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Evaluation of suitable genotypes for direct seeded rice (DSR) method

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Abstract
The present investigation was conducted during *Kharif* 2019 at I-Block, ZARS, V C Farm, Mandya, UAS, GKVK, Bengaluru to investigate the effect of DSR method on seed quality and yield of different genotypes. The field experiment comprised of eight genotypes with three replications in randomized complete block design. The results revealed that under DSR method KRH-4 registered significantly earlier days to 50% flowering (89.00) and maturity (118.00), more productive tillers plant^{-1} (14.13), panicles plant^{-1} (16.47), longer panicles (21.77 cm), filled grains panicle^{-1} (153), grain yield plant^{-1} (37.40 g), grain yield plot^{-1} (11.90 kg), grain yield hectare^{-1} (59.50 q), test weight (19.11 g), followed by BR-2655 (96.67%, 130.00, 13.33, 16.20, 25.81 cm, 115.00, 32.61 g, 9.73 kg, 48.66 q, 21.73 g, respectively) and MTU-1001 expressed significantly lower performance includes 94.67%, 127.67, 11.80, 11.87, 19.70 cm, 65.00, 25.34 g, 7.50 kg, 37.5 q, 20.30 g, respectively).

Keywords: Rice, DSR, days to 50% flowering, days to maturity, yield

1. Introduction

Rice (*Oryza sativa* L.) is a "Global Grain" cultivated traditionally across the world and feed millions of human species as a daily bread for more than 50 per cent of the anthropoid population. In India, rice produced to hold the lead for sustained food production by contributing 20-25 per cent to agriculture and persuade food availability for more than half of the total population (Anon., 2019) [1]. This crop is the pane food of livelihood for millions of rural menage and plays a prominent role in the country's food security. So, the term "Rice is life" is most appropriate in Indian context. DSR has been stated as a prime conservation technology and it brings down water and manpower use by 50 per cent and 5-10 per cent of productivity surpassing the yield of anaerobic rice. It provides a very revitalizing opportunity to offer water and environmental sustainability besides, enriching the soil by providing congenial environment for succeeding crops. However, the well puddle conditions provide compatible circumstances for rice; it also generates unbreakable crust below the surface, prohibiting the root extension and proliferation in deeper layers of winter crops. It offers certain advantages like economizing irrigation water, human resource, energy, time, decreased emission of greenhouse gas (Methane), better growth of succeeding crop etc.

Direct seeding can be accomplished by sowing of pre-germinated seed to puddled soil (wet seeding) or prepared seedbed (dry). DSR entails specially bred cultivars / varieties which has good mechanical vivacity in the coleoptiles to ease earlier emergence of the seedling under crust conditions (usually formed after light rains), early seedling vigour for weed competitiveness (Limei Zhao *et al*., 2009) [6], efficient root system for anchorage and to tap soil moisture from layers in utmost evaporative demands and yield stability over planting times are desirable traits for DSR. Despite, the evolution of suitable agronomic package and varieties to promote direct seeded rice is ongoing (Pathak *et al*., 2011) [9], as yet, no cultivar was developed that possesses traits specifically required to evolve maximum yield under dry direct-seeded conditions, especially for rainfed systems that perhaps prone to drought and low fertility. Rice genotype development and resource management are disparaging to achieve optimal production under DSR. Presently, good performing rice varieties are only for transplanted rice and little is known about the yield prospective and plant type pre-requisites for direct seeding. Despite its economic benefits, not all cultivars of rice are suitable for direct seeding.

2. Material and Methods

2.1 Experimental site

The field experiment was conducted during *kharif*, 2019 at Zonal Agricultural Research

Station, V. C. Farm, Mandya. The experimental site consisted of deep black clay. The field experiment was laid out in a randomized complete block design.

2.2 Treatment details

This experiment consist of 8 genotypes with 3 replications *viz*., BR-2655, MTU1001, Thanu, Gangavathi Sona, IR-64, MAS-26, MAS-946-1 and KRH-4 (hybrid). Seed rate 20 kg/ha, Spacing 20 × 10 cm sowing by dibbling. Plot size 5 × 4 m. Recommended dose of NPK 100:50:50 kg ha^{-1} was applied to all the treatments at the time of dibbling in the form of urea, DAP and MOP. 50% urea, 100% of P_2O_5 and 100% K_2O was applied as basal dose during seeding. Remaining 50 per cent of N was top dressed three weeks after sowing.

2.3 Data analysis

The experimental data collected on various growth and yield components of plant were subjected to Fisher's method of Analysis of Variance technique as outlined by Gomez and Gomez (1984). The level of significance used in 'F' test was at p=0.05, whenever F-test was significant for comparison amongst the treatments an appropriate value of critical difference (CD) was worked out otherwise against CD values abbreviation NS (Non-Significant) was indicated. All the data were analyzed and the results are presented and discussed at a probability level of 0.05 per cent.

3. Results

The experimental results indicated that, Earlier days to 50% flowering and maturity was observed in IR-64 (78.33%, 110.33 days). Whereas, BR-2655 took more days to 50% flowering and maturity (96.67%, 130 days). The hybrid KRH-4 produced significantly higher number of productive tillers $plant^{-1}$ (14.13). While, MTU-1001 produced lesser number of tillers $plant^{-1}$ (11.80). BR-2655 produced longer panicles (25.81cm) which was on par with Gangavati Sona (23.46 cm) while, KRH-4 (21.77 cm), MAS-946-1 (21.76 cm), MAS-26 (21.59 cm), IR-64 (21.13 cm), Thanu (20.09 cm) and MTU-1001 (19.70 cm) produced shorter panicles.

KRH-4 expressed higher number of panicles $plant^{-1}$ (16.47) followed by BR-2655 (16.20) and Thanu (15.13) whereas, MTU-1001 produced lower number of panicles (11.87). KRH-4 recorded higher number of spikelets $panicle^{-1}$ (199) followed by BR2655 (172), Thanu (148), Gangavati Sona (133) and MAS-946-1 (121) while, IR-64 (84) and MTU-1001(81) produced lower number of spikelets $panicle^{-1}$. The hybrid KRH-4 registered higher number of filled grains $panicle^{-1}$ (153) followed by BR-2655 (115), Thanu (104) and Gangavati Sona (89) while, IR-64 (79) and MTU-1001(65) noticed lower number of filled grains $panicle^{-1}$. KRH-4 (37.40 g), BR-2655 (32.61 g), Thanu (31.98 g) and Gangavati sona (31.79 g) registered the higher grain yield $plant^{-1}$. Whereas, the lower grain yield $plant^{-1}$ was expressed by MAS-946-1 (31.32 g), MAS-26 (30.49 g), IR-64 (27.32 g) and MTU1001 (25.34 g). Higher grain yield $plot^{-1}$ was noticed in KRH-4 (11.90 Kg) which was on par with BR-2655 (9.73 Kg), Thanu (9.13 Kg) and Gangavati Sona (9.06 Kg), Whereas, the lower yield was observed in MAS-946-1 (8.68 Kg), MAS-26 (8.61 Kg), IR-64 (7.91 Kg) and MTU-1001 (7.50 Kg). Higher grain yield $hectare^{-1}$ (59.50 q) was noticed in KRH-4 which was followed by BR-2655 (48.66 q), Thanu (45.66 q) and Gangavati Sona (45.28 q). Whereas, the lower yield was registered in MAS-946-1 (43.40 q), MAS-26 (43.06 q), IR-64 (39.53 q) and MTU-1001 (37.50 q). Maximum 1000 grain weight (21.73 g) was noticed in BR-2655 which was on par with IR-64 (20.88 g), MAS-946-1 (20.51 g), MAS-26 (20.42 g) and MTU-1001 (20.30 g). While, minimum was observed in Gangavati Sona (17.75 g), Thanu (18.07 g) and KRH-4 (19.11 g).

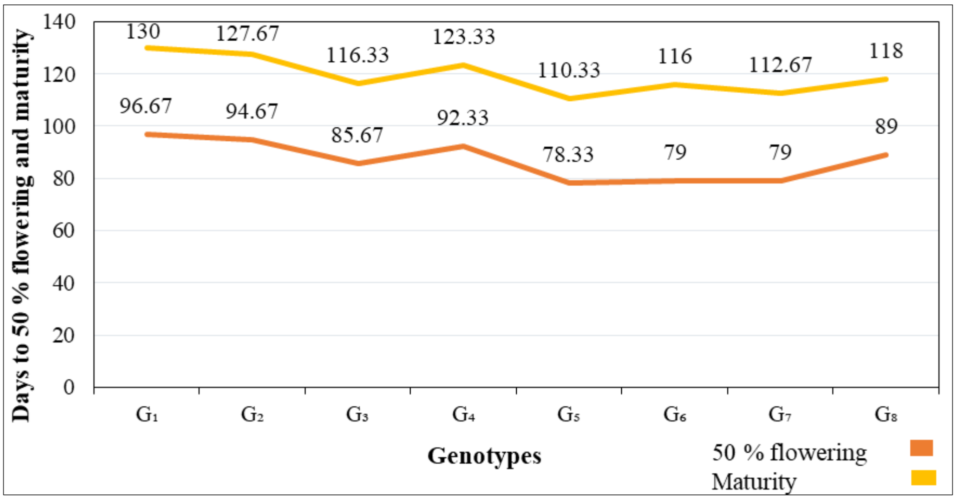

Fig 1: Days to 50% flowering and days to maturity of paddy genotypes tested under DSR method

Table 1: Days to 50 per cent flowering, days to maturity, number of productive tillers $plant^{-1}$, panicle length and number of panicles $plant^{-1}$ among paddy genotypes tested under DSR method

Genotypes	Days to 50% flowering	Days to maturity	Number of productive tillers $plant^{-1}$	Panicle length (cm)	Number of panicles $plant^{-1}$
BR-2655	96.67	130.00	13.33	25.81	16.20
MTU-1001	94.67	127.67	11.80	19.70	11.87
Thanu	85.67	116.33	13.20	20.09	15.13
Gangavathi Sona	92.33	123.33	12.73	23.46	14.40
IR- 64	78.33	110.33	12.33	21.13	12.60
MAS-26	79.00	116.00	12.47	21.59	13.20

MAS-946-1	79.00	112.67	12.73	21.76	14.13
KRH-4	89.00	118.00	14.13	21.77	16.47
S.Em±	3.68	4.54	0.67	1.13	1.15
C.D (P=0.05)	11.17	13.78	1.94	3.43	3.49
CV (%)	7.00	6.59	11.08	8.96	13.88

Table 2: Number of filled grains panicle-1, grain yield plant-1(g), grain yield plot-1(kg), grain yield hectare-1(q) and 1000 grain weight (g) among paddy genotypes tested under DSR method

Genotypes	Number of filled grains panicle-1	Grain yield plant-1 (g)	Grain yield plot-1 (kg)	Grain yield hectare-1 (q)	Test weight (g)
BR-2655	115	32.61	9.73	48.66	21.73
MTU-1001	65	25.34	7.50	37.50	20.30
Thanu	104	31.98	9.13	45.66	18.07
Gangavathi Sona	89	31.79	9.06	45.28	17.75
IR- 64	79	27.32	7.91	39.53	20.88
MAS-26	84	30.49	8.61	43.06	20.42
MAS-946-1	86	31.32	8.68	43.40	20.51
KRH-4	153	37.40	11.90	59.50	19.11
S.Em±	7.50	2.10	0.44	2.20	0.668
C.D (P=0.05)	22.75	6.39	1.34	6.69	1.93
CV (%)	13.42	11.76	8.43	8.43	4.58

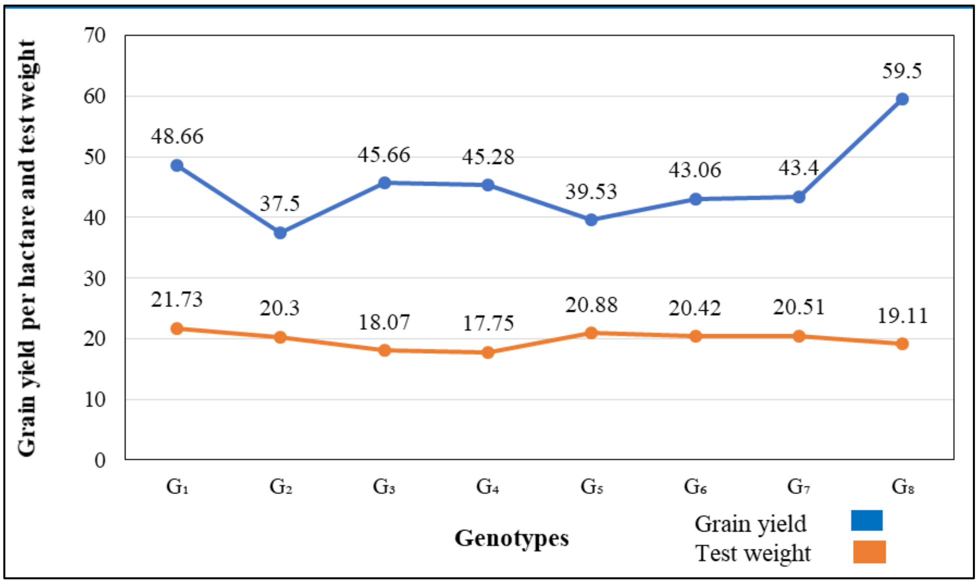

Fig 2: Grain yield hectare-1 and test weight of paddy genotypes tested under DSR method

4. Discussion

This difference in 50% flowering, days to maturity and productive tillers per plant among genotypes could be due to their genetic makeup and these findings are in accordance with Magat and Apo (2004) [7] and Mahantashivayogayya *et al.* (2016) [8] in rice.

This difference in panicle length and number of panicles plant-1 could be due to genetic potentiality of the genotypes, which is primarily influenced by heredity and these findings are in accordance with Sridhara (2008) [11] in rice. Significant differences were observed among rice genotypes for number of grains and number of filled grains panicle-1 in the present study. Fertile grain is an important contributing factor to grain yield in rice, irrespective of method of cultivation (Wiangsamut *et al*., 2008) [13]. Such variability in rice under aerobic condition was reported in rice varieties by Ameen *et al*. (2014) [1].

Variation in grain yield could be due to difference in yield components (Chandrasekhar *et al*., 2001 and Ashrafuzzaman *et al*., 2009) [4, 3]. Higher grain yield under direct seeding was mainly due to higher number of tillers and most of the tillers produced were early and were productive. A similar varietal difference in seed yield was reported by Radha (2005) [10] and Srilaxmi *et al*. (2005) [12] in rice. This variation among the genotypes is attributed to inherent genetic variability and are genetically diverse. Such variability among rice genotypes was also reported by Kavita *et al.* (2015) and Mahantashivayogayya *et al.* (2016) [8] in rice under DSR. Among the eight genotypes tested under DSR method KRH-4 hybrid performed better followed by BR-2655, Thanu, Gangavathi Sona, MAS-946-1, MAS-26, IR-64 and MTU-1001.

5. Conclusion

Growth and yield parameters differed significantly for different varieties. The variety KRH-4 (G_8) recorded significantly earlier days to 50% flowering (89.00), days to maturity (118.00), number of productive tillers per plant 14.13, higher panicle length (21.77 cm), number of panicles per plant (16.47), number of filled seeds per panicle (153.33), grain yield per plant (37.40 g), grain yield per plot (11.90 kg), seed yield per hector (59.50 q), test weight of 1000 seeds (19.11 g) followed by BR-2655.

6. Acknowledgement

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