Performance of Pre Released Rice (*Oryza sativa* L.) Genotypes under Different Sowing Windows in Rabi Season

D. Anil¹* and Sreedhar Siddi²

¹Jayashankar Telangana State Agricultural University, Rice Agronomy Scheme, Agricultural Research Station, Kunaram – 505 174, Peddapalli District, Telangana State, India.
²Jayashankar Telangana State Agricultural University, Rice Breeding Scheme, Agricultural Research Station, Kunaram – 505 174, Peddapalli District, Telangana State, India.

Authors’ contributions

This work was carried out in collaboration between both authors. Author DA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author SS managed the analyses of the study and one of the contributor of pre released rice genotypes. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2020/v10i1030248

Editor(s):
(1) Dr. Anthony R. Lupo, University of Missouri, USA.

Reviewers:
(1) Mahmoud Ali Refaey Eltoukhy, Benha University, Egypt.
(2) Kareem Ali Jasim, University of Baghdad, Iraq.

Complete Peer review History: http://www.sdiarticle4.com/review-history/60987

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

*Corresponding author: E-mail: anil.deva001@gmail.com;
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 26\(^{th}\) December and followed by the genotype KNM 733 with sown on 20\(^{th}\) 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 20\(^{th}\) December with the genotype KNM 118 and followed by sown on 26\(^{th}\) November with the genotype KNM 733.

Keywords: 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 160.43 million 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° N latitude and 79.4943° 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 m² (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 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 D₁, D₂ and D₃ 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 D₁, D₂ and D₃ 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

3.1 Growth Parameters

3.1.1 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 different with the other genotypes due to inherent characteristics. All the genotypes were significantly different with respect to growth attributes due to inherent characteristics.

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) | 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 |
| KNM 118 | 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 |
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.

3.2 Yield Parameters and Yield

3.2.1 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 panicles¹ is significantly influenced by different sowing dates. The crop sown on 20th November produced more number of filled grains panicles¹ (240.0) and which was significantly difference with the 5th December and 20th December sown crop (Table 2). These results aligned with the findings of Dawadi et al. [17]. There was also a significant difference among the varieties with respect to filled grains panicles¹. Significantly more number of filled grains panicle¹ (278) were recorded in the genotype RNR 15048 and superior over to other genotypes. The number of spikelets panicle¹ 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 panicle¹ due to varieties and sowing times in aerobic rice system.

3.2.2 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.

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** | | | | | | | | |
| 20th November 5th December | 459.0 | 22.54 | 240.16 | 7550.0 | 5617.0 | 16.77 | 57.67 | 75,680.0 | 2.22 |
| 5th December | 406.0 | 23.37 | 227.50 | 7993.0 | 5778.0 | 17.05 | 58.49 | 83,059.0 | 2.34 |
| 20th December | 479.0 | 23.44 | 200.33 | 8138.0 | 5472.0 | 16.64 | 60.15 | 85,597.0 | 2.38 |
| **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 | 5472.0 | 12.38 | 59.67 | 81,112.0 | 2.32 |
| KNM118 | 449 | 22.64 | 133.70 | 7792.0 | 5590.0 | 12.38 | 59.67 | 79,418.0 | 2.28 |
| **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 | 1.22 | 5544.0 | 0.09 |
| **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 | Mean |
|-----------------|-----------|------|
|                 | KNM 733   | RNR 15048 | KNM 1638 | KNM 118 |
| 20th November 5th December | 8301.0 | 7727.0 | 7562.0 | 6752.0 | 7586.0 |
| 20th December | 7877.0 | 7872.0 | 8035.0 | 8183.0 | 7992.0 |
| **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 |
3.2.3 Grain yield (Kg ha⁻¹)

Grain yield is a function of interplay of various yield components such as number of filled grains panicles¹, 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.

3.3 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].

3.4 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.

3.5 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.

ACKNOWLEDGEMENTS

The author sincerely thanks Rice Agronomy, Agricultural Research Station, Kunaram, Peddapally, Telangana State-505174 where the work has been done and also Head of research station and Associate Director of Research, Regional Agricultural
Research Station, Jagtial for providing the support.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anonymous. United States, Department of Agriculture; 2019.
2. Anonymous. Agricultural statistics at a glance. Directorate of Economics and Statistics, Government of India; 2018.
3. Bhat FM, Riar CS. Effect of amylase, particle size and morphology on the functionality of starches of traditional rice varieties. International journal of biological macromolecules. 2016;92:637-644.
4. Bashir MU, Akber A, Iqbal, Zaman H. Effect of different sowing dates on yield and yield components of direct seeded coarse rice (Oryza sativa L.) Pakistan Journal of Agricultural Science. 2010; 47(4):361-365.
5. Vange T, Obi IU. Effect of planting date on some agronomic traits and grain yield of upland rice varieties at Makurdi, Benue state. Nigerian Journal of Sustainable Development of Agriculture Environment. 2006;2(1):1-9.
6. Annie P, Swain P, Rav KS. Agrophysiological parameter of rice (Oryza sativa) hybrids as affected by different data of planting under costal Orissa. Indian Journal of Agricultural Science. 2009; 79(1):25-28.
7. Koireng RJ, Devi NM, Devi KP, Gogoi M, Anal PSR. Effect of variety and spacing on the productivity of direct seeded rice (Oryza sativa L.) under Manipur condition. Indian Journal of Pure and Applied Biosciences. 2019;7(5):335-341.
8. Nizamani GS, Imtiaz AK, Abdula K, Siddiqui MA, Nizamani MR, Khaskheli MI. Influence of different row spacing on agronomic traits in different wheat varieties. International Journal of Development Research. 2014;(411):2207-2211.
9. Suleiman AA, Nganya JF, Ashraf MA. Effect of cultivar and sowing date on growth and yield of wheat (Triticum aestivum L.) in Khartoum, Sudan. Journal of Forest Products & Industries. 2014; 3(4):198-203.
10. Sharma A, Dhaliwal LK, Sandhu SK, Singh S. Effect of plant spacing and transplanting time on phenology, tiller production and yield of rice (Oryza sativa L.). International Journal of Agricultural Scince. 2011;7:249-253.
11. Osman KA, Mustafa AM, Elsheikh YMA, Idris AE. Influence of different sowing dates on growth and yield of direct seeded rice (Oryza sativa L.) in semi-arid zone. International Journal of Agronomy and Agricultural Research. 2015;6:38-48.
12. Mali H, Choudhary J. Performance of bread wheat (Triticum aestivum L.) varieties under different row spacing. Journal of Wheat. 2011;4(2):55-57.
13. Dileep K, Pasupalak S, Balisarsingh A. Effect of establishment methods and sowing time on growth and yield of rice varieties (Oryza sativa L.). The Pharma Innivation Journal. 2018;7(4):904-907.
14. Peng-fei L, Zhi-hua Z, Yan-xia Z, Shao-hua X, Mingzhu J, Wen-jing H, Xu-hu Z. Effects of sowing date, basic seedling, nitrogen rate and field water on early rice “Liangyou9168”. Advance Journal of Food Science and Technology. 2013;5(4):414-417.
15. Wani SA, Qayoom S, Bhat MA, Lone BA, Nazir A. Influence of sowing dates and nitrogen levels on growth yield and quality of scented rice cv. Pusa Sugandh-3 in Kashmir valley. Journal of Applied and Natural Science. 2016;8(3):1704-1709.
16. Jagtap DN, Chavan VG, Mahadkar UV, Chavan SA. Effect of sowing times on the yield and yield attributes of rice (oryza sativa L.) varieties. Journal of Indian Society of Coastal Agricultural Research. 2016;34(2):27-30.
17. Dawadi KP, Chaudhary NK. Effect of sowing dates and varieties on yield and yield attributes of direct seeded rice in Chitwan condition. The Journal of Agriculture and Environment. 2013;14:121-130.
18. Balaji naik B, Raji reddy D, Sreenivas G, Leela Rani P. Effect of sowing dates and varieties on growth, yield and economics of aerobic rice (Oryza sativa L.) during kharif season. The Journal of Research PJTSAU. 2015;43(1&2):18-24.
19. Muhammad Usman Bashir, Nadeem Akbar, Asifqbal, Haroonzaman. Effect of different sowing dates on yield and yield components of direct seeded coarse rice
20. Chengde PD, Chavan SA, Ashwini patil, Shalu Kumar. Effect of sowing times on yield and economics of different rice genotypes under climatic condition of Konkan. Journal of Pharmacognosy and Phytochemistry. 2017;6(5):2462-2466.

21. Hussain A, Bhat MA, Ganai MA, Hussain T. Influence of planting dates and spacing schedules on performance of basmati rice Pusa Sugandh 3 under Kashmir valley condition. Environment and Ecology. 2009; 27(1):396-398.

22. Suresh K, Balaguravalah D, Ramalu V, Rao CSH. Evaluation of rice varieties under different management practices for late planting situation of Nagarjune Sagar left canal command area Andhra Pradesh, India. International Journal of Plant Animal and environmental Science. 2013;3(2): 258-260.

23. Waliya US, Waliya SS, Sindhu Nayyar S. Production of direct-seeded rice in relation to different dates of sowing and varieties in central Punjab. Journal of Crop Weed. 2014;10(1):126-129.

24. Manjunatha BN, Basavarajappa R, Pujari BT. Effect of age seedling on growth, yield and water requirement by different system of rice intensification. Karnataka Journal of Agricultural Science. 2010;23(2):231-234.

25. Reddy SN, Narayana P. Pattern of dry matter accumulation and N uptake by rice as influenced by age of seedling and date of planting. Andhra Agriculture Journal. 1984;32:155-56.

26. Hussain MF, Salam M, Uddin M, Sarkar ZP. A comparative study of direct seeding versus transplanting method on the yield of aus rice. Pakistan Journal of Agronomy. 2002;1(2-3):86-88.

27. Salahuddin KM, Chowhdury SH, Munira S, Islam MM, Parvin S. Response of nitrogen and plant spacing of transplanted aman rice. Bangladesh Journal of Agricultural Research. 2009; 34(2):279-285.

© 2020 Anil and Siddi; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/60987