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PERFORMANCE OF LOCAL RICE CULTIVARS UNDER AEROBIC ECOSYSTEM OF NAGALAND

T. GOHAIN

Department of Agronomy, School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema-797 106

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ABSTRACT

A field experiment was conducted at the School of Agricultural Sciences & Rural Development (SASRD), Nagaland University, Medziphema Campus farm during kharif 2013 on a sandy loam soil under aerobic eco-system (upland rainfed) condition. Ten different local rice cultivars were grown with improved packages of practices. Among the different local rice cultivars, Masah red recorded the highest plant height (183cm) followed by Ronga shye (175cm) and Nyakmok (154cm). Cultivar Melungu shye was the shortest (96cm) followed by Kshai-chushu ghee (126cm). Cultivar Ronga she, Masah red and Jamaghu recorded highest number of panicles m^{-2}, panicle weight and number of grains/panicles. Ronga shye recorded highest grain yield (20.07 q ha^{-1}) followed by Masah (19.63 q ha^{-1}) and Jamaghu (18.89 q ha^{-1}). Kebe be and Melunyu shye could not respond well to improved packages of practices and recorded the lowest grain yield of 6.30 q ha^{-1} and 8.89 q ha^{-1}, respectively. All the cultivars were recorded to be medium in duration. The traditional local rice cultivars responded differently with the improved packages of practices. Among the different local rice cultivars, Ronga shye, Masah red and Jamaghu recorded maximum grain yield.

Key words: Local rice cultivar, improved packages of practices, growth, production

INTRODUCTION

Rice (*Oryza sativa*) is the staple food of the country. Rice production constitutes the major economic activity and a key source of livelihood for the rural household of many Indians. Rice demand was projected to increase by 25% from 2001 to 2025 to keep population growth. Upland (aerobic) rice area is being shrinking due to lack of appropriate technologies on fertilizer application and suitable varieties for rainfed aerobic ecosystems. It is necessary to increase yield per unit area with less water to fulfill the increasing rice demand with shrinking resources. Water is looming crisis due to competition among agricultural, industrial and domestic users. In Asia, more than 50% of irrigation water is used to irrigate rice. Under upland conditions, where the crops are not flooded at all during the growth period is an effective way to save water and to reduce the methane emissions produced by flooded rice (Tung *et al.*, 2005). This concept of aerobic rice entails the adoption of improved packages of practices responsive cultivars that are adapted to aerobic culture aiming at 70-80% yields of high input flooded rice (Prasad, 2011). Rice in Nagaland is cultivated under different ecosystem because of its diverse climate and physiographic condition. Nagaland consists of various tribes who used different local rice cultivars or land races in their respective areas. Local cultivars represent a unique and critical source of genetically variable traits that can serve as a source for future rice improvement. Generally the productivity of the local rice cultivars is lower because of low genetic potentiality and poor management practices followed by the traditional rice growers. Since the cultivated area cannot be increased, effort is needed to be intensified to increase the productivity of these local rice cultivars. Traditional farmers are reluctant to adopt modern packages of practices with proper nutrition and plant protection measures. They grow the crop without any scientific packages of practices. Keeping this in view, the present study was undertaken to evaluate some of the promising local rice cultivars under good management practices to see the responses on modern packages of practices.

MATERIALS AND METHODS

A field experiment was conducted during rainy season of 2013 at research farm of School of Agricultural Sciences, Nagaland University, Medziphema. The soil was sandy loam, having organic carbon (8.7 g kg^{-1}), available N 198 kg ha^{-1} and P 22.4 kg ha^{-1} and medium in available K 189 kg ha^{-1} with acidic (pH 5.6) soil reaction. The experiment was laid out in randomized block design with 10 different local rice cultivars grown in three replications. Modern packages of practices were adopted with proper fertilization and plant protection measures. The different local rice cultivars are V_1- Kshai-Chushu ghee, V2- Ronga shye, V3- Semvu shye, V_4-Kebe be, V_5- Melunyu shye V_6- Nyakmok, V_7- Jamaghu, V_8- Masah red, V_9- Kengukehongi and V_{10}- Manikhwea. Improved packages of practices

Corresponding author E-mail- tankeswar1968@gmail.com

include proper land preparation, seed treatments, line sowing, proper fertilizer, weed management and proper plant protection measures. Recommended dose of fertilizers for rice 120 kg N ha^{-1}, 60 kg P_2O_5 ha^{-1} and 60 kg K_2O ha^{-1} were applied for high yielding varieties in North East so half of this dose was applied for the local rice cultivars as they are low responsive to applied nutrients. The whole quantity of P and K and half of N was applied as basal and remaining amount of N was top dressed in two equal splits at tillering and panicle-initiation stage. The experimental area was ploughed twice with tractor drawn cultivator and with rotovator to obtain the desired tilth. The seed was treated with fungicide Carbendazim @ 1g kg^{-1} seed. The seed of rice was directly sown in rows of 20cm spacing on 5 June 2013. Thinning was done at 15 DAS to maintain uniform plant stand in all plots. Hand weeding was done twice at 20 and 4o days for control of weeds. Data recorded on various growth and yield parameters of rice crop were analysed following standard statistical analysis of variance procedure.

RESULTS AND DISCUSSION

Growth attributes

The growth attributes of different local rice cultivars varied significantly under identical conditions depending upon their adaptability to the improved cultivation practices. A perusal data presented in Table 1 indicated that the plant height at the harvest varied significantly among the different cultivars. The maximum plant height (183cm) was recorded with cultivar Masah red followed by Ronga shye (175 cm) and the lowest with the cultivar Melungu shye (96 cm). The plant height ranged from 112 cm in the cultivar Kengukehongi to 154 cm in the cultivar Nyakmok. It was observed that under improved package of practices traditional local rice cultivars recorded maximum vegetative growth. It may be due to available of better environment for proper growth and development. Significantly higher number of leaves was recorded in cultivars Ronga shye, Nyakmok and Jamaghu (6.55) and the lowest with the cultivar Kengukehongi (4.88).

Table 1: Growth parameters of different local rice cultivars

Rice cultivars	Plant height (cm)	Leaves $Plant^{-1}$	Tillers m^2	CGR (g day^{-1})	RGR (g $g^{-1}day^{-1}$)	Panicles m^{-2}
V1-Kshai-Chushu ghee	126.0	6.22	143	0.075	0.04	96.65
V2-Ronga shye	175.0	6.55	178	0.118	0.04	126.65
V3-Semvu shye	149.0	6.11	153	0.070	0.03	110.00
V4-Kebe be	132.00	5.33	165	0.110	0.03	116.50
V5-Melunyu shye	96.00	6.11	172	0.050	0.03	121.65
V6-Nyakmok	154.00	6.55	180	0.070	0.03	128.30
V7-Jamaghu	139.00	6.55	153	0.100	0.04	116.50
V8-Masah red	183.00	6.44	175	0.090	0.03	128.30
V9-Kengukehongi	112.00	4.88	177	0.060	0.03	133.30
V10-Manikhwea	145.00	6.44	183	0.070	0.03	90.00
SEm+	9.18	0.28	5.48	0.04	0.01	25.6
CD (P=0.05)	27.28	0.83	16.29	NS	NS	NS

The number of tillers per $meter^{-2}$ varied significantly among the cultivars and maximum number of tillers (183 m^{-2}) was recorded with cultivar Manikhwea closely followed by cultivar Nyakmok (180 m^{-2}). The lowest number of tillers was recorded with the cultivar Kashai-Chushu ghee (143). The tillers in the other cultivars ranged from 153 in Jamaghu to 178 in the cultivar Ronga shye. Rice cultivars were more or less smilar in respect of CGR and RGR. However, highest CGR (0.11g day^{-1}) was recorded in Kebe be and similar RGR (0.04 g g^{-1} day^{-1}) were recorded in Kshai-Chushu ghee, Ronga shye and Jamaghu. Production of the higher growth stature with Masah red and Ronga shye might be due to its potential for profuse rooting and tillering ability under aerobic culture in the domain of investigation over Melunyu shye, which might be due to reverse response, since the cultivars susceptible to withstand moisture stress, would lead to poor growth especially under aerobic culture. It also reduced canopy photosynthesis and there by the lower growth parameters.

Yield attributes

Number of panicles per m^2 did not differ significantly among the different local rice cultivars. However, cultivar Kengukehongi recorded maximum numbers of panicles m^{-2} (133) followed by Nykmok and Masah red and lowest were recorded in the cultivars Manikhwea (90) and Kshai-Chushu ghee (97) respectively. However, numbers of panicles with

Semvu shye were at par with Kebe be and Jamaghu (Table 1). Longest panicles (31.23 cm) was recorded in Jamaghu which were at par with Ronga shye (30.90cm), Semvu shye (29.76 cm) and Masah red (29.53 cm) and the shortest was in Kengukehongi (24.16cm). Weights of panicles were found to be non-significant among the different cultivars. However, Ronga shye recorded maximum (7.81 g) and Melunyu shye recorded lowest (4.74 g) panicle weight. Numbers of grains per panicles varied significantly among the cultivars. Masah red recorded maximum number of grains (233) per panicles followed by Semvu she (195) and the lowest in Melunyu shye (91). Number of grains per panicle varied from 110 in Kebe be to 168 in Kshai Chushu ghee. The seed size varied significantly among the different cultivars. Some produced bolder seeds and, hence, recorded significantly higher test weight as compared to other cultivars. The maximum test weight was recorded in cultivar Jamaghu (39.44 g) followed by Kengukehongi (38.38 g) and Ronga shye (33.98 g). Similar test weight was recorded in Semvu shye (27.71 g), Melunyu shye (26.50 g) and in Kebe be (26.04 g) respectively. Lowest test weight was recorded in cultivar Masah red (18.09 g). Fertility percent is the ratio of filled and unfilled grains per panicle and expressed as percentage. Cultivar Ronga shye recorded highest fertility percent (81.87) which was comparable with Masah red (78.25) it may be because of effective translocation of assimilates to the sink, which might have resulted in sound filling of grains/panicle. This has been documented by Bouman *et al*. (2006) in their findings. The lowest fertility percentage was recorded in the cultivar Melunyu shye (57.67%) followed by Kebe be (64.97%). The harvest index is the resultant of the ratio of grain yield to the biological yield which depends on the accumulation of photosynthates in the form of straw and grains. The cultivar Masah red recorded maximum harvest index (32.92) and the lowest harvest index was recorded in the cultivars Kebe be and Melunyu shye (15.63). The harvest index in other cultivars varied from 17.59 in the cultivar Manikhwea to 27.45 in the cultivar Nyakmok.

Table 2: Yield and yield attributing characters of different local rice cultivars

Rice cultivars	Length of panicle (cm)	Weight of Panicle (g)	Grains per panicle	Test weight (g)	Grain yield (q ha^{-1})	Fertility percent	Harvest index (%)
V1-Kshai-Chushu ghee	28.06	6.84	168	31.01	10.00	72.14	22.22
V2-Ronga shye	30.90	7.81	144	33.98	20.00	81.87	20.20
V3-Semvu shye	29.76	7.13	195	27.71	14.07	73.76	20.98
V4-Kebe be	26.50	3.96	110	26.04	6.30	64.97	15.63
V5-Melunyu shye	25.53	4.74	91	26.50	8.89	57.67	15.63
V6-Nyakmok	27.40	7.22	169	30.96	17.78	70.36	27.45
V7-Jamaghu	31.23	6.68	129	39.44	18.89	76.34	24.25
V8-Masah red	29.53	7.48	233	18.09	19.63	78.25	32.92
V9-Kengukehongi	24.16	5.85	126	23.62	10.37	62.99	22.36
V10-Manikhwea	27.23	6.05	118	38.38	12.59	67.73	17.84
SEm±	1.48	0.96	20.52	1.01	2.50	4.82	4.38
CD (P=0.05)	4.39	NS	60.98	3.01	NS	14.32	13.03

Yield

Crop yield is a complex process and grain yield is the resultant of partitioning of the photosynthates from the source to sink which depends upon various growth and yield attributes. The grain yield varied significantly among the different cultivars and the maximum yield (20 q ha^{-1}) was recorded in the cultivar Ronga shye closely followed by the cultivar Masah red (19.63 q ha^{-1}) and Jamaghu (18.89 q ha^{-1}). The lowest grain yield (6.30 q ha^{-1}) was recorded in the cultivar Kebe be. These differences in the grain yield of different local rice cultivars may be attributed to the differential growth and development of the plant due to their interaction with the improved packages of practices. This might be resulted in differential expression of their genetic potential and thus, resulted in higher values of growth and yield attributes in some of the cultivars, and ultimately, resulted in varied grain yields in different cultivars. The traditional rice cultivars growing by the farmers are low yielder. However, few cultivars produced good yield. Improved cultivation practices enhanced yield under aerobic culture with suitable cultivars was owing to the fact that production of significantly more productive tillers lead to accrual of more photosynthesis, resulting in higher grain yield of rice under aerobic culture. Performance of different cultivars under aerobic culture with variation in the yield was reported by Bouman *et al.* (2005) using different N levels, which was due to enhanced stature

of yield attributes, forming larger sink size coupled with efficient translocation of photosynthates to the sink. These results corroborate with those reported by Belder *et al.* (2005) and Sathiya and Ramesh (2009). The traditional local rice cultivars response differently in the improved packages of practices. Among the different local rice cultivars, Ronga shye, Masah red and Jamaghu recorded maximum grain yield. These three cultivars were found to be better responsive to improved packages of practices. These cultivars recorded near about 20 q ha^{-1} grain yield and which are very much suitable for productivity enhancement by the varietal alteration for partially meeting out the rice production in Nagaland.

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