Chemical Science Review and Letters ISSN 2278-6783

Research Article

Yield and Yield Attributes as Affected by Different Sowing Dates and Different Maturity Classes Cultivar on Direct Seeded Rice

Sucheta Dahiya*[1], S. S. Punia[1], Jagdev Singh[1], Suresh Kumar Kakraliya[1], Balwinder Singh[2], H. S. Jat[2,3], and R. K. Malik[2]

[1]Department of Agronomy, Chaudhary Charan Singh Haryana Agricultural University, Hisar (HR) - 125004, India
[2]International Maize and Wheat Improvement Centre (CIMMYT), New Delhi -110012, India
[3]Central Soil Salinity Research Institute, CSSRI, Karnal (HR) - 132001, India

Abstract

Field experiment was conducted to appraise the effect of different sowing dates and different maturity class's cultivars on yield and yield attributes of the direct seeded rice during the *Kharif* season of 2014 and 2015, at Central Soil Salinity Research Institute, Karnal. Experiment comprised of four sowing dates *viz.* 10th June, 25th June, 10th July, 25th July and different maturity classes cultivar *viz.* Arize 6129 (Early), Arize 6444 (Mid) and Pusa 44 (Long). Data on yield related parameters of direct seeded rice were recorded. Results revealed that direct seeded rice sown on 10th June with early maturing cultivar Arize 6129 proved to be the best for obtaining maximum grain yield and yield attributes such as number of panicles per m^2, 1000- kernel weight and paddy yield.

Keywords: Direct seeding, sowing dates, different maturity class's cultivar, yield attributes, yield

***Correspondence**
Author: Sucheta Dahiya
Email: candidsucheta@gmail.com

Introduction

Rice (*Oryza sativa*), the staple food of more than half of the population of the world, is an important target to provide food security and livelihoods for millions. Imminent water crisis, water-demanding nature of traditionally cultivated rice and climbing labor costs ramble the search for alternative management methods to increase water productivity, system sustainability and profitability. Rice occupies a pivotal place in Indian agriculture and is the stable food for more than 70 % of population. In India it is grown on an area of 42.41 mha with total production of 104.40 mt, with productivity of 2462 kg/ha [1]. The major contribution in the national food basket (10.5 mha) comes from rice-wheat system [2]. The rice-wheat system contributes about 65 % of food grain production [3]. In Haryana, rice was grown over an area of 1.21 mha with total production of 3.97 mt and productivity of 3272 kg/ha [4].Therefore, there is sufficient scope for direct seeding of rice in the state. India's north western farmers have been adopting direct seeded rice (DSR) for benefits associated with reduced labor costs as well as savings in water and energy use [5]. There are many improved crop water management technologies which can help to reduce the irrigation requirement by reducing losses through deep drainage, seepage, runoff and soil conservation and direct seeding of rice is one among them; however there is lack in information regarding performance of different maturity classes of rice cultivars under different sowing dates. The precise sowing date for direct seeding of rice also play a vital role in improving its growth and escalating the yield as it ensures that vegetative growth occurs during a period of satisfactory temperatures and high levels of solar radiation. Sowing date also has a direct impact on the rate of establishment of rice seedling [6, 7] investigated the effect of planting dates on grain yield and some agronomic parameters by early sowing (June 15 and June 30) and late sowing (July 15 and July 30). These indicated that planting date affected the performance of these traits significantly. Grain yield (t ha-1) and plot yield (g) were highest on the July 30. While [8] find the effect of different planting dates from July, 1 to 31 with 10 days interval on six rice varieties (98801, PK-5261-1-2-1, 97502, 98409, Basmati-385 and Super Basmati). Yield parameters like number of tillers, grains per spike, plant height, 1000-grain weight and sterility were significantly affected. Basmati-385 and Super Basmati produced maximum paddy yield (5655 and 5612 kg/ha) when planted on July, 11 and July 1, respectively. So, keeping all the point of views, the

proposed study was, therefore, aimed to find the optimum sowing date and different maturity class's cultivar of direct seeded rice to get more productivity.

Materials and Methods

The study was carried out at CIMMYT-CSISA Research Farm of Central Soil Salinity Research Institute, Karnal during *Kharif* season of 2014 and 2015. The experiment was laid out in Split Plot Design with three replications having a gross plot size of 9.0 m × 4.3 m. Seed was sown directly in the field with the help of drill seeding in lines 20 cm apart. Rice was sown on four different sowing dates 10th June, 25th June, 10th July and 25th July. The cultivars used having different maturity classes Arize 6129 (Early), Arize 6444 (Mid) and Pusa 44 (Long).Crop was fertilized with N, P, and K as per recommended rate using Urea, DAP and SOP as a source. Zn was also applied at recommended rate. All other agronomic practices except those under study were kept normal. Plant protection measures were taken as per recommendation. Harvesting was done as and when crop was mature. Data on yield parameters *i.e.* number of panicles (m-2), 1000- kernel weight (g) and paddy yield (kg/ha) were recorded. The experimental data for various yield and yield attributing characters was statistically analyzed by the methods of analysis of variance (ANOVA). The significance of treatment effect was computed with the help of 'F' (variance ratio) test and to judge the significance of difference between means of two treatments, critical differences (CD) was worked out.

Results and Discussion

Panicles (m-2)

Number of panicles per m^{-2} was influenced by different sowing dates as well as different maturity class's cultivar. Maximum number of panicle m^{-2} (346,340) respectively for both consecutive years was observed when crop was sown on 10th June while the crop sown on 25th July gave minimum tillers m^{-2} (251,245) during both years. Early maturing variety Arize 6129 showed maximum number of panicle m^{-2} (316,311) for both consecutive years and minimum number of panicle m^{-2} was recorded in Pusa 44 (316,311) for both consecutive years. All the remaining treatments were found statistically different from each other. Among yield components, productive tillers are most important because the final yield is mainly determined by the number of panicles per unit area. This increase of panicles m-2 at 10th June sowing was attributed to favorable environmental conditions which improve its growth and development as compared to other sowing dates. In case of maturity classes cultivar Arize 6129, the early maturing hybrid showed up maximum panicle per m^{-2} because it preserve more light and showed up more vegetative as well as reproductive growth during the respective growing period. Our results are in alignment with the findings of [9-11]. From the seeding of 15th June onward number of panicles per square meter was found in decreasing trend [12].

Total Florets per panicle

Number of florets per panicle is significantly affected by different sowing dates. 10^{th} June seeding produced maximum number of florets (152,151) for the year 2014 and 2015 respectively while minimum number of kernels per panicle (137,136) for the year 2014 and 2015 respectively was produced by 25th July seeding. All the other sowing dates were non significant to each other. Whereas early maturing cultivar Arize 6129 showed up maximum florets per panicle for both years (149,146) due to varietal character as compare to Arize 6444 and Pusa 44. Late sowing, shortened the growth period of the plant which reduced the leaf area, length of panicle and number of florets per panicle than early sowing. These are in line with the findings of [12]. He reported that maximum number of filled grains per panicle was visualized in the early sowing and declined gradually with delay of sowing date whereas number of filled grains penicle-1 was found in the decreasing trend from the sowing of 15 of June onward [13, 14]. Kernels panicle-1 showed better response with early sowing [15, 16].

1000- Grain weight (g)

1000 Kernel weight was significantly affected by sowing date. Rice sown on 10^{th} June produced heavier grains while crop sown on 25^{th} July produced minimum grain weight. While in case of maturity classes Arize 6129, early maturing hybrid produced heavier grain than other two maturity classes during both years which indicated that the

environmental conditions like temperature, humidity was most encouraging during growing period during 10th June as compared to other sowing dates. Similar findings have been reported by [10, 15, 17]. Early seeding (15 June) had the highest 1000-grain weight and decreased as sowing delayed [12]. Test weight decreased gradually with delay in sowing time [13].

Paddy yield (Kg ha-1)

Paddy yield is an integrated function of interaction of various yield attributing characters such as number of florets per panicle, panicles and 1000 grain weight. The data pertaining to the paddy yield as affected by different sowing dates and different maturity classes are given in **Table 1**. A glimpse of table indicated that all sowing dates differ significantly with respect to paddy yield except 10th and 25th June sowing, they are significantly at par with each other.10th June sowing produced maximum paddy yield (8024, 7921 kg ha-1) while less paddy yield (3891, 3580 kg ha-1) was observed in 25th July sowing. The diminishing trend in the grain yield in delayed sowing might be associated with significantly lower number of panicles m-2, less number of filled grains/panicle and low 1000-grain weight. The higher paddy yield was attributed to more number of productive tillers, more number of florets per panicle and increased 1000 grain weight. Whereas in case of maturity classes early sowing variety Arize 6129 showed maximum paddy yield (7185,6917) kg/ha than other two maturity class's (6604,6404) and (5876, 5743) kg/ha respectively. These results are also in line with the findings of [12] who concluded that sowing of 15 June has highest grain yield it decreases with delay in sowing. Maximum paddy yield (4530, 4030 and 4530 kg ha-1) was obtained in early sown rice group [18]. Rice yields declined with delaying of sowing date [19].

Table 1 Effect of sowing dates and different maturity classes on yield and yield attributing characters

Treatments	**Number of panicles/m^2**		**Total florets/panicle**		**Test weight (g)**		**Grain yield (kg/ha)**	
Sowing dates	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**
10 June	346	340	**152**	**151**	25.88	25.48	8024	7921
25 June	326	320	149	147	24.88	24.79	7880	7681
10 July	295	289	144	143	23.72	23.31	6425	6236
25 July	251	245	137	136	22.91	21.50	3891	3580
SE (m)±	2.12	1.49	0.77	0.73	0.14	0.15	130	80
C.D at 5%	7.48	5.27	2.71	2.57	0.48	0.50	457	281
Cultivars								
Arize6129 (E)	316	311	**149**	**146**	24.72	24.38	7185	6917
Arize 6444 (M)	303	298	146	146	24.48	23.53	6604	6404
Pusa 44 (L)	293	286	141	141	24.29	22.93	5876	5743
SE (m)±	1.72	1.39	0.79	0.58	0.10	0.12	78	67
C.D. at 5%	5.20	4.22	2.39	1.73	0.28	0.37	235	203

Conclusion

Based on the results of this study, it could be concluded that early sowing dates and maturity class cultivar resulted in the maximum number of panicle per m-2, total florets per panicle, 1000- grain weight and paddy yield for both the years 2014 and 2015, while delaying in sowing dates after 25th June reduces the yield gradually. Therefore, 10th June with Arize 6129 can be selected as the optimum sowing dates for direct seeding of upland rice varieties.

References

[1] Anonymous, 2014. www.agriharyana.nic.in 30.5.2014.
[2] Yadav, R.L.1998.Factor productivity trend in rice wheat cropping system under long term use of chemicals. Experimental Agri. 34:1-18.

[3] Singh, V.K., Dwivedi, B.S., Sharma, S.K. and Shukla, A.K.2004.Modern technologies for rice-wheat production system in India. Research Bulletin. Project Directorate for cropping system Modipurram, Uttar Pradesh, India pp: 32-34.
[4] Anonymous b, 2014. www.informaecon.com 30.5.2014
[5] Kumar, A., Dharm Bir and Gill, G.S.2014.Changes in weed flora and its management in direct seeded rice in nort western India. In: Weed Sci. Soc. America & Canadian Weed Sci.Soc. Joint Ann. Meet 2014. Vancouver, Canada, 3-6 February, 2014. Abstract No.338. pp. 94-95
[6] Tashiro, T., M. Saigusa and K. Shibuya. 1999. A Trial of No-tillage Direct Seeding of Rice (Oryza sativa L.) at Early Spring in Cold Climate Region in Japan. Japanese J. Crop Sci. 68(1):146-150.
[7] Vange T. and I.U. Obi. 2006. Effect of planting date on some agronomic traits and grain yield of upland rice varieties at Makurdi, Benue state, Nigeria. J. Sust. Develop. Agric. Environ. 2(1):1-9.
[8] Akram, H.M., A. Ali, M.A. Nadeem and M.S. Iqbal.2007. Yield and yield components of rice varieties as affected by transplanting dates. J. Agric. Res. 45(2):105-111.
[9] Pandey, N., A.K. Verma and R.S. Tripathi. 2001. Effect of planting time nitrogen on tillering pattern, dry-matter accumulation and grain yield of hybrid rice (Oryza sativa). Indian J. Agric. Sci. 71(5):337-338.
[10] Lu, K.Y. and M.L. Cai. 2000. Characteristics of growth and development and high yield cultivation technology in rice. J. Huazhong Agric. Univ. 19(2):91-94.
[11] Paraye, P.M. and V.S. Kandalkar. 1994. Effect of seedling age on long-duration, rain fed varieties of rice under delayed transplanting. Indian J. Agric. Sci. 64(3):187-188.
[12] Shah, L.M. and K.P. Bhurer. 2005. Response of wet seeded rice varieties to sowing dates. Nepal Agric.Res. J. 6:35-38.
[13] Mahmood, N., A. Hussain, B. Akhtar, A.H. Ahmad and M. Saleem. 1995. Effect of transplanting date and Irrigation on rice paddy yield. Sci. Tech. Dev.14 (3):49-52.
[14] Saikia, L., K.Chandra and T.C. Mahanta. 1989. Performance of late transplanting rice in Assam.Intl. Rice Res. Newsletter 14(1): 21.
[15] Biswas, P.K. and V.M. Salokhe. 2001. Effects of planting date, intensity of tiller separation and plant density on the yield of transplanted rice. J. Agric.Sci. 137(3):279-287.
[16] Back, N.H., S.S. Kim, I.B. Im, M.G. Choi, W.H. Yang and S.Y. Cho. 1998. The optimum sowing date and rate for growth and yield of rice. J. Crop Sci. 40:33-38.
[17] Yawinder, S.D., H.S. Nagi., G.S. Sidhu and K.S. Sekhon.2006. Physicochemical, milling and cooking quality of rice as affected by sowing and transplanting dates. J. Sci. Food Agric. 37(9):881-887.
[18] Khakwani, A.A., M. Zubair, M. Mansoor, K. Naveed, I.H. Shah, A. Wahab, M. Ilyas and I. Ahmed. 2006. Agronomic and morphological parameters of rice crop as affected by date of transplanting. J. Agron. 5(2):248-250.
[19] Hwang, C.D., D.K. Shin, K.Y. Lee, S.T. Park and S.T. Park and S.C. Kim. 1998. The critical seeding date of corrugated furrow rice in eastern coastal area. J. Crop Sci. 40:62-69.

Publication History
Received 24th Jan 2017
Revised 13th Feb 2017
Accepted 13th Feb 2017
Online 25th Feb 2017