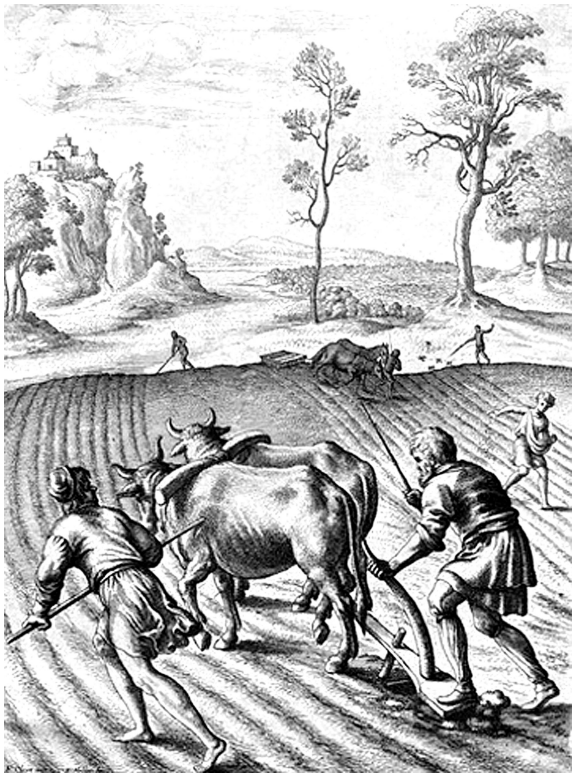

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On-Farm Evaluation of Rainfed Lowland Rice Varieties at Olokose Village, Odeda, Ogun State, Nigeria

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Abstract: A participatory variety selection trial was conducted in 2005 and 2006 in Olokose village to evaluate top crosses of *Oryza sativa* × *Oryza sativa* varieties developed for lowland agro-ecology under farmers' conditions and select desirable varieties for the ecology using the farmers participatory approach. The trial was conducted with thirteen lowland rice varieties planted in a randomized complete block design replicated in time. In the trial it was found that WITA 4 and WAS-161-B-6-B-B-1-B lowland rice varieties performed best with a grain yield of 7553 and 5000 kg ha^{-1}, respectively. The heavy tillering and non-lodging characteristics of the varieties were preferred traits apart from their high yields. WITA 4 and WAS-161-B-6-B-B-1-B which recorded higher yields of 98.03 and 31.09% over Etunbe, the local variety that yielded 3814 kg ha^{-1}, were preferred by most of the farmers.

Key words: *Oryza sativa* crosses, top-bottom approach, participatory variety selection, technical knowledge transfer

INTRODUCTION

Rice (*Oryza sativa*) is a major cereal crop in Nigeria and an important staple food of many households. Rice production in Nigeria rose from 2.4 million metric tonnes in 1994 to 3.1 million metric tonnes in 2002. Despite the rise in domestic production, the demand/consumption of rice far exceeds local production, precipitating an increase in the rice importation bill to as high as US $160 million in 2003 (FAO, 2003). The earliest cultivation of improved rice varieties (*O. sativa* L.) started in about 1890 with the introduction of upland varieties to the high forest zone in Western Nigeria (Atanda *et al*., 1978). Consequently, by 1960 *O. sativa* had taken over from *O. glaberrima*, which is now limited to some deep-flooded plains of the Sokoto-Rima river basin and other isolated pockets of deep swamps all over the country (Atanda *et al*., 1978; Imolehin, 1991a). With expansion of the rice cultivated land area from 2 million hectare to 2.9 million hectare, there has been a steady increase in rice production in Nigeria. The production increase of about 32% has, however, not been enough to meet the consumption demand of the rapidly growing urban population that has a great preference for parboiled rice (Singh *et al*., 1997). Per capita rice consumption rose from 3.5 kg in 1970 to more than 24 kg in the 1990s (Anonymous, 1994). This phenomenon was largely the result of increased per capita income, rapid population growth and changes in the tastes and diet of Nigerians. The total domestic rice demand is estimated at about 5 MMT while the production was 2.3 MMT and import stood at 1.3 MMT in 2004/2005. There is thus a shortfall of 1.4 MMT in what was required to satisfy the domestic requirement. The major problem of this shortage in domestic supplies is as a result of low productivity of cultivated local and some improved varieties, susceptibility to pest and diseases and poor nutrition arising from low soil fertility. Most of these problems are usually perceived by researchers who often times try to develop varieties to fit into different agro-ecologies. This approach to problem identification and solution has usually been top-bottom (Okeleye *et al*., 2006; Mccracken, 1988). That is, problems are perceived, diagnosed and solved by researchers through established National and International Institutions with little regard to the farmers. Varieties released through this process most often are not adopted by farmers. A change of approach is required as advocated by WARDA (2003). This is more so for inland valleys with great potential for higher yields than upland ecologies but with few improved varieties adopted by farmers. Also, in the conventional system of variety development and testing, selected varieties pass through the nationally coordinated rice evaluation trials in which newly bred varieties are evaluated for at least three years for desired characteristics before being

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released to Nigerian farmers (Imolehin, 1991b). Hithreto, most of these varieties introduced are upland varieties while most of the improved lowland varieties had not gotten to the few lowland rice farmers in the state. Thus, local varieties are used by lowland farmers. Ogun State is traditionally known for upland rice production. In order to get these lowland varieties across to the farmers, a new approach should be adopted to ensure that time required for testing, selection and adoption are reduced through the Participatory Variety Selection Concept proposed by WARDA (2003). Rice production to meet domestic demand can therefore be achieved effectively when improved rice varieties, along with appropriate cultural and management practices, are utilized by Nigerian farmers in all the ecological zones of the country. The objective of this study, therefore, was to evaluate top crosses of *Oryza sativa* × *Oryza sativa* varieties developed for lowland agro-ecology under farmers' conditions and select desirable varieties for the ecology using the farmers participatory approach.

MATERIALS AND METHODS

The trial was sited in one of the extension villages of the University of Agriculture, Abeokuta (UNAAB) noted for rainfed lowland rice production. The village population is about 60 farmers (male and female) (Table 1). Olokose village is situated in Odeda Local Government Area of Ogun State in Nigeria which is some few kilometers from the state capital, Abeokuta. This village is largely occupied by migrant farmers from the guinea savannah zone of Nigeria termed the middle-belt and are traditionally known for lowland rice cultivation. The host community has learnt the art of lowland rice production through these migrant farmers. A visit was made in company of the extension officers of the University's Agricultural Media Resources and Extension Centre (AMREC) to the village for a preliminary village square meeting. The purpose of the visit was to inform the community about the new varieties and to solicit for collaboration, selection of project site and to fix a date for the commencement of the trial. The concept of the participatory approach to variety selection and adoption was explained. The second visit was made to train the farmers on their role in the participatory variety selection approach and the benefit they stood to derive from it. Thereafter, the selected site was manually prepared by the farmers. The planting was done in August each year. A follow up visit was made to the farm to observe emergence of the varieties and also to further brief the farmers on Participatory Variety Selection (PVS) methodology. Subsequently, a farm visit was made weekly for other cultural operations, training and interaction between the farmers, the researchers and Agricultural Media Resources and Extension Centre (AMREC) Staff.

Preparation of the paddy: The lowland site for transplanting was prepared between late July and early August in both years. This involved clearing, stumping and puddling to get a smooth seed bed.

Nursery bed preparation: A drybed nursery was established in mid July of each year near the rice field. The size of each bed on which each variety was sown was 1×5 m. The topsoil was scooped, softened and watered. The seeds were sown and watered regularly until they were 3 weeks old.

Transplanting: After land preparation, farmers planted thirteen lowland rice varieties in the paddy in a randomized complete block design replicated in time. The field was laid out in a size of 4×25 m with an alley of 0.5 m in-between each variety. A seedling was transplanted per hill at a spacing of 20×20 cm. No fertilizer was applied as practiced by the farmers. No weed control was done as the field remained submerged throughout the growth period of the varieties. Data were collected on number of tillers per hill, plant height (cm), number of days to 50% flowering, panicle length (cm) and yield (kg ha^{-1}). The data were subjected to analysis of variance using MSTATC. At harvest, grain quality (1 = the best, 5 = the worst) was taken for taste, aroma, thresh-ability, ease of cooking, storage quality and swelling capacity.

Follow up visits: Follow-up visits were conducted during the tillering, vegetative, heading and maturity stages of development of the varieties. The farmers were taught how to recognise and count the tillers, note any signs of blast and stem borer attacks. They were asked to select their choice varieties from the lot at each stage of the visit.

RESULTS

The demographic and gender analysis indicated that 33 and 30% of the farmers at Olokose village are in the age group of 25-40 in 2005 and 2006, respectively (Table 1).

The age group 25-40 is regarded as the most vibrant and productive with an average farmer cultivating between 0.5-1 ha. of lowland variety. A slight decrease from 25 to 23% recorded in population of farmers in age group 41-60 in the same period was due to the toll of hard labour, old age and drudgery associated with rice production. It was found that 40% female, on average

Table 1: Demographic and gender analysis of farmers at Olokose village Participatory Variety Selection (PVS) trials

	2005		2006	
Variables	Frequency	Percentage of total	Frequency	Percentage of total
Age group				
10-15	11	18	14	23
15-25	9	15	10	17
25-40	20	33	18	30
41-60	15	25	14	23
≥60	5	8	4	7
Gender				
Male	15	25	13	22
Female	25	42	23	39
Children	20	33	24	40

Table 2: Mean squares from analysis of variance of number of tiller, plant height, number of days to 50% flowering, panicle length and yield

Sources	df	No. of tillers hill^{-1}	Plant height (cm)	No. of days to 50% flowering	Panicle length (cm)	Yield (kg ha^{-1})
Replication	1	572.46	6.50	0.03	1.17	146149.52
Varieties	12	166.53	10838.85**	6208.00**	198.02*	38161113.91*
Error	12	142.54	2106.70	0.46	68.67	13077478.47

*: p≤0.05; **: p≤0.01

Table 3: Plant height, number of days to 50% flowering, panicle length and grain yield of lowland rice in 2005 and 2006 at Olokose Village in Odeda, Ogun State, Nigeria

	Treatments				
Varieties	Plant height (cm)	No. of days to 50% flowering	Panicle length (cm)	Grain yield (kg ha^{-1})	Yield increase of improved over local (%)
L-18-6	95.8^{cd}	98.00^{g}	24.40^{cd}	3454^{b}	-
WAS122-IDSA-1-WAS-2-WAB-1	97.9^{bcd}	97.00^{h}	24.70	4502^{b}	118
WAS161-B-6-B-B-1-B	87.0^{d}	87.00^{i}	24.50^{cd}	5000^{b}	131
WAS161-B-6-3-FKR-1	87.0^{d}	87.00^{i}	24.60^{dc}	4981^{b}	131
WAS186-B-8-B-2	78.8^{d}	87.00^{i}	23.50^{d}	4404^{b}	115
FAROX508-3-10-F42-2-1	118.4^{abc}	123.00^{c}	32.60^{a}	3916^{b}	103
FAROX508-3-11-F63-1-1	125.8^{ab}	128.00^{b}	25.80^{bcd}	3467^{b}	-
FAROX508-3-11-F76-3-1	136.3^{a}	122.00^{d}	29.40^{ab}	3054^{b}	-
FAROX508-3-10-H20-1-1	133.3^{a}	129.00^{a}	30.30^{ab}	3227^{b}	-
FAROX508-3-10-H30-1-1	126.0^{ab}	122.00^{d}	27.50^{abcd}	2962^{b}	-
WITA 4	98.4^{bcd}	102.00^{e}	25.80^{bcd}	7553^{a}	198
TOOX4004-43-1-2-1 (CK)	121.0^{bcd}	102.00^{e}	27.80^{bcd}	2988^{b}	-
ETUNBE (Local)	141.3^{a}	101.00^{f}	30.60^{ab}	3814^{b}	-
LSD (0.05)	28.9	0.42	5.21	2275	

Means followed by the same alphabets are not significantly different (p≤0.05) from one another according to Duncan Multiple Range Test

basis, as compared to 23% male are involved in rice production. The 36% children involvement in the practice and art of lowland rice production gives a ray of hope that there would be an average succession of lowland rice farmers in the village.

Table 2 shows the mean square values for the parameters measured. Plant height and number of days to 50% flowering were highly significant (p≤0.01). Panicle length and grain yield were also found to be significant (p≤0.05).

The mean separation of parameters that were significant is shown in Table 3.

Among the varieties WITA 4 with a plant height of 98.40 cm recorded the highest grain yield of 7553 kg ha^{-1}. Most of the varieties that grew very tall; FAROX 508-3-10-F42-2-1, FAROX 508-3-11-F63-1-1, FAROX 508-3-11-F76-3-1, FAROX508-3-10-H20-1-1 and FAROX508-3-10-H30-1-1 (118.40, 125.75, 136.30, 145, 133.30 and 126.00 cm) recorded relatively lower grain yields (3916, 146.3467, 3054, 3227 and 2962 kg ha^{-1}). The assimilates that should have been used in grain filling were expended on vegetative growth. The farmers were really not fascinated by this growth habit and did not show interest in those varieties. The varieties that were preferred by most of the farmers are WITA 4 and WAS-161-B-6-B-B-1-B because of their large number of tillers carrying productive panicles (table not shown). Optimization of tiller production by regulating tillering through in-season crop management is essential for achieving high rice yield (Jiang, 1994; Su *et al*., 1996). The farmers liked this trait as it smother weeds and thus reduce cost of weed control. Other properties visually rated included fullness of grains, non-breakage of grains during processing, white grain colour, cookability and acceptable aroma. But most importantly the farmers were more interested in the grain yield.

DISCUSSION

The central objective of rice research is to increase production capabilities per unit area at the peasant level, through breeding and the selection of stable and low-level management varieties. Appropriate use of these improved and, in most cases, ecology-specific rice varieties by farmers in the different ecologies will boost overall national rice production. In this study, decrease in population of the most active age group 25-40 years old from 33% in 2005 to 30% in 2006 was noted. This decrease was probably caused by difficult farm work associated with lowland rice cultivation. Provision of subsidy on agricultural inputs, incentives, life supporting facilities, light farm tools and implements for the poor resource farmers at affordable prices by the government will attract more vibrant and young energetic men and women into lowland rice production. More female 41% engaged in lowland rice farming than men 24%. They are basically involved in land clearing, nursery bed preparation, preparation of the paddy and transplanting while the children 37% were involved in bird scaring. The traits considered very important by the farmers were number of tillers per hill, plant height, number of days to 50% flowering, panicle length and grain yield. Some of the improved varieties yielded significantly higher than the local check while others yielded much lower. The farmers ranked WITA 4 as the best and WAS122-IDSA-1-WAS-2-WAB-1, WAS161-B-6-B-B-1-B, WAS161-B-6-3-FKR-1, WAS186-B-8-B-2, FAROX508-3-10-F42-2-1 as good varieties because they had between 100-198% yield increase over and above Etunbe (check). Farmers would prefer to use a high-yielding cultivar that performs consistently from year to year (Kang, 1993). They may even be willing to sacrifice some yield if they are guaranteed to some extent that a particular cultivar will produce consistently from year to year (Kang and Pham, 1991). Although number of tillers was not significant, panicle length and number of days to 50% flowering appeared to be the only course to high grain yield recorded by the preferred varieties. All appeared to be medium duration and flowered between 78 and 88 days. Early flowering could have a bearing on longer period of grain filling. The active participation of the farmers in this trial exposed them to be able to differentiate between agronomic traits of improved varieties and their own. Technical knowledge is an important factor in determining the adoption of improved crop management practices and increased yield. This makes farmers' training and active participation in selection processes of new rice varieties very essential since this will enhance instant adoption; instead of Top-Bottom approach when new varieties are passed to farmers by researchers with expectation of acceptance and adoption. The introduced variety, most times, are not accepted and may not possess the qualities desired by the farmers. This study, in agreement with (Okeleye *et al*., 2006), has the potential to involve farmers in the development of new farming systems or adoption of new technologies.

CONCLUSION

After the trial, only two varieties WITA 4 and WAS-161-B-6-B-B-1-B were preferred by majority of the farmers primarily because of their higher grain yields and tillering ability. WITA 4 was adjudged the best by all the farmers that participated in the variety selection trial. It is thus recommended that breeders should pay more attention to improvement of tillering ability that contributed directly to grain yield in their crop improvement efforts. Therefore, results from Participatory Varietal Selection (PVS) trials should always be considered in breeding programmes.

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