Original Research Article

PERFORMANCE OF PRE RELEASED RICE (*ORYZA SATIVA* L.) GENOTYPES UNDER DIFFERENT SOWING WINDOWS IN RABI SEASON.

ABSTRACT

The aim of this study was to investigate the effect of different sowing dates on growth and yield potential of pre released rice genotypes under irrigated conditions of Northern Telangana zone. The field experiments were carried out during two consecutive rabi seasons of 2018-19 and 2019-20, on clay soils of agricultural research station, Kunaram, Telangana state, India. The experiment was laid out in strip plot design with three replications. The treatments comprised of three sowing dates i.e. 20th November, 5th December and 20th December in horizontal factor and four genotypes i.e. KNM 733, RNR 15048, KNM 1638 and KNM 118 in vertical factor. Pooled data analysis results revealed that the different sowing dates and genotypes significant effect on all the studied growth and yield characters. The rice crop sown on 20th December recorded significantly higher grain yield (8138 kg ha^{-1}) and Among the genotypes, the short slender, short duration genotype KNM 733 recorded the recorded the maximum grain yield (8024 kg ha^{-1}), which was on par with the other genotypes . The treatment combinations data results concluded that the, among the genotypes the genotype KNM 118 was recorded highest grain yield (8438 kg ha^{-1}) when sowing was taken up on 20th December and followed by the genotype KNM 733 with sown on 20th November. In respect of economics of treatment combinations, the highest net returns (Rs.91,165 ha^{-1}) and B:C (2.47) ratio were obtained when rice crop was sown during 20th December with the genotype KNM 118 and followed by sown on 20th November with the genotype KNM 733.

Key words: Dates, Economics, Genotypes, Grain yield, KNM, Sown,

1. INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important staple food grain crops of the world, which constitute the principle food for 60 per cent of the world's population and 2/3rd of Indian population. Rice is intensively grown in 88 countries across the world on an area about 160.43million hectares with annual production of 495.73 million tones [1]. In India rice is grown in 43.79 million hectares, the production level is 116.40 million tones and the productivity is about 2659 kg ha^{-1} (Agricultural statistics at a glance-2018) [2]. In Telangana rice is grown in 1.95 million hectares with annual production of 4.46 million tones and the productivity is about 3436 kg ha^{-1} (Agricultural statistics at a glance-2018) More than 80 per cent of the world's rice is produced and consumed in Asia [3], where it is an integral part of culture and tradition. Rice, it is believed, is associated with wet, humid climate, though it is not a tropical plant. It is probably a descendent of wild grass that was most likely cultivated in the foothills of the far Eastern Himalayas.

The optimum period of time for sowing and transplanting of rice is critical in achieving high grain yield. However, optimum rice planting dates vary with regional, location and genotypes [4].

Rice plants require a particular temperature for its phenological affairs such as panicle initiation, flowering, panicle exertions from flag leaf sheath and maturity. Performance of a genotype entirely depends upon the time of planting. Rice needed before or after the window of optimum dates usually has slow germination and emergence, poor crop stand establishment, increased soil borne, seedling diseases damage under cold conditions, and seeds lose by birds or mice. Seedling at the optimum time is an important factor of transplanting for uniform stand establishment of rice. On the other hand, seedling sown with the delay of sowing more than optimum produces fewer tillers due to the reduction of the vegetative period and hence results in poor yield. Among the crop production tools, optimum time and method of sowing are the important agronomic tools that allow the crop to complete its growth timely and successfully under specific agro-ecology zone [5].

The significantly highest effective tillers $hill^{-1}$, leaf area index (LAI) at flowering , filled grain $panicle^{-1}$, 1000 grain weight coupled with significantly lower sterility percentage were observed with 15 July planting during the rainy season [6].

Varieties play a unique role in maximizing yield by improving the input- use efficiency as the genetic potential of variety limits the expression of its yield and affects plant growth in response to environment condition. The genotype KNM 733 is a short slender, short duration, non-shattering and good quality traits with high yield potential and the genotype KNM 1638 is an early duration, medium slender and non-lodging culture with high yield potential.

Pre released KNM rice cultures developed from breeding experiments are to be evaluated for their performance with best checks under different dates of sowings before recommending to the farmers. There is a need to find out the optimum dates of sowings during rabi for getting higher yield in Northern Telangana Zone.

2. MATERIALS AND METHODS

A field experiment was conducted for two consecutive rabi seasons of 2018-19 and 2019-20 at Agriculture Research Station, Kunaram situated at an altitude of 231 m above mean sea level at 18.5272^{o}’ N latitude and 79.4943^{o}f’ E longitude. The soil of the experiment cites was clay in texture, saline in reaction. It was normal electrical conductivity (0.40 dS m^{-1}) and just below neutral in reaction (pH 6.36). The organic carbon content was low (0.26-0.40%) while medium in available Nitrogen and phosphorus respectively but high in potash content. The experiment was laid out in strip plot design replicated thrice. The treatments combination comprised three sowing dates in the horizontal factor *viz.* 20th November, 5th December and 20th December, and four genotypes in the vertical factor *viz.* KNM 733, RNR 15048, KNM 1638 and KNM 118. The net size of each plot was 27 m^2 (6.0 × 4.5 m). Row to row and plant to plant distance was made at 15 cm apart and seedlings were transplanted according to different dates of sowings. Seeds were sown at the rate of 50 kg ha^{-1} in each date of sowing in the nursery. The seeds were treated with bavistin @ 2g kg^{-1} seed before sowing. One third of the recommended dose of nitrogen (150 kg ha^{-1}), full dose of phosphorus (60 kg ha^{-1}) and half dose of potash (40 kg ha^{-1}) were applied at after main field preparation, and the remaining nitrogen was top-dressed in two equal splits dose, at active tillering (18 -20 DAT), and at panicle initiation stage The remaining half of the potassium applied at panicle initiation stage in the D_1, D_2 and D_3 transplanted plots. For effective weed management, oxadiarzyl (70 grams *a.i.*ha^{-1}) was used in moist condition at morning sunshine hours in all the treatments just after D_1, D_2 and D_3 transplanted fields. Zinc sulphate (2 grams $liter^{-1}$) was sprayed to foliage at 25 and 30 DAT to avoid zinc deficiency in the crop. Irrigation was applied @ 5 cm at 7 to 8 days interval to maintain soil moisture at field capacity from sowing to one week before harvest during dry spells in the season. The plant height, tillers production and dry matter accumulation were recorded at tiller initiation, maximum tillering, panicle initiation, 50 % flowering and maturity stage of the crop growth. The yield attributes and grain yield was recorded at harvest and sun dried straw yield was recorded 15 days after harvest.

3. RESULTS AND DISCUSSION

Growth parameters:

3.1. Plant height (cm):

The crop sown on 20th December recorded significantly maximum plant height (103.0 cm) and followed by 5th December and 20th November(Table 1). Plant height is directly proportional to the length of the vegetative phase of the crop. Koireng et al. [7] reported that significantly different responses of different genotypes to various management variable and environments with respect to growth attributes due to inherent characteristics. Among the genotypes, the genotype RNR 15048 registered the highest plant height (107.0 cm) and which was significantly difference with the other genotypes KNM 733 (96.0 cm), KNM118 (94.0 cm) and KNM 1638 (89 cm) (Table 1). The interaction effect of dates of sowing and varieties on plant height was significant. It may be due to the genetic character of the variety and higher photosynthesis efficiency. The results consistent with the findings of Nizamani et al. [8] and Suleiman et al. [9], who observed plant height, differed significantly among the varieties.

3.2. Number of tillers per square meter:

At harvest stage, crop sown on 20th December recorded significantly more number of effective tillers m^{-2} (457.0) over the crop sown on 20th November; however, this was statistically at par with each other and significantly to crop sown on 5th December. This may be due to availability of favorable soil and air temperature during growing cycle of the crop. Similarly these findings were supported by Sharma [10] and Osman et al. [11]. Among the short duration genotypes *viz*., KNM 118 and KNM 733 registered higher number of effective tillers m^{-2} (447 and 438) and were on par with each other and significantly superior over RNR 15048 and KNM 1638 varieties. It might be due to differences in genetic makeup of these rice varieties. The results are in close conformity with Mali and Choudhary [12], who also found highly significant difference in number of effective tiller plant^{-1} count.

3.3. Total dry matter per square meter:

The total dry matter production per square meter was not significantly influenced by different dates sowing (Table 1). The maximum dry matter accumulation registered crop sown on 20th December (1687.0 gm^{-2}) than crop sown on 5th December and 20th November. Among the genotypes, the genotype of KNM 1638 accumulated more dry matter m^{-2} (1730.0 gm^{-2}) and significantly superior over rest of the varieties respectively. The difference in dry matter accumulation among the genotypes might be due to their genetic potential and differential plant height. Similar results were obtained by Dileep et al. [13].

3.4. Phenology:

The days taken to reach flowering and harvest varied significantly among the sowing dates (Table 1).The significantly higher number of days was taken by 20th November sown crop, while the significantly lowest number of days was taken by 20th December sown crop. Sowing date primarily influences the length of vegetative period of rice with early sown rice requiring a greater number of days to accumulate the same number of degree days units compared with later sown rice. A linear negative correlation between sowing dates and growth period, in the later sowing dates was also reported by Peng-fei et al. [14]. Wani et al*.* [15], reported the days taken to reach flowering and harvest varied significantly among the sowing dates.

Yield parameters & Yield

3.5. Yield attributes:

Total number of panicle per square meter varied significantly among the different dates of sowing (Table 2). The maximum number of panicles m^{-2} (479.0) were produced crop sown on 20th December and it is on par with the crop sown on 20th November and significantly difference with the sown crop on 5th December. There was no significant difference was observed among the genotypes with respect to number of panicle per square meter. Similarly these findings were supported by Jagtap et al. [16]. Number of filled grains $panicles^{-1}$ is significantly influenced by different sowing dates. The crop sown on 20th November produced more number of filled grains $panicles^{-1}$ (240.0) and which was significantly difference with the 5th December and 20th December sown crop (Table 2). These results alined with the findings of Dawadi et al. [17]. There was also a significant difference among the varieties with respect to filled grains panicles^{-1}. Significantly more number of filled grains panicle^{-1} (278) were recorded in the genotype RNR 15048 and superior over to other genotypes. The number of spikelets panicle^{-1} is basically genetic feature of a variety. These results are in close conformity with Balaji naik et al. [18], who also observed significantly differences in number of filled spikelets panicle^{-1} due to varieties and sowing times in aerobic rice system.

3.6. Test weight (1000 grain weight):

The crop sown on 5th December recorded more 1000 grain weight (17.05 g) and was significantly superior to 20th November and 20th December sown crop (Table 2). Higher test weight obtained from the crop sown in 5th December might be attributed optimum photoperiod available for crop growth and development. These results are in line with the findings of Muhammad et al. [19] and Jagtap et al. [16]. Among the genotypes, the genotype KNM 118 recorded significantly the highest 1000 grain weight (25.3g) over the other genotypes KNM 733, KNM 1638 and RNR 15048. These results clearly indicated that, the 1000 grain weight is a varietal feature which might be affected least with the environmental conditions.

3.7. Grain yield (Kg ha^{-1}):

Grain yield is a function of interplay of various yield components such as number of filled grains panicles^{-1}, productive tillers and test weight. The data pertaining to the grain yield as affected by different sowing dates are given in (Table 2). Significantly more grain yield (8138.0 kg ha^{-1}) was realized from the crop sown on 20th December and which is on par with the crop sown on 5th December and was significantly difference with the grain yield of crop sown on 20th November (Table 2). Chendge et al. [20], reported that the increased yield might be due to result of optimum growth and development parameters and yield contributes associated with favorable weather condition responsible for more growth and development resulted in more storage of photosynthates in the grain. There was no significant difference observed among the genotypes with respect to grain yield. Among the genotypes tested, the genotype KNM 733 noticed more grain yield (8024.0kg ha^{-1}) followed by other genotypes. The cumulative effects of superior growth and yield attributes were finally reflected in terms of higher grain yield. Similar findings have been reported by Hussain et al. [21], Suresh et al. [22] and Walia et al. [23]. So, it would be better to choose short duration genotype KNM 733 and follow optimum sowing dates from 5th December to 20th December under irrigated conditions of Northern Telangana Zone.

Interaction effect

The interaction effect among the different sowing dates and genotypes for grain yield found to be significant in the pooled mean of the data (Table 3).The short duration long slender genotype KNM 118 sown during 20th December recorded higher grain yield (8438 kg ha^{-1}) and followed by crop sown on 20th November With the genotype KNM 733 (8301 kg ha^{-1}). Similar findings were reported by Manjunath et al. [24] and Reddy et al. [25].

3.8. Harvest index (%):

The harvest index was significantly influenced by different dates of sowing and genotypes. The crop sown on 20th December registered higher harvest index (60.0) and which was significant difference with other dates of sowing. There was no significant difference among the genotypes with respect to harvest index values. Similar findings was observed by Hossain et al. [26] and Salahuddin et al. [27], concluded that high harvest index was mainly due to higher grain yield which was achieved through better performance in most of the yield, attributing traits. Similar was observed in the present study.

3.9. Economic analysis:

Data pertaining to economic analysis is given in (Table 3). A perusal of data indicated that higher net returns (Rs. 85, 597 ha^{-1} and Rs. 83, 059 ha^{-1}) and B:C ratio (2.38 and 2.34) was recorded in 20th December, which was however, comparable with 5th December sown crop and significantly superior to crop sown on 20th November (Table 2). There was no significant difference between among the genotypes with respect to net income and B:C ratio. Among the treatment combinations tested (Table 4), it was observed that the highest net returns (Rs.91,165 ha^{-1}) and B:C (2.53) ratio were obtained when rice crop was sown during 20th December with the genotype KNM 118 and followed by sown on 20th November with the genotype KNM 733 (Rs.88,667 ha^{-1} and 2.61). From the above results it was affirmed that 20th December and 5th December sown crop produced higher net returns and more benefit-cost ratio. There was no significant difference between among the genotypes with respect to net income and B:C ratio.. So, it would be better to choose short duration genotypes KNM 118 and KNM 733 and follow optimum sowing dates from 5th December to 20th December under irrigated conditions of Northern Telangana zone. These results are close conformity with the Balaji naik et al. [18]

.4. CONCLUSION:

The conclusion drawn from this study is that, the sowing dates significantly affect the yield and yield components of pre released rice genotypes. Thus It would be concluded that rabi rice in Northern Telangana Zone to be sown during 20th November to 20th December with the genotypes KNM 733 and KNM 118 respectively, so as to obtain higher yield and economic returns.

Table. 1. Growth and yield attributes of pre released rice cultures as influenced by different dates of sowing during rabi season (Pooled data of 2 years).

Treatments	Plant height (cm)	No. of tillers m^{-2}	Dry matter production (g m^{-2})	No. of days to			
				Maximum tillering	Panicle Initiation	50% Flowering	Maturity
Main plot: Date of sowing							
20th November	92.0	454.0	1497.0	65	93	105	134
5th December	95.0	397.0	1586.0	59	89	101	129
20th December	103.0	457.0	1687.0	60	93	100	127
SEm ±	0.28	4.17	60.0	0.16	0.53	0.18	0.26
CD (P = 0.05)	1.10	16.39	NS	0.62	2.06	0.70	1.02
Sub-plot: Pre Released Cultures							
KNM 733	96.0	438.0	1588.0	58	89	100	127
RNR 15048	107.0	432.0	1585.0	63	92	103	132
KNM 1638	89.0	426.0	1730.0	66	95	107	136
KNM118	94.0	447.0	1458.0	58	89	99	125
SEm ±	0.42	3.62	21.6	0.23	0.45	0.16	0.32

CD (P = 0.05)	1.45	12.54	75.0	0.78	1.55	0.57	1.11
Interaction (D X V)							
SEm ±	SEm ±	0.38	8.16	81.79	0.39	1.0	0.44
CD (P = 0.05)	CD (P = 0.05)	1.16	NS	252.0	1.20	NS	1.35
Interaction (V X D)							
SEm ±	0.38	7.30	82.45	0.33	0.90	0.37	0.53
CD (P = 0.05)	1.33	NS	286.0	1.15	NS	1.29	1.85

Table. 2. Yield attributes and yield of pre released rice cultures as influenced by different dates of sowing during rabi season (Pooled data of 2 years).

Treatments	No. of panicles m^{-2}	Panicle length (cm)	No. of filled grains $panicle^{-1}$	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Test weight (g)	Harvest index (%)	Net returns	B:C Ratio
Main plot: Date of sowing									
20^{th} November	459.0	22.54	240.16	7550.0	5617.0	16.77	57.67	75,680.0	2.22
5^{th} December	406.0	23.37	227.50	7993.0	5778.0	17.05	58.49	83,059.0	2.34
20^{th} December	479.0	23.44	200.33	8138.0	5472.0	16.64	60.15	85,597.0	2.38
SEm ±	4.85	0.10	2.76	1.02	32.01	0.05	0.31	1,412.0	0.02
CD (P = 0.05)	19.02	0.40	10.85	305.4	125.69	0.18	1.22	5544.0	0.09
Sub-plot: Pre Released Cultures									
KNM 733	450	23.51	224.41	8024.0	5765.0	15.11	58.40	83,642.0	2.35
RNR 15048	449	23.65	278.44	7885.0	5469.0	12.38	59.67	81,112.0	2.31
KNM 1638	443	22.65	254.10	7912.0	5666.0	14.43	58.49	81,610.0	2.32
KNM118	449	22.64	133.70	7792.0	5590.0	25.35	58.53	79,418.0	2.28
SEm ±	5.01	0.07	2.84	112.0	107.3	0.05	0.66	2,034.0	0.03

CD (P = 0.05)	NS	0.26	9.81	NS	NS	0.18	NS	NS	NS
Interaction (D X V)									
SEm ±	6.74	0.18	6.34	162.0	137.6	0.09	1.02	2,941.0	0.05
CD (P = 0.05)	20.77	0.57	NS	499	424.0	0.27	NS	9061.0	0.15
Interaction (V X D)									
SEm ±	6.75	0.17	5.46	142	109.7	0.08	0.83	2590.0	0.04
CD (P = 0.05)	23.38	0.58	NS	494	380.3	0.27	NS	8972.0	0.14

Table.3. Interaction effect of dates of sowing on grain yield (kg ha^{-1}) of different rice genotypes (Pooled data).

Dates of sowing	Varieties				
	KNM 733	**RNR 15048**	**KNM 1638**	**KNM 118**	**Mean**
20th November	8301.0	7727.0	7562.0	6752.0	7586.0
5th December	7877.0	7872.0	8035.0	8183.0	7992.0
20th December	7894.0	8055.0	8139.0	8438.0	8132.0
Mean	8024.0	7885.0	7912.0	7791.0	
SEm ±	162.0				
CD (P = 0.05)	499.0				

Table. 4. Yield and economics of rice cultures as affected by different treatment combinations.

Treatments	Grain yield (kg ha^{-1})			Gross Returns (Rs. ha^{-1})			Net Returns (Rs. ha^{-1})			B:C Ratio		
	2018	2019	Mean	2018	2019	Mean	2018	2019	Mean	2018	2019	Mean
D1V1	8910	7693	8301	1,61,714	1,39,619	1,50,667	99,714	77,619	88,667	2.61	2.25	2.43
D1V2	8365	7089	7727	1,51,832	1,28,662	1,40,247	89,832	66,662	78,247	2.45	2.08	2.26
D1V3	7767	7357	7562	1,40,965	1,33,536	1,37,250	78,965	71,536	75,250	2.27	2.15	2.21
D1V4	6968	6537	6752	1,26,467	1,18,646	1,22,557	64,467	56,646	60,557	2.04	1.91	1.98
D2V1	7609	8146	7877	1,38,097	1,47,854	1,42,975	76,097	85,854	80,975	2.23	2.38	2.31
D2V2	6874	8870	7872	1,24,764	1,60,996	1,42,880	62,764	98,996	80,880	2.01	2.60	2.30
D2V3	6827	9244	8036	1,23,913	1,67,785	1,45,849	61,913	1,05,785	83,849	2.00	2.71	2.35
D2V4	7880	8487	8184	1,43,026	1,54,038	1,48,532	81,026	92,038	86,532	2.31	2.48	2.40

D3V1	7752	8037	7894	1,40,696	1,45,871	1,43,283	78,696	83,871	81,283	2.27	2.35	2.31
D3V2	7685	8426	8056	1,39,486	1,52,929	1,46,207	77,486	90,929	84,207	2.25	2.47	2.36
D3V3	7157	9122	8139	1,29,896	1,65,567	1,47,731	67,896	1,03,567	85,731	2.10	2.67	2.38
D3V4	8633	8244	8439	1,56,695	1,49,635	1,53,165	94,695	87,635	91,165	2.53	2.41	2.47

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