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Research Article

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RESPONSE OF RICE (*ORYZA SATIVA*L.) GENOTYPES UNDER DIFFERENT PLANTING DATES

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ABSTRACT

The present study aimed to evaluate the impact of planting date on the growth and yield of rice genotypes. The study was conducted during Khaif season of 2022; the field experiment was conducted at the Rice Research Center (RRC) Dokri. The experiment was laid out in split plot design containing three sowing dates' viz. 30thJune, 15th July and 30thJuly in main plots and four rice genotypes viz. NUYT-M-11, N U Y T -M-8, NUYT-M-10 and Latify (check) as sub plot treatments. Nevertheless, rice crops sown on June 30th demonstrated markedly superior performance compared to other sowing dates. These crops exhibited a plant height of 97.27 cm, 19.18 tillers per plant, a panicle length of 24.77 cm, a seed index of 29.82 g, a biological yield of 8964 kg/ha, a grain yield of 6000 kg/ha, and a harvest index of 84.11%. The interaction between genotypes and sowing dates significantly influenced the observed plant height, tillers per plant, panicle length, seed index, biological yield, grain yield, and harvest index. Among the genotypes, NUYT-M-11 sown on June 30th displayed the highest values for these parameters.

Keywords: planting date, genotypes, tillers, panicle, biological yield.

INTRODUCTION

Rice is second in Pakistan's list of the most important crops for eating. It has been a big source of money for the country in the last few years. It is the main food for about half of the world's people, and as the number of people has grown, so has the number of people who eat it (Sudheer et al., 2018). Rice is a good source of food and money. It is the second most important food grain in Pakistan after wheat, and it is the second most important source of foreign exchange. New rice cultivars with improved drought tolerance are needed to reduce rice crop yield losses in rainfed low and areas and increase overall rice production (Kumaretal.,2021). In all the rice growing regions of the world, rice cultivation is influenced by the Agro-climatic conditions and crop improvement has always been considered as an important parameter to select and evolve superior rice varieties. Within the broad scope of the Agro-climatic factors, soil salinity and water availability for rice cultivation are two of the most important factors that limit productivity. Sowing dates play a crucial role in influencing the performance of various rice genotypes. The ideal sowing time varies based on factors such as geographic location, local weather conditions, and the particular genotype being cultivated. Studies have revealed that early sowing dates can lead to increased yields and improved rice fiber quality, especially in areas with extended growing seasons. However, sowing too early may also raise the likelihood of harm from pests, diseases, and unfavorable weather conditions like frost. Conversely, late sowing dates can negatively affect rice performance, as there may not be sufficient time for the plants to mature before encountering detrimental weather conditions such as frost or drought. Moreover, late sowing can result in diminished yields and inferior fiber quality, as plants may face higher temperatures and extended periods of stress. Determining the appropriate sowing date for rice genotypes should consider various factors, including local climate and weather patterns, pest and disease risks, and the specific traits of the rice genotype in question. By carefully weighing these factors, farmers can optimize their sowing dates to maximize both the yield and quality of their rice harvests (Ding *et al*., 2019; Dewi et al., 2021).

MATERIALS AND METHODS

The field experiment took place at the Rice Research Center during the Khaif season of 2022.

(RRC) Dokri. The experimental site in the Larkana district is located between 67° 56” 20ꞌ to 68° 29” 34ꞌ East longitudes and 27° 7” 31ꞌ to 27° 56” 2ꞌ North latitudes. The experiment was laid out in split plot design containing three sowing dates viz. 30thJune, 15thJuly and 30th July in main plots and four rice genotypes viz. NUYT-M-11, N U Y T -M-8, NUYT-M-10 and Latify (check) as sub plot treatments. Ten plants were randomly selected from each treatment to collected data for yield and yield components.

Statistical analysis: The experimental data for various wheat traits were collected and analyzed using a factorial design of analysis of variance. The analysis was performed with the computer program Statistix (SWX), Version 8.1, a Student Edition released in 2005 by Analytical Software. Additionally, a least significant difference (LSD) test was employed to assess the significance levels among different combination means, following the approach outlined by Gomez and Gomez in 1984.

RESULTS&DISCUSSION

Plant height (cm): Results showed that significantly differences amongst the combination of sowing dates and genotypes and their interactions were observed, while sowing dates were significant at 5% probability level, and data are presented (Table 1). The tallest rice plant height (97.27 cm) was observed when the crop was sown on June 30th, followed by July 15th, with an average plant height of 89.86 cm. The shortest plant height with an average 82.36 cm, was observed when the crop was sown on July 30th. The genotype NUYT-M-11 showed the tallest plant height (92.65 cm), followed by NUYT-M-10 (90.80 cm) and NUYT-M-8 (88.93 cm), while the shortest plant height (86.96 cm) was observed in the Latify (Check) genotype. The interactive effect of genotypes and sowing date, the genotype NUYT-M-11 and sowing date of June 30th resulted in the tallest plant height (100.05 cm), whereas the interaction between Latify (Check) and the sowing date of July 30th resulted in the shortest plant height (79.28 cm). Our results are similar to those Sahu et al. (2014) found that delaying the sowing date of rice crops had a positive impact on plant height,

Numberoftillersplant^{-1}: The maximum number of tillers plant^{-1} (19.18) was observed on June 30th, followed by July 15th with an average number of tillers plant^{-1} of 15.80, according to the results presented in Table 2. The genotype NUYT-M-11had the highest number of tillers plant^{-1} (17.21), followed by NUYT-M-10 (15.57) and NUYT-M-8 (15.11), while the lowest number of tillers plant^{-1} (14.87) was observed in the Latify (Check) genotype. The interactive effect of genotypes and sowing date showed that the genotype NUYT-M-11 and sowing date of June 30th resulted in the highest number of tillers plant^{-1} (20.23), while the interaction between NUYT-M-8 and the sowing date of July 30th resulted in the lowest number of tillers plant^{-1} (10.42). Result depicted from this study are confirmed by Singh et al. (2019) who reported that both early and late planting of genotypes negatively affect rice tiller and overall seed rice yield.

Panicle length (cm): The statistical analysis of variance for the panicle length (cm) indicated that combination of sowing dates and their interactions were high, while sowing dates were significant at 5% probability level, and data are presented (Table 3).The tallest panicle length (24.77 cm) was observed when the crop was sown on June 30th, followed by July 15th with an average panicle length of 22.51 cm, according to the results presented in Table 4.3. The shortest panicle length with an average of 20.11cm was observed when the crop was sown on July 30th. The genotype NUYT-M-11 had the tallest panicle length (23.23 cm), followed by NUYT-M-10 (22.81 cm) and NUYT-M-8 (22.21 cm), while the shortest panicle length (21.61 cm) was observed in the Latify (Check) genotype. The interactive effect of genotypes and sowing date showed that the genotype NUYT-M-11 and sowing date of 30th June resulted in the tallest panicle length (25.27 cm), while the interaction between Latify (Check) and the sowing date of July 30th resulted in the shortest panicle length (19.21 cm). Similarly, Zhu et al. (2021) found that grains at different positions of the panicle and panicle length exhibited distinct variations in eating quality, starch physiochemical properties, and fine structure.

Seed index (1000-grains weight, g): The study examined the effect of Planting dates and genotypes on the seed index (1000-grains weight) of rice (Table 4). The highest seed index (1000-grains weight) was observed on June 30th with an average of 29.82 g, followed by July 15th with an average of 28.76 g. On the other hand, the lowest seed index (1000-grains weight) was observed on July 30th, with an average of 27.93 g. Among the genotypes, NUYT-M-11 had the highest seed index (1000-grains weight) of 29.15 g, followed by NUYT-M-10 (28.99 g) and NUYT-M-8 (28.69 g). The genotype Latify (Check) had the lowest seed index (1000-grains weight) of 28.52 g. The interaction between genotypes and Planting dates showed that NUYT-M-10 and the sowing date of June 30th resulted in the highest seed index (1000-grains weight) of 30.11 g, while the interaction between Latify (Check) and the sowing date of July 30th resulted in the lowest seed index (1000-grains weight) of 27.61 g. The results of presented research are supported by Hussain et al., 2013 who reported the optimum time gave higher grain weight with high quality rice seed.

Biological yield (kg ha^{-1}): The biological yield (kg ha^{-1}) of rice genotypes NUYT-M-11, NUYT-M-8, NUYT-M-10, and Latify (Check) sown on different dates. According to the results presented in Table 5, the tallest rice biological yield (8964kg ha^{-1}) was observed when the crop was sown on June 30th, followed by July 15th with an average biological yield of 7820 kg ha^{-1}. The shortest biological yield with an average 7107 g kg ha^{-1}was observed when the crop was sown on July 30th. The genotype NUYT-M-11 showed the tallest biological yields (8071 kg ha^{-1}), followed by NUYT-M-10 (8221 kg ha^{-1}) and NUYT-M-8 (7989 kg ha^{-1}), while the shortest biological yield (7573 kg ha^{-1}) was observed in the Latify (Check) genotype. The interactive effect of genotypes and sowing date, the genotype NUYT-M-10 and sowing date of June 30th resulted in the tallest biological yield (9575 kg ha^{-1}), whereas the interaction between Latify (Check) and the sowing date of July 30th resulted in the shortest biological yield (6913 kg ha^{-1}). Result of this experiment were confirmed by Xu et al. (2021) The delayed sowing date treatment resulted in reduced starch biosynthesis in inferior grain cells, leading to lower grain yield and inferior grains with decreased biological and grain yield.

Grain yield (kg ha^{-1}): The statistical analysis of variance for the grain yield kg ha^{-1}indicated that combination of sowing dates and their interactions were high, while sowing dates were significant at 5% probability level, and data are presented (Table 6). The maximum rice grain yield (6000kg ha^{-1}) was observed when the crop was sown on June 30th, followed by July 15th with an average grain yield of 5715kg ha^{-1}. The shortest grain yield with an average 5330 g kg ha^{-1}was observed when the crop was sown on July 30th. The genotype NUYT-M-11 showed the tallest grain yield (6015kg ha^{-1}), followed by NUYT-M-10 (5672kg ha^{-1}) and NUYT-M-8 (5623kg ha^{-1}), while the shortest grain yield (5569kg ha^{-1}) was observed in the Latify (Check) genotype. The interactive effect of genotypes and sowing date, the genotype NUYT-M-11 and sowing date of June 30th resulted in the tallest grain yield (6015 kg ha^{-1}), whereas the interaction between Latify (Check) and the sowing date of July 30th resulted in the shortest grain yield (5225 kg ha^{-1}). The LSD test revealed that the variations in grain yield among planting dates and genotypes were statistically significant at a level of ($P<0.05$). These studies, along with the data presented here, highlight the importance of selecting an appropriate sowing date for rice crops to maximize their potential performance and yield (Wang et al. 2021 & Ramachandra et al., 2015).

Harvest index (%): The harvest index (%) of rice genotypes NUYT-M-11, NUYT-M-8, NUYT-M-10, and Latify (Check) sown on different dates. The results presented in Table 7, the tallest rice harvest index (84.11%) was observed when the crop was sown on June 30th, followed by July 15th with an average harvest index of 69.99%. The shortest harvest index with an average 55.79% was observed when the crop was sown on July 30th. The genotype NUYT-M-11 showed the tallest harvest index (89.17%), followed by NUYT-M-10 (85.97%) and NUYT-M-8 (82.42%), while the shortest harvest index (50.47%) was observed in the Latify (Check) genotype. The interactive effect of genotypes and sowing date, the genotype Latify (Check) and sowing date of June 30th resulted in the tallest harvest index (89.17%), whereas the interaction between Latify (Check) and the sowing date of July 30th resulted in the shortest harvest index (50.47%). Similar findings were reported by Ali et al. (2009) early planting of rice genotypes results in increased vegetative growth rather than seed rice yield (Akram et al., 2007).

Table 1. Plant height (cm) of rice genotypes as affected by various planting dates

Planting dates	Genotypes				Mean ± SE
	NUYT-M-11	NUYT-M-8	NUYT-M-10	Latify (Check)	
30thJune	100.05	96.35	98.20	94.50	**97.27 ± 2.38 a**
15thJuly	92.65	88.95	90.80	87.10	**89.87 ± 2.38 b**
30thJuly	85.25	81.50	83.40	79.28	**82.36 ± 2.55 c**
Mean ± SE	**92.65 ± 7.61a**	**88.93 ± 7.41 c**	**90.80 ± 7.42 b**	**86.96 ± 7.40d**	
LSD 0.05	**Planting dates**=0.1785**Genotypes**=0.2062**P x G**=0.3571				

Table 2. Number of tillers plant^{-1} of rice genotypes as affected by various planting dates

Planting dates	Genotypes				Mean ± SE
	NUYT-M-11	NUYT-M-8	NUYT-M-10	Latify (Check)	
30thJune	20.23	18.96	19.12	18.40	**19.18 ± 0.77 a**
15thJuly	17.97	15.94	15.21	14.09	**15.80 ± 1.63 b**
30thJuly	13.44	10.42	12.39	12.13	**12.09 ± 1.25 c**
Mean ± SE	**17.21 ± 17.2 a**	**15.11 ± 15.1 b**	**15.57 ± 15.6 b**	**14.87 ± 14.9 b**	
LSD 0.05	**Planting dates**=1.0109**Genotypes=** 1.1673**P x G=**2.0219				

Table 3. Panicle length (cm) of rice genotypes as affected by various planting dates

Planting dates	Genotypes				Mean ± SE
	NUYT-M-11	NUYT-M-8	NUYT-M-10	Latify (Check)	
30thJune	25.27	24.61	25.21	24.01	**24.77 ± 0.59 a**
15thJuly	23.41	22.21	22.81	21.61	**22.51 ± 0.77 b**
30thJuly	21.01	19.81	20.41	19.21	**20.11 ± 0.77 c**
Mean ± SE	**23.23 ± 2.13 a**	**22.21 ± 2.40 c**	**22.81 ± 2.40 b**	**21.61 ± 2.40 d**	

LSD 0.05	**Planting dates**=0.2258**Genotypes**=0.2607**P x G**=0.4515

Table 4. Seed index (1000-grains weight, g) of rice genotypes as affected by various planting dates

Planting dates	**Genotypes**				**Mean ± SE**
	NUYT-M-11	**NUYT-M-8**	**NUYT-M-10**	**Latify (Check)**	
30th June	30.00	29.68	30.11	29.51	**29.82 ± 0.28 a**
15th July	29.19	28.61	28.82	28.45	**28.76 ± 0.32 b**
30th July	28.28	27.79	28.03	27.61	**27.93 ± 0.29 c**
Mean ± SE	**29.15 ± 29.2 a**	**28.69 ± 28.7 c**	**28.99 ± 29.0 b**	**28.52 ± 28.5 d**	
LSD 0.05	**Planting dates**=0.0169**Genotypes**= 0.0195**P x G**=0.0338				

Table 5. Biological yield (kg ha^{-1}) of rice genotypes as affected by various planting dates

Planting dates	**Genotypes**				**Mean ± SE**
	NUYT-M-11	**NUYT-M-8**	**NUYT-M-10**	**Latify (Check)**	
30th June	9352	8700	9575	8230	**8964 ± 614.36 a**
15th July	7641	7905	8158	7578	**7820 ± 265.88 b**
30th July	7221	7364	6931	6913	**7107 ± 221.85 c**
Mean ± SE	**8071 ± 8071.3 a**	**7989 ± 7989.7 ab**	**8221 ± 8221.3 a**	**7573 ± 7573.7 b**	
LSD 0.05	**Planting dates**=424.25**Genotypes**= 489.88 **P x G**=848.50				

Table 6.Grain yield (kg ha^{-1})of rice genotypes as affected by various planting dates

Planting dates	**Genotypes**				**Mean ± SE**
	NUYT-M-11	**NUYT-M-8**	**NUYT-M-10**	**Latify (Check)**	
30th June	6015	6000	6007	5978	**6000 ± 15.90 a**
15th July	5715	5575	5645	5505	**5715 ± 90.37 b**
30th July	5435	5295	5365	5225	**5330 ± 90.37 c**
Mean ± SE	**6015 ± 290.06 a**	**5623 ± 354.98 c**	**5672 ± 321.87 b**	**5569 ± 80.60 d**	
LSD 0.05	**Planting dates**=9.8237**Genotypes**= 11.343 **P x G**=19.647				

Table 7. Harvest index (%) of rice genotypes as affected by various planting dates

Planting dates	**Genotypes**				**Mean ± SE**
	NUYT-M-11	**NUYT-M-8**	**NUYT-M-10**	**Latify (Check)**	
30th June	89.17	82.42	85.97	78.87	**84.11 ± 4.45 a**
15th July	75.32	68.22	71.77	64.67	**69.99 ± 4.58 b**
30th July	61.12	54.02	57.57	50.47	**55.79 ± 4.58 c**
Mean ± SE	**75.20 ± 14.03 a**	**68.22 ± 14.20 c**	**71.77 ± 14.20 b**	**64.67 ± 14.20 d**	
LSD 0.05	**Planting dates**=0.1482**Genotypes**=0.1711 **P x G**=0.2963				

CONCLUSIONS

Upon reviewing the outcomes of the current study, it was determined that the rice genotype planted on June 30th exhibited the best performance with a grain yield of 6000 kg per hectare, followed by July 15th with 5715 kg per hectare, and July 30th with 5330 kg per hectare.

RECOMMENDATIONS

From the present study, it was recommended that rice genotype NUYT-M-11 be recommended for general cultivation due to its better grain yield performance, followed by NUYT-M-10 and NUYT-M-8

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