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Research Application Summary

Adaptability of rice cultivars to different ecologies in western province of Zambia

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Abstract

Rice in Zambia has traditionally been grown in lowland flooded or semi-flooded environments. These environments are unfortunately only a small portion of Zambia, occupying only 1% of the total land. The increase in food demand in the country requires that other rice production environments be sought to expand the cultivation of the crop beyond the traditional flooded plains. This study was therefore set up to screen several lowland rice varieties and two upland rice varieties for suitability for cultivation in upland conditions. Two sites, Longe and Namushakende were used for the trial with 2 environments (upland and lowland) chosen at each site. There was both an environment and variety effect on grain yield. The superior varieties in upland conditions were Nerica 1 and Nerica 4. Under lowland conditions the best yielders were Supa, Kajakete, Wahiwahi and Black rice. It is recommended that the Nerica upland varieties be explored further for possible cultivation in upland Zambia conditions.

Key words: Flood plains, lowland rice, Nerica, upland rice

Résumé

Le riz en Zambie a été traditionnellement cultivé dans des environnements des plaines inondées ou semi-inondées. Ces milieux sont malheureusement qu'une petite partie de la Zambie, qui occupe seulement 1% de la superficie totale. L'augmentation de la demande alimentaire dans le pays exige que d'autres milieux de production du riz soient cherchés pour étendre la culture du riz au-delà des plaines traditionnelles inondées. Cette étude a donc été mise en place pour examiner plusieurs variétés de riz de plaine et deux variétés de riz de montagne quant à leur aptitude de culture dans les conditions de montagne. Deux sites, Longe et Namushakende ont été utilisés pour l'essai avec 2 milieux (montagne et plaine) choisis à chaque site. Il y avait à la fois l'effet du milieu et de la variété sur le rendement en grain. Les variétés de meilleure qualité dans des conditions de montagne ont été Nerica 1 et Nerica 4. Dans des conditions de basse altitude, les variétés de plus grand rendement ont été Supa, Kajakete, Wahiwahi et le riz noir. Il est recommandé

que les variétés Nerica de montagne soient explorées préalablement pour la croissance possible dans des conditions de montagne zambienne.

Mots clés: Plaines d'inondation, riz de plaine, Nerica, riz de montagne

Background

In Zambia, rice is gaining importance as both a commercial and food crop, especially in the rural areas. However, rice production is still low because of the limited lowland flood plains where it is cultivated (Mupo and Kambalakoko, 2008).There has been a demand that the superior rice varieties currently grown under flood plain to be grown in other ecological zones especially in the western province.

Production of rice in Zambia is done in lowlands because the varieties available are only adapted to lowland flood plains. High rainfall areas like agro-ecological regions II and III that receive rainfall between 800 to more than 1500mm per annum could be considered for screening rice cultivars that would eventually be released for cultivation in upland environments. This study was carried out to identify rice cultivars that are adapted to lowland and upland ecologies in order to indentify parental lines for developing varieties suitable for upland cultivation.

Literature Summary

The high adaptability of a variety refers to its high grain yield performance over diverse environmental conditions (De Datta, 1981). One of the most original features of rice is the fact that it can be grown under very different environmental conditions, especially in relation to water supply. It can be grown either as an upland crop, supplied solely by rain water or at the other end of the scale, as a floating crop, in sheet of water which maybe several meters deep, all the intermediate stages being possible (Kaitisha *et al*, 2002).

Rice in Western Province is cultivated in *Lishanjo, Litapa, Milapo,* flooded *Saana* and *Dambos* in the Wet Season from October to June (Mupo and Kambalakoko, 2008). Upland cultivation is rarely practiced. But this type of cultivation will become more important, as the rice requirement for local and national consumption is projected to increase.

Study Description

The study was conducted on two locations with each location having two ecologies. The two locations were Namushakende Technical Assessment Site (TAS) in Mongu and Longe TAS in

Kaoma. Each TAS had two sites the upland and the lowland making four sites in total.

Usually for Mongu, rainfall averages just less than 1000mm per annum. More than 90% of this total falls in the period November-March, and about 66% in the three wettest months, December-February. The soils in Mongu are sandy comprising predominantly medium and fine quartz sand with only very minor contents of heavy, dark or weatherable minerals. The sand grains are rounded and surrounded indicating an Aeolian origin. Kaoma on the other hand receives rainfall of more than 1000mm per annum and the soils are sandy loam.

Fifteen (15) varieties were tested for upland cultivation. Thirteen (13) of the 15 varieties are lowland and locally grown and they included; Supa, Burma, Sumbawanga, Giza, Kajakete, Angola 1, Malawi faya, IITA, Burma 2, Koshi hikari, Wahiwahi, Xiangzhou 5 and Black rice. The other two were the New Rice for Africa (Nerica 1 and Nerica 4) varieties already adapted to upland cultivation elsewhere.

Research Application

Yield was highly significant P< 0.05 across the four sites The highest yielding variety was Nerica 4 with yields of 3124 kg/ha at Namushakende TAS upland condition and 2100 kg/ha at

Table 1. Average rice grain yields at the two ecologies in Longe and Namushakende, Zambia.

Longe Upland		Longe lowland		Namushakende upland		Namushakende lowland	
Variety	Mean	Variety	Mean	Variety	Mean	Variety	Mean
Nerica 1	2100 a	Supa	3244 a	Nerica 4	3124 a	Supa	4502 a
Nerica 4	1900 b	Wahi wahi	2780 b	Nerica 1	2945 b	Kajakete	3997 a
Koshi hikari	1602 c	Black rice	2703 b	Koshi hikari	2932 b	Wahi wahi	3100 b
Xiangzhou 5	1568 c	Kajakete	2688 b	IITA	2717 c	Black rice	3086 b
IITA	1402 d	Burma	2 2341 bc	Xiangzhou 5	2189 c	Nerica 1	2904 c
Giza	1345 d	Angola 1	2146 cd	Giza	1860 c	IITA	2717 d
Angola1	785 e	IITA	2080 cd	Sumbawanga	1345 d	Malawi faya	2700 d
Supa	782 e	Sumbawanga	2042 cd	Black rice	1262 d	Nerica 4	2700 d
Black rice	680 f	Koshi hikari	1989 cd	Kajakete	1206 d	Angola 1	2576 de
Kajakete	670 f	Burma	1985 cd	Burma	987 e	Burma	2453 e
Sumbawanga	621 g	Malawi faya	1883 cd	Supa	885 ef	Koshi hikari	2256 f
Malawi faya	610 gh	Nerica 4	1882 cd	Burma	2 874 ef	Xiangzhou 5	2189 f
Burma	580 gh	Xiangzhou 5	1818 cd	Angola 1	859 ef	Sumbawanga	2018 g
Burma	2 564 hi	Nerica 1	1744 de	Malawi faya	769 f	Burma	2 1970 g
Wahi wahi	522 i	Giza	1334 e	Wahi wahi	742 f	Giza	1238 h
L.S.D	45.32		458.7		140		134.6
C.V%	5.7		14.8		6		3.5

Longe TAS also under upland conditions. The lowest yielding varieties were Burma, Supa, Burma 2, Angola 1, Malawi faya and Wahi wahi for Namushakende TAS while at Longe TAS Angola 1, Supa, Black rice, Kajakete, Sumbawanga, Malawi faya, Burma, Burma 2 and Wahi wahi were the lowest yielding varieties. At both sites Wahi wahi yielded the lowest with average yields of 742 kg/ha at Namushakende TAS and 522 kg/ha at Longe TAS.Under lowland conditions, there were high significant differences in grain yield.

Under lowland, dambo or paddy conditions, at Longe TAS, Supa, Wahi wahi, Black rice and Kajakete were significantly high yielding varieties with average yields of 3244 kg/ha, 2780 kg/ha, 2703 kg/ha and 2688 kg/ha respectively ($P < 0.05$). At Namushakende TAS, Supa, Kajakete, Wahi wahi and Black rice were on the higher yielding side with average yields of 4502, 3997, 3100 and 3086 kg/ha, respectively. Under lowland or paddy, for Namushakende TAS, as well as Longe TAS the lowest yielding variety was Giza with average yields of 1238 kg/ha and 1334 kg/ha, respectively.

It was observed that if varieties were to be bred for specific environments, in this case upland rain fed, the number of tillers, number of productive tillers, number of spikelets per panicle and days to maturity should be considered as they tended to have a greater influence on the performance and yields of the cultivars in the study.

References

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