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EFFECT OF DIFFERENT SOWING DATES ON YIELD AND YIELD COMPONENTS OF DIRECT SEEDED COARSE RICE (*Oryza sativa* L)

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Field experiment was conducted to evaluate the effect of different sowing dates on yield and yield components of the direct sown coarse rice during the Kharif season of 2008, at Agronomic Research Area, University of Agriculture, Faisalabad. Experiment comprised of six sowing dates i.e. 31st May, 10th June, 20th June, 30th June, 10th July and 20th July. Data on agronomic parameters and economics of coarse rice were recorded. Results revealed that direct seeded rice sown on 20th June proved to be the best for obtaining maximum grain yield and net return. 20th June sowing also gave maximum number of productive (panicle bearing) tillers, number of kernels per panicle, 1000-grain weight and benefit-cost ratio.
Keywords: Direct seeding, coarse rice, sowing dates, yield components

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the world's most important staple food crops. In Asia, it is the main item of the diet of 3.5 billion people. Therefore, increase in population will require 70 percent more rice in 2025 than is consumed today (Kim and Krishnan, 2002). Vietnamese are on the top with rice consumption of 240 kg per person followed by Thais with 204 kg per person. But per capita consumption of rice in Pakistan is very low only 20.78 kg due to high cost of rice as compared to wheat flour (Shaikh and Kansaro, 2003).

During 2009-10, area under rice cultivation was 2883 thousand hectares (2.7% less than the last year) and total production was 6883 thousand tons (1% less than last year) with an average yield of 2387 kg ha^{-1}. It contributed 6.4 % to the value added in agriculture and 1.4% to gross domestic product (Govt. of Pakistan, 2008).

Rice is normally sown at the end of May and transplanted during the 1st week of July. Transplanting is a traditional method which gives high and stable yield but at the same time it is a laborious and expensive job. Now-a-days farmers are switching towards some other methods like direct seeding of rice to minimize these expenses and difficulties (Mehmood *et al*., 2002). The exact sowing date for direct seeding of rice also play a vital role in improving its growth and increasing the yield. The sowing time of the rice crop is important for three major reasons. Firstly, it ensures that vegetative growth occurs during a period of satisfactory temperatures and high levels of solar radiation. Secondly, the optimum sowing time for each cultivar ensures the cold sensitive stage occurs when the minimum night temperatures are historically the warmest. Thirdly, sowing on time guarantees that grain filling occurs when milder autumn temperatures are more likely, hence good grain quality is achieved (Farrell *et al*., 2003). Sowing date also has a direct impact on the rate of establishment of rice seedling (Tashiro *et al.*, 1999).

Vange and Obi (2006) investigated the effect of planting dates on grain yield and some agronomic characters by early seeding (June 15 and June 30) and late seeding (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. Recently Khalifa (2009) in Egypt carried out field experiment for physiological evaluation of four hybrid rice varieties under six different sowing dates. Results indicated that early date of sowing is the best time of sowing for important properties such as maximum tillering, panicle initiation, heading date, number of tillers m^{-2}, plant height and root length at panicle initiation and heading stage, chlorophyll content, number of days to panicle initiation and heading date, leaf area index, sink capacity, spikelets/leaf area ratio, Number of grains per panicle, Panicle length (cm), 1000 grain weight (g), number of panicles m^{-2}, five Panicle weight (g) and grain yield (T ha^{-1}). While Akram *et al*. (2007) 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). Different yield and 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 1, respectively. Minimum sterility was observed in rice planted on 21st July followed by July 1, 11 and 31. In another experiment highly significant effect of sowing date (Starting from June 15 to July 29 at 15 days interval)was detected on grain yield and yield attributing characteristics like tillers number m^{-2}, filled grains/panicle and 1000-grain weight in both the years (1998 & 99). Yield components like tillers number m^{-2}, number of filled grains/panicle and 1000-grain weight were found in the decreasing trend from the seeding of 15 of June onward. June 15 seeding had the highest tillers number m^{-2} whereas the lowest in July 29 seeding. More number of filled grains/panicle was visualized in the early seeding and declined gradually in the successive seeding dates. June 15 seeding had the highest 1000-grain weight and decreased as sowing delayed. June 15 seeding date recorded significantly the highest grain yield in 1998/99 whereas June 15 to July 14 seeding date had statistically the similar yield in 1999/00 (Shah and Bhurer, 2005). The proposed study was, therefore, aimed to find the optimum sowing date of direct seeded coarse rice.

MATERIALS AND METHODS

Experiment was conducted at agronomic research area, University of Agriculture, Faisalabad, during kharif 2008. The experiment was laid out in Randomized Complete Block Design with three replications having a gross plot size of 3.0 m × 6.0 m. Seed was sown directly in the field with the help of single row hand drill. KS-282, a promising variety of rice was used as a test crop. Rice was sown on six different sowing dates 31st May, 10th June, 20th June, 30th June, 10th July and 20th July. Crop was fertilized with N, P, and K at recommended rate using Urea, DAP and SOP as source. All other agronomic practices except those under study were kept normal. Plant protection measures were taken as necessary. Harvesting was done as and when crop was mature. Data on yield parameters i.e. plant height (cm), number of productive tillers (m^{-2}), number of kernels per panicle, 1000- kernel weight (g) and paddy yield (kg ha^{-1}) were recorded. Economic analysis was carried out on the basis of variable cost and prevailing prices (Chaudhary *et al*., 1995). Data recorded were analyzed statistically using Fisher's analysis of variance technique. Difference among the treatment means were compared using least significant difference (LSD) test at 5 % probability level (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

***Plant height (cm)*:** Plant height was affected significantly by different sowing dates. The crop sown on 31st May produced the maximum plant height (92.80 cm). Plant height decreased significantly as sowing was delayed. The lowest plant height (69.37 cm) was observed when the crop was sown on 20th July which was statistically at par with 10th July sowing (70.03 cm). Plants sown on June 10th and 20th produced statistically similar plant height while 30th June sown plants produce statistically different plant height. It is obvious that the reduction in plant height was attributed to the reason that late planting had shorter growing period due to photoperiodic response. Longer growing season of May planted crop produced taller plants and higher dry matter production as compared to the rest planting dates. These results are in line with Khakwani *et al*. (2006) and Paraye and Kandalkar (1994) who reported that plant height is significantly affected by sowing dates. These results are also in line with Saikia *et al*. (1989) and Gravois and Helms (1998) who reported that early sowing of rice produced taller plants than delayed sowing.

***Productive tillers (m^{-2})*:** Number of fertile tillers per m^{-2} was influenced by various planting dates. Maximum number of fertile tillers m^{-2} (335) was observed when crop was sown on 20th June while the crop sown on 20th July gave minimum tillers m^{-2} (200). All the remaining treatments were also statistically different from each other. Among yield components, productive tillers are very important because the final yield is mainly a function of the number of panicles bearing tillers (productive tillers) per unit area. This increase of fertile tillers m^{-2} at 20th June sowing was attributed to favorable environmental conditions which enabled the plant to improve its growth and development as compared to other sowing dates. Our results are in alignment with the findings of Pandey *et al.* (2001), Lu and Cai (2000) and Paraye and Kandalkar (1994). Number of fertile tillers per square meter was found in decreasing trend from the seeding of 15th June onward (Shah and Bhurer, 2005).

***Kernels per panicle*:** Number of kernels per panicle is significantly affected by different sowing dates. 20th June seeding produced maximum number of kernels (84.90) while minimum number of kernels per panicle (46.57) was produced by 20th July seeding. 31st May and 10th June seeding produced statistically similar number of kernels per panicle while 30th June and 10th July planting gave statistically similar results. Late sowing, shortened the growth period of the plant which reduced the leaf area, length of panicle and number of kernels per panicle than early sowing. These are in line with the findings of Shah and Bhurer (2005). He reported that more number of filled grains per panicle was visualized in the early seeding and declined gradually in the successive seeding dates. Number of filled grains penicle^{-1} was found in the decreasing trend from the seeding of 15 of June onward (Mahmood *et al.* 1995; Saikia *et al.* 1989). Kernels panicle^{-1} showed better response with early sowing (Biswas and Salokhe, 2001; Back *et al*., 1998).

***1000-Kernel weight (g)*:** 1000 Kernel weight was significantly affected by sowing date. Rice sown on 20th June produced heavier grains while crop sown on 20th July produced minimum grain weight. This indicated that the environmental conditions like temperature, humidity was most favorable for grain development during 20th June as compared to other sowing dates. Similar findings have been reported by Yawinder *et al.* (2006), Biswas and Salokhe (2001), Lu and Cai (2000) and Majid *et al.* (1989). Early seeding (15 June) had the highest 1000-grain weight and decreased as sowing delayed (Shah and Bhurer, 2005). 1000-grain weight decreased gradually with delay in planting time (Mahmood *et al.,* 1995).

***Paddy yield (Kg ha^{-1})*:** Paddy yield is a function of interplay of various yield components such as number of kernels per panicle, productive tillers and 1000 kernel weight. The data pertaining to the paddy yield as affected by different sowing dates are given in Table1. A glance of table indicated that all sowing dates differ significantly with respect to paddy yield. 20th June sowing produced maximum paddy yield (4291 kg ha^{-1}) while less paddy yield (743 kg ha^{-1}) was observed in 20th July sowing. Rest of the treatments differed significantly with each other. The decreasing trend in the grain yield in delayed seeding might be associated with significantly lower number of productive tillers 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 kernels per panicle and increased 1000 kernel weight. These results are also in line with the findings of Shah and Bhurer (2005) who reported that June 15 seeding recorded significantly the highest grain yield and decreased with the delay in sowing. Highest paddy yields (4530, 4030 and 4530 kg ha^{-1}) were obtained in early sown rice group (Khakwani *et al.*, 2006). Rice grain yields declined as seeding date was delayed (Hwang *et al*., 1998).

***Economic Analysis*:** A brief overview of the Table 2 indicated that maximum net income of Rs. 56928.67 was recorded when crop was sown on 20th June. This was followed by 10th June and 31st May giving net income of Rs. 33286.72 and 16438.78, respectively. A loss of Rs. 25859 was received from plots sown on 20th

Table 1. Effect of different sowing dates on yield and yield components of direct seeded coarse rice

Treatments	Plant Height (cm)	Productive Tillers (m^{-2})	Kernels per Panicle	1000 Grain Weight (g)	Economic Yield (Kg ha^{-1})
31st May	92.80 a	311.0 c	71.90 b	18.17 bc	2555.0 c
10th June	87.73 b	321.7 b	72.29 b	19.35 b	3286.0 b
20th June	85.87 b	335.0 a	84.90 a	20.99 a	4291.0 a
30th June	78.53 c	272.3 d	64.12 c	17.99 c	1932.0 d
10th July	70.03 d	230.0 e	58.83 c	17.67 c	1270.0 e
20th July	69.37 d	200.0 f	46.57 d	16.31 d	743.0 f
LSD (p=0.05)	3.011	2.508	7.14	1.35	499.0.4

Table 2. Economic analysis of rice as affected by different sowing dates

Treatment	Gross Income (Rs)	Total Expenditure (Rs)	Net Profit (Rs)	Benefit Cost Ratio
31st May	84617	68178.22	16438.78	1.24
10th June	106647	73360.28	33286.72	1.45
20th June	137736	80807.33	56928.67	1.71
30th June	65876	63092.49	2783.506	1.04
10th July	45124	58187.07	Loss 13063.1	0.78
20th July	28423	54282	Loss 25859	0.52

July. Maximum benefit cost ratio was observed in 20th June sowing (1.71) while the least benefit cost ratio was observed in 20th July sowing (0.52). These results are in accordance to the findings of Singh *et al.* (1997) who reported that Net return and benefit: cost ratio was also higher in case of 15 June sowing. Direct seeding gave maximum net return under salt affected soil related to coarse rice variety (Arshad Ullah *et al.*, 2007). Net return and benefit: cost ratio was also higher in case of 15 June planting (Singh *et al.*, 1997).

CONCLUSION

From the experiment, it is concluded that the optimum sowing date for direct seeding of coarse rice variety KS-282 is 20th June for getting maximum yield and net income, while delay in sowing after 20th June reduce the yield gradually.

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ABSTRACT: In rice (Oryza sativa L.), yield is related to characteristics of branches and spikelets. To investigate the effects of late sowing date on differentiation and degeneration of spikelets in rice, field experiments were conducted in Chongzhou and Hanyuan, China. Differentiation and survival of branches and spikelets in Hanyuan were lower than that of Chongzhou, whereas degeneration was greater than that of Chongzhou. In Chongzhou, sowing date affected differentiation and survival of primary, secondary, and total branches, as well as differentiation and degeneration of secondary and tot Effect of Different Date of Sowing and Nitrogen Level on Production of Direct Seeded Rice. American Journal of Food Science and Nutrition Vol.6 , No. 1, Publication Date: Jun. 19, 2019, Page: 1-5. 2398 Views Since June 19, 2019, 323 Downloads Since Jun.Â 2015. Productivity and economics of direct seeded rice (Oryza sativa L.). Journal of Applied and Natural Science 7 (1): 410 â€“ 416. [04]. Joshi E, D Kumar, B Lal, V Nepalia, P Gautam and AK Vyas. 2013. Management of direct seeded rice for enhanced resource - use efficiency. Plant Knowledge Journal. Southern Cross Publishing Group: 119-134. [05]. Ehsanullah S, A Anjum, U Ashraf, H Rafiq, M Tanveer and I Khan. Direct seeded rice, if managed properly, can yield as high as transplanted rice (Hayat et al., 2003; Ali et al., 2007). The present study was, therefore, undertaken to compare and standardize planting technique best suited to paddy growers under the agro-ecology of Dera Ismail Khan or similar environmental conditions prevailing in other parts of the country.Â Effect of different stand establishment techniques on rice yields and its attributes. J. Anim. Pl.Â Impact of seeding dates and varieties on weed infestation, yield and yield components of rice (Oryza sativa L.) under direct wet seeded culture. Pakistan J. Weed Sci. Res. 9: 59â€“65. Jaiswal, V. P. and G. R. Singh (2001). Effect of sowing dates and seed rates on some rice cultivars. Filed Crops, Research institute, Rice Research and Training Center, ARC, Egypt. Water Relation and Field Irrigation Department, National Research Center, Egypt.Â 2007. Effect of sowing method and seeding rate on yield and yield components of rain fed rice (Oryza sativa L.) varieties in woliso, south-west shoa zone of Oromia region. M. Sc. thesis, Haramaya University, 30-59. [15]. Dereje S/dingel. 2016. Effects of seed and nitrogen rates on yield and yield attributes of upland rice under irrigation at Gewane, Northeastern Ethiopia, MSc Thesis in Agronomy, Haramaya University, Ethiopia. [16]. FAO (Food and Agricultural Organization of the United Nations).