



Effect of Variety and Spacing on the Productivity of Direct Seeded Rice (*Oryza sativa* L.) under Manipur Condition

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ABSTRACT

Field experiment was conducted during the kharif season 2016 to evaluate the effect of Variety and Spacing on the Productivity of Direct Seeded Rice (*Oryza sativa* L.). Four rice cultivars CAU-R1, RCM-7, RCM-10 and KD-263 were sown with three row spacing 15, 20 and 25 cm). The experiment was laid out in a (FRBD) with three replication. Consequences shown that among four rice varieties, CAU-R1 produced significantly higher no of tiller per square meter (96.44) and no of effective tiller per square meter (88.58) than other varieties. Significantly higher no of filled grain per panicle (146.18), test weight (26.71g), grain yield (50.57 q /ha) and straw yield (66.60 q ha⁻¹) were also recorded from CAU-R1 than other varieties. Planting at 25 cm row spacing resulted in significantly higher number of tillers per square meter (90.18), effective tillers per square meter (86.82), Panicle length (25.24 cm), No. of filled grain/panicle(146.27) and grain yield (44.68 q ha⁻¹) as compared to 20 and 15cm row spacing. However, plant height (130.09 cm), No. of unfilled spiklets per panicle (36.12) and Straw yield (66.70 q/ha) were significantly greater with 15 cm row spacing.

Keywords: Rice; Direct seeded; Variety; Spacing; Growth; Yield.

INTRODUCTION

Rice (*Oryza sativa* L.) belongs to the family graminaceae is the stable food for nearly three billion people all over the world. In India, rice is the most important and extensively grown food crop, occupying about 40 million tones of rough rice. The demand for rice in India is projected at 180 million tones for the year of 2020. With many constraints producing more

rice from the same land to feed additional population is a great challenge. Selection of appropriate variety and improve management practices is principle factors attributed to yield. Row spacing affects crop yield as it not only determines the optimum crop stand, but also facilitates inter-culture and convenient herbicide application for effective and efficient weed control.

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In addition, proper row spacing is important for maximizing light interception, penetration, light distribution in crop canopy and average light utilization efficiency of the leaves in the canopy and, thus, affects yield of a crop (Hussain et al., 2003). Row spacing requirements of rice depend on architecture and growth pattern of the varieties. For higher yield, higher proportion of incident radiation at the soil surface must be intercepted by crop canopy (Eberbach et al., 2005). The plant spacing influences the availability of sunlight, leaf area, and nutrient to the plant, photosynthesis and respiration. The plant to plant and row to row distances determine the plant population per unit area which has a direct effect on the yield of rice. Moreover, yield may be reduced in narrow spacing due to increased competition of plants for nutrient and moisture (Das & Yaduraju, 2011).

The other essential factor is rice genotypes are generally selected for higher yields and greater tolerance to adverse conditions and early maturity (Kumar et al., 2013). However, success of any crop production depends on the use of appropriate and selectivity of location-specific genotype/variety of high yield potential, and additionally improved cultural practices is an imperative part, may not be ignored. In recent past, rice varieties developed by plant breeders have high yield potential. Cultural management plays a significant role in rice production. Row spacing and optimum variety are of prime importance (Eissa et al., 1995), but all the varieties do not perform well in the same plant spacing, optimum plant densities vary greatly between areas, climatic conditions, soil and varieties (Darwinkel et al., 1977).

Rice is generally planted by broadcast method by most of the farmers in Manipur, though research scientists use line sowing and advise the same to the rice farmers. Now-a-days due to infestation of weeds, it has become important to sow the crops in lines with suitable row spacing, which besides facilitating inter-culture and convenient herbicide application for effective and efficient

weed control may also help in reducing the seed rate per hectare without any adverse effect on the final grain yield.

Therefore, the present piece of research work was undertaken to find out the effective spacing for maximizing seed yield for direct seeded of some newly developed rice varieties in Manipur and similar situation of NEH Region of India.

MATERIALS AND METHODS

A field research was carried out in the Agronomy Research Farm of College of Agriculture, Central Agricultural University, Imphal, Manipur, during the *kharif* season 2016 to evaluate the performance of direct seeded rice varieties grown under different spacing. The varieties were sown on 25.06.2016 in a Factorial Randomized Block Design with three replications and combinations of two factors, such as varieties (CAU-R1, RCM-7, RCM-10 and KD-263) and different row spacing (15 cm, 20 cm and 25 cm). Observations were recorded for different traits. In order to secure the effect of different treatments, the following observations such as plant population, Plant height, number of tillers per square meter, effective tillers per square meter, Panicle length (cm), Number of unfilled spikelet per panicle, Number of filled grains per panicle, Test weight, Grain yield and Straw yield were recorded during the study. The mean data was statistically analyzed by adopting the appropriate methods outlined by Gomez & Gomez (1984). The critical differences were calculated at five percent level of probability, wherever 'F' test was significant.

RESULTS AND DISCUSSION

Influence on growth parameters

Effect of varieties

Several researchers reported significantly different responses of different genotypes to various management variable and environments with respect to growth attributes due to inherent characteristics. In this study plant height varied significantly due to different variety. RCM-10 recorded

significantly higher plant height over the rest of the variety (Table 1). It may be due to the genetic character of the variety and higher photosynthesis efficiency (Yang et al., 2001). The results consistent with the findings of Bisne et al. (2006), Nizamani et al. (2014) & Suleiman et al. (2014), who observed plant height, differed significantly among the varieties. But significantly higher tillers numbers was recorded in CAU-R1 (Table 1). Variation in tillers numbers might be due to differences in genetic makeup of these rice varieties. These results are in conformity with the findings of Rahman et al. (2010), & Mali & Choudhary (2011) who observed significant differences in the tillers count. Likewise, higher plant population per square meter was also observing in CAU-R1 than other varieties (Table 1).

Effect of row spacing

Several researches have showed significant effect of spacing on rice growth parameters, though the effects were varied under variable agro-ecologies. In the present experiment also different row spacing exerted significant effect on different growth parameters of direct seeded rice. However, different row spacing had non significant effects on plant population (Table 1), these results agree with the findings of Abdul-Ghaffar et al. (2013), who reported that row spacing did not affect the seedling density. Maintenance of optimum row spacing can help to optimize tillering capacity. Number of tillers per square meter was influenced significantly due to variable row spacing. In 25 cm row spacing plants utilized all available resources more efficiently including light, water, air and nutrients (Table 1). These results are in consonance with the findings of Ali et al. (2016) who observed that narrow row spacing increased number of tillers per unit area significantly over wider row spacing. Similarly plant height was also significantly influenced by different row spacing (Table 1). Plant with closer spacing maintained superior plant height at all stages of growth and wider spaced plants were comparatively shorter in height. It appears that there was more intense inter and intra plant

competition for solar energy and aeration in closely spaced plants and grow taller attempting to capture sufficient sunlight. Similar results were reported by Sihag et al. 2015.

Influence on yield attributes and yield

Effect of row spacing

The analysis of variance resolved the yield parameters of the planting geometries. Results showed that 25 cm planting geometry had superiority in various yield attributing characters viz.; effective tillers per square meter, panicles length, grains per panicle, test weight, and grain yield etc. (Table 2). Results indicate that wider spacing had linearly increasing effect on the performance of individual plants. The plants grown with wider spacing have more area of land around them to draw the nutrition and had more solar radiation to absorb for better photosynthesis process and hence performed better as individual plants. Tusekelege et al. (2014) also observed similar result. The effective tillers, number of grains per panicle and grain yield were significantly higher in wider spacing of 25 cm as compared to closer row spacing of 20 cm and 15 cm and unfilled spikelet were significantly higher in closer spacing of 15 cm as compared to other spacing (Table 2). Similar results have also been obtained by Lenin et al. (2015), Das et al. (2017), Gorgy (2010), Ogbodo et al. (2010), & Durga (2012). Closer row spacing of 15 cm produced significantly higher straw yields (66.70 q/ha) over 20 cm (63.23 q/ha) and 25 cm (60.52 q/ha) respectively. Similar results have also been obtained by Thakur et al. (2009), Sreedhar et al. (2010), Ahmed et al. (2015), Alam et al. (2015) & Baskar et al. (2013). The higher yield in 25 cm plant geometry might be due to higher effective tillers per square meter and less unfilled spikelet per panicle (Table 2) in comparison to 15 cm and 20cm row spacing. The same findings have also been obtained by Verma et al. (2002) & Deb et al. (2012). Likewise grain yield also decreased significantly with decrease in spacing. Similar results have also been obtained by Rashid et al. (2006).

Effect of varieties

Rice CAU-R1 variety was markedly superior in various all yield and yield attributing characters *viz*; effective tillers per square meter, panicles length, grains per panicle, test weight, grain yield and less number of unfilled spikelet per panicle over RCM-7, RCM-10 and KD-263. The higher grain yield in CAU-R1 was achieved due to more number of effective tillers per square meter, panicles length, grains per panicle, test weight over other varieties. Saeed et al. (2012) also reported significant differences among the varieties for grain yield. The cumulative effects of superior growth and yield attributes were finally reflected in terms of higher grain yield. Both grain and straw yields were also higher in the CAU-R1 over

other varieties. Ultimately, CAU-R1 produced significantly higher grain and straw yields (50.57, 66.60 q/ha) as compare to KD-263 (43.95 and 61.13 q/ha), RCM-7 (35.58 and 62.24 q/ha) and RCM-10 (35.87 and 63.96 q/ha) respectively. Further, grain yields of rice directly correlated to the number of effective tillers, number of grains per panicle and test weight. These yield attributing characters were significantly superior in CAU-R1 as compared to RCM-7, RCM-10 and KD-263, which attributed to produce higher grain yield. Similar results have also been obtained by Parte Archana (2007) & Gawali et al. (2015) who reported grain and straw yield of wheat was affected significantly by the different varieties.

Table 1: Effect of Variety and Spacing on Growth parameters of Direct Seeded Rice

Treatments	Plant height (cm)	Number of tillers /sq. m	Plant population/sq. m
Varieties			
CAU-R1	125.34	96.44	28.00
RCM-7	120.48	83.22	27.67
RCM-10	143.18	83.47	27.56
KD-263	119.83	89.70	27.67
S.E.m (±)	1.46	0.84	1.15
CD (p=0.05)	3.03	1.52	NS
Spacing			
15 cm	130.09	86.14	31.58
20 cm	128.18	88.30	26.75
25 cm	123.44	90.18	24.83
S.E.m (±)	1.26	0.73	0.99
CD (p=0.05)	2.63	1.75	NS

Table 2: Effect of Variety and Spacing on Yield and Yield attributes of Direct Seeded Rice

Treatments	effective tillers/sq.m	Panicle length (cm)	No. of unfilled spikelets/ panicle	No. of filled grains/ panicle	Test weight (g)	Grain yield (q/ha)	Straw yield (q/ha)
Varieties							
CAU-R1	88.58	25.19	34.16	146.18	26.71	50.57	66.60
RCM-7	79.21	24.63	28.83	133.72	25.41	35.58	62.24
RCM-10	81.98	24.39	34.30	138.27	25.83	35.87	63.96
KD-263	85.12	24.49	34.19	141.13	25.68	43.95	61.13
S.E.m (±)	1.04	0.63	0.56	2.28	0.56	0.54	0.54
CD (p=0.05)	2.17	NS	1.17	4.74	1.01	1.12	1.12
Spacing							
15 cm	79.70	23.93	36.12	133.22	25.19	38.60	66.70
20 cm	84.64	24.85	32.02	139.98	25.91	41.20	63.23
25 cm	86.82	25.24	30.48	146.27	26.61	44.68	60.52
S.E.m (±)	0.90	0.54	0.49	1.97	0.48	0.47	0.47
CD (p=0.05)	1.88	NS	1.01	4.10	NS	0.97	0.97

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- Koireng et al.** *Ind. J. Pure App. Biosci.* (2019) 7(5), 335-341 ISSN: 2582 – 2845
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