The Pharma Innovation Journal 2022; SP-11(11): 2252-2255

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(11): 2252-2255

www.thepharmajournal.com
Received: 08-09-2022
Accepted: 15-10-2022

Chitti Bharatkumar
University of Agricultural Sciences, Dharwad, Karnataka, India

Hanumaratti NG
University of Agricultural Sciences, Dharwad, Karnataka, India

Surendra P
University of Agricultural Sciences, Dharwad, Karnataka, India

Satish RG
University of Agricultural Sciences, Dharwad, Karnataka, India

Corresponding Author:
Chitti Bharatkumar
University of Agricultural Sciences, Dharwad, Karnataka, India

Performance of potential paddy genotypes suitable for summer cultivation in Hilly regions of Karnataka

Chitti Bharatkumar, Hanumaratti NG, Surendra P and Satish RG

Abstract

The present investigation is undertaken to identify potential high yielding, short duration rice genotypes suitable for Summer Cultivation Hilly region of Karnataka. The thirty four promising breeding lines and checks was evaluated during summer-2021-22. Which include germplasms collected from AICRP experiments and also generated from crossing Sona Mahsuri x Anatarsali. The field experiment was conducted in a Randomized Complete Block Design (RCBD) with three replications. In the present study results revealed significant difference among genotypes for all traits studied under stress, indicating presence of considerable amount of genetic variation among the population. Among genotypes evaluated IET-22627 (98.14, 3435.00), IET-22636 (96.90, 3391.66), IET-21940 (96.25, 3368.75) and KRGL-20-1-5-B (94.34, 3302.08) noted highest fertility percentage and grain yield (kg/ha) respectively.

Keywords: Summer cultivation, hilly region, potential paddy genotypes

Introduction

In India rice is cultivated on an area of 44.15 m. ha with production of 174.71 m. tons (2018-19), while in Karnataka it is cultivated on 9.85 lakh ha with production of 29.45 lakh tonnes of rice annually and the productivity of 2990 kg/ha (2018-19). The sowing time of summer rice is November to February and harvesting time is March to June. The area under summer crop cultivation of Karnataka is 1.54 lakh ha, which is low compared to Andhra Pradesh 6.44 lakh ha and Telangana 7.43 lakh ha. The productivity summer crop is 2990 kg/ha, which is also low compared to Andhra Pradesh 4644 kg/ha and Telangana 3413 kg/ha.

The lower productivity is mainly because of lower yield levels of paddy genotypes during summer. As summer crop is sown in the month of November-December which is exposed to severe hot summer temperatures (32-45 ºC) during flowering stage causing spikelet sterility. Rice is sensitive to high temperature, especially at the reproductive stage, which causes spikelet sterility and yield losses. The main cause of spikelet sterility, which is induced by high temperature at the flowering stage, is anther dehiscence (Satake and Yoshida, 1978 [11]; Mackill *et al*., (1982) [5]; Matsui *et al*., (1997a) [8], b [7], 2001 [9]). This is most severe problem in case rice-growing areas is rising temperatures (Catherine *et al*., 2012) [1].

Hence the present investigation was undertaken to identify potential high yielding, short duration rice genotypes suitable for Summer Cultivation Hilly region of Karnataka.

Material and Methodology

The experiment was carried out in the Agriculture Research Station, Malagi, University of Agricultural Sciences, Dharwad. This is situated at 14.72^0 N latitude, 75.00 ^{0}E longitude and at a altitude of 594.63 m above mean sea level. The thirty four promising breeding lines and checks was evaluated during summer-2021-22. Which include germplasms collected from AICRP experiments and also generated from crossing Sona Mahsuri x Anatarsali. These checks are different flowering duration early, medium, late duration, tolerance and susceptible to summer condition. The field experiment was conducted in a Randomized Complete Block Design (RCBD) with three replications.

Twenty five days old seedlings of each genotype were transplanted in 5 rows of 5m length by adopting a spacing of 20 cm between rows and 15 cm between plants. All the necessary precautions were taken to maintain uniform plant population of each genotype in all replication. All the recommend package of practices was adopted besides providing necessary prophylactic plant protection measures to raise a good crop. Data were recorded on a total of eight agro-morphological characters *viz*., Days to 50% flowering, Plant height (cm), Number of tillers per plant, Number of productive tillers per plant, Panicle length (cm), 1000 grain weight (g), Grain yield (Kg/ha), Fodder yield (Tons/ha).

Table 1: List of Promising breeding lines and checks

Sl. No.	Promising breeding lines		
1	KRGL-20-1-5-B	18	IET-23358
2	MSB-43-1-2	19	IET-22636
3	IVT-BI0-19(IET-24767)	20	IET-23191
4	IET-22554-1	21	IET-22631
5	IET-22460	22	IET-22627
6	IR-78875	23	IET-22632
7	BA-60-6-2	24	IET-21267
8	Dwarf MS early	25	IET-23173
9	Ms early	26	IET-22554-1-8
10	IET-23344	27	YSM-59-1-5
11	IET-22626	28	IR-78875-A
12	IET-23357	29	IET-29926
13	IET-23177	30	SMA-13-4-1
14	IET-22625	31	SMA-13
15	IET-21940	32	SMA-13-101
16	IET-22633	33	SMA-13-2
17	IET-23343	34	SMA-13-1
Checks			
1.	BPT-5204 (National Check)		
2.	SIRI-1253 (Local Check)		
3.	IR-64 ((long slender grain national check)		
4.	MTU-1010 (Long slender national check)		
5	MTU-1001(medium slender grain national check)		

Sampling and measurements: The experiment was undertaken to ensure heading and flowering occurred between late April month and late may month in order to expose summer heat condition. Flowering date was recorded by observing 50% plants heading. Spikelet fertility was determined manually by pressing the spikelet between the thumb and index finger at harvest. Both partially and fully filled spikelets were categorized as a filled spikelet. Spikelet fertility was calculated as follows:

$$\text{Spikelet fertility (\%)} = \frac{\text{No. of fertile spikelet's per panicle}}{\text{Total No. of spikelet's panicle}} \text{X100}$$

The mean data was statistically analyzed by adopting the appropriate methods outlined by Panse and Sukhatme (1978) [10] and Sundarajan *et al*. (1972) [13]. The critical differences were calculated at five per cent level of probability, wherever 'F' test was significant.

Table 2: Mean Performance of promising breeding lines for productivity traits

Sl. No	Genotypes	Grain yield (kg/ha)	Days to 50% flowering	Plant height (cm)	Panicle length (cm)	No. tillers/Plant	No of productive tillers/Plant	1000 grain weight (g)	Fodder yield (Ton/ha)	Spikelet fertility (%)	Grain type#
1	KRGL-20-1-5-B	3302.08	70.00	83.40	23.10	22.00	19.20	18.50	6.44	94.35	MS
2	MSB-43-1-2	3083.33	74.00	87.30	23.10	21.50	18.00	24.50	9.13	88.10	MS
3	IVT-BI0-19(IET-24767)	1515.83	78.00	80.40	23.40	24.60	18.10	28.50	11.79	43.31	MS
4	IET-22554-1	1845.83	78.00	108.90	17.30	27.70	14.40	24.50	10.27	52.74	MS
5	IET-22460	1837.50	58.00	95.60	23.00	22.80	18.20	18.50	11.58	52.50	MS
6	IR-78875	2095.83	58.00	86.80	23.90	23.70	19.00	26.50	6.15	59.88	MS
7	BA-60-6-2	2041.67	78.00	86.80	22.30	24.60	18.60	17.50	5.27	58.33	MS
8	Dwarf MS early	1966.67	52.00	76.30	25.40	22.20	19.10	18.50	8.81	56.19	MS
9	Ms early	2154.17	50.00	78.95	19.95	25.60	19.00	20.50	5.27	61.55	MS
10	IET-23344	2133.33	56.00	76.90	25.20	23.00	19.30	25.50	6.96	60.95	MS
11	IET-22626	2154.17	72.00	84.20	22.20	24.60	17.90	28.50	9.00	61.55	MS
12	IET-23357	2424.17	72.00	93.70	24.70	25.40	19.70	17.50	10.52	69.26	SB
13	IET-23177	2229.17	72.00	93.00	22.10	25.60	21.40	20.50	12.85	63.69	MS
14	IET-22625	1958.33	72.00	81.40	27.60	24.60	20.60	27.00	4.84	55.95	MS
15	IET-21940	3368.75	72.00	89.20	23.50	25.00	18.40	35.00	5.10	96.25	SB
16	IET-22633	2053.33	68.00	88.70	19.70	24.30	15.50	27.50	5.48	58.67	MS
17	IET-23343	1590.00	68.00	83.90	24.20	24.80	18.90	23.50	3.29	45.43	MS
18	IET-23358	1600.83	63.00	84.00	16.50	25.80	12.10	26.50	2.81	45.74	MS
19	IET-22636	3391.67	63.00	84.60	20.90	25.00	16.10	33.50	8.76	96.90	SB
20	IET-23191	3141.67	77.00	91.00	26.70	26.60	21.40	29.00	7.56	89.76	MS
21	IET-22631	2458.33	78.00	70.60	25.80	27.20	20.90	25.50	7.83	70.24	MS
22	IET-22627	3435.00	76.00	92.70	25.80	27.60	20.50	20.50	9.52	98.14	MS
23	IET-22632	1750.00	76.00	84.70	26.50	24.50	20.20	27.50	10.63	50.00	MS
24	IET-21267	1545.00	82.00	81.10	23.50	25.90	17.10	31.50	5.42	44.14	MS
25	IET-23173	1630.83	82.00	71.10	25.20	24.90	22.00	20.50	8.69	46.60	MS
26	IET-22554-1-8	1909.17	61.00	63.30	16.30	24.60	12.10	27.50	8.56	54.55	MS

27	YSM-59-1-5	1683.33	82.00	91.50	22.80	25.80	16.90	22.00	6.63	48.10	MS
28	IR-78875-A	1433.33	76.00	72.35	24.90	26.00	17.90	25.00	11.54	40.95	MS
29	IET-29926	2174.17	58.00	95.70	16.70	26.50	13.30	25.50	10.56	62.12	MS
30	SMA-13-4-1	2000.00	82.00	90.80	18.50	26.30	14.80	23.50	8.79	57.14	MS
31	SMA-13	2268.33	56.00	86.80	12.50	28.80	10.00	25.50	9.71	64.81	MS
32	SMA-13-101	1373.33	63.00	101.10	22.00	23.00	17.50	29.50	6.31	39.24	MS
33	SMA-13-2	1246.67	71.00	96.30	17.40	29.20	16.20	23.00	9.08	35.62	MS
34	SMA-13-1	1006.67	70.00	60.00	21.00	24.30	18.40	23.50	8.21	28.76	MS
Checks											
1	BPT-5204 (National Check)	2241.67	78.00	60.60	15.20	20.00	12.10	15.50	5.83	64.05	MS
2	MUGAD SIRI-1253 (Local Check)	2254.17	92.00	60.35	17.40	17.80	16.40	25.00	6.90	64.40	MS
3	IR-64 ((long slender grain national check)	2945.83	76.00	74.60	19.90	22.60	16.00	30.00	7.67	84.17	LS
4	MTU-1010 (Long slender national check)	2304.17	82.00	65.10	21.80	23.90	16.50	24.50	6.85	65.83	LS
5	MTU-1001(medium slender grain national check)	3425.00	58.00	67.00	17.50	21.90	16.40	34.50	6.19	97.86	LS
	Trial Mean	2178.80	70.51	82.58	21.68	24.62	17.44	24.91	7.87	62.25	
	C.V.(%)	17.38	1.28	10.61	8.26	4.91	8.20	3.40	14.81	17.38	
	C.D. (5%)	766.38	1.83	17.73	3.62	2.45	2.90	1.71	2.36	21.90	
	S.EM	267.69	0.64	6.19	1.27	0.85	1.01	0.60	0.82	7.65	

Results and Discussion: In the present study results revealed significant difference among genotypes for all traits studied under stress, indicating presence of considerable amount of genetic variation among the population. The large genetic variability among the germplasm towards different characters indicates the scope for improving the short duration and yield attributing traits. The Mean performance for the short duration and yield attributing traits are shown in Table 2.

With respect to plant height, the mean values ranged between 60.00 cm for SMA-13-1 and 108.90 cm for IET-22554-1 compared local the check variety MUGAD SIRI-1253 (60.35cm).

The days to 50% flowering were ranged minimum 50 days for MS early and 82 days for SMA-13-4-1 compared to local check MUGAD SIRI-1253 (92 days). The days to maturity ranged between 80-110 days. The temperature during summer is typically higher during the spikelet flowering period, resulting in severe spikelet sterility, which suggests that early flowering cultivar type like Dwarf MS early (52), IET-23344 (56), SMA-13 (58), IET-22460 (58), IR-78875 (58) and check variety MTU-1001 (58) could be used as genetic donors over come spikelet sterility.

The important trait for summer cultivation of paddy is spikelet fertility percentage. Spikelet fertility under summer ranged from 98.14% to 28.76 % due to weather conditions. Lowest spikelet fertility was observed in SMA-13-1 and highest in IET-22627. Among promising breeding lines four breeding lines identified as genetic donors based on spikelet fertility, which recorded more than 90% fertility. Among them IET-22627 (98.14, 3435.00), IET-22636 (96.90, 3391.66), IET-21940 (96.25, 3368.75) and KRGL-20-1-5-B (94.34, 3302.08) noted highest fertility percentage and grain yield (kg/ha) respectively.

Popular varieties in Asia, particularly in the India, have high yields, good grain quality, and resistance to pests and diseases. However, they lack heat tolerance. Due to the advent of climate change caused by global warming, breeding for heat-tolerant varieties has become important. New rice varieties should possess adaptability to rising temperatures in addition to the desirable traits that a variety should have. The breeding populations created through a regional collaboration project need to adapt to increasing temperatures in specific locations. Genetic variability in any crop is pre-requisite for selection of superior genotypes over the existing cultivars. Variation was observed for all the characters among the genotypes studied, indicating the existence of sufficient amount of variability. These results were in conformity with the findings of Dhanwani *et al.* (2013) [2], Dhurai *et al.* (2014) [3] and Kavitha *et al.* (2015) [4]. Yield data were obtained from screening of the rice accessions showed the genotypic difference. An increase in panicle length, number of panicles, number of tillers per plant, average weight of five panicles and minimum per cent of chaffyness observed and this increase resulted in high yields even with high temperature compared with other checks with the findings of Mahantashivayogayya *et al.* (2016) [6].

Among yield components, the number of panicles/plant and grains/panicle showed greater sensitivity to high-temperature stress, whereas 1000-grain weight was less affected by the same level of heat stress. The marked reduction in grain yield of rice under high temperature stress during vegetative growth was mainly attributed to the significant reduction in the number of panicles/plant followed by the number of grains/panicle. The reduction in grain yield by high-temperature stress during the reproductive growth phase was caused by significant decreases in the number of panicles/plant and number of grains/ panicle and the marginal reduction in 1,000-grain weight (Surender 2021) [12].

References

1. Catherine C, Gemma, Victoria ND. TE Velde of Agulhas. Managing climate extremes and disasters in Asia: Lessons fromthe IPCC SREX reports. Climate and Development Knowledge Network; c2012. Available from http://www.ifrc.org/docs/IDRL/Managing Climate Extremes Asia. pdf. March 5 2013.
2. Dhanwani RK, Sarawgi AK, Solanki A, Tiwari JK. Genetic variability analysis for various yield attributing and quality traits in rice (*O. sativa* L.). The Bioscan 2013;8(4):1403-1407.
3. Dhurai SY, Bhati PK, Saroj SK. Studies on genetic variability for yield and quality characters in rice (*Oryza*

sativa L.) under integrated fertilizer management The Bioscan. 2014;9(2):745-748.

4. Kavitha K, Sharath Kumar Reddy, Rajarajeswari, Sudhakar. Relationship of water use efficiency and heat tolerance traits with grain yield in elite paddy genotypes under aerobic cultivation. The Ecoscan. 2015;9(1&2):601-604.
5. Mackill DJ, Coffman WR, Rutger JN. Pollen shedding and combining ability for high temperature tolerance in rice. Crop Science. 1982;22:730-733.
6. Mahantashivayogayya K, Basavaraj S, Lakkundi MS, Ramesha Amaregouda, Mohammed Ibrahim, Masthana Reddy BG, *et al*. Response of Rice Genotypes for Heat Stress during Summer Season in the Northern Parts of Karnataka, Journal of Rice Research. 2016;9(1):24-29.
7. Matsui T, Namuco OS, Ziska LH, Horie T. Effects of high temperature and CO_2 concentration on spikelet sterility in indica rice. Field Crops Research. 1997b;51:213-219.
8. Matsui T, Omasa K, Horie T. High temperature-induced spikelet sterility of japonica rice at flowering in relation to air temperature, humidity and wind velocity condition. Japanese Journal of Crop Science. 1997a;66:449-455.
9. Matsui T, Omasa K. Rice (*Oryza sativa* L.) cultivars tolerant to high temperature at flowering: anther characteristics, Annals of Botany. 2002;89:683-687.
10. Panse VG, Sukhatme PU. Statistical Methods for Agricultural Workers, Indian Council of Agriculture Research, New Delhi; c1978.
11. Satake T, Yoshida S. High temperature-induced sterility in indica rice at flowering. Japanese Journal of Crop Science. 1978;47:6-10.
12. Surender R, Lavanya K, Abdul Fiyaz, Chiranjeevi M, Shiva Prasad G, Subba Rao LV. Screening of rice (O. *sativa* L.) genotypes for heat tolerance to develop climate resilient rice genotypes. The Pharma Innovation Journal. 2021;10(2):132-143.
13. Sundarraj N, Nagaraju S, Venkataramu S, Jaganath MK. Design and analysis of field experiment, Univ. Agric. Sci. Bangalore; c1972.