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

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 sowing 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 penicle$^{-1}$ 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 20$^{th}$ June produced heavier grains while crop sown on 20$^{th}$ July produced minimum grain weight. This indicated that the environmental conditions like temperature, humidity was most favorable for grain development during 20$^{th}$ 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. 20$^{th}$ June sowing produced maximum paddy yield (4291 kg ha$^{-1}$) while less paddy yield (743 kg ha$^{-1}$) was observed in 20$^{th}$ 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 20$^{th}$ June. This was followed by 10$^{th}$ June and 31$^{st}$ May giving net income of Rs. 33286.72 and 16438.78, respectively. A loss of Rs. 25859 was received from plots sown on 20$^{th}$ June.

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

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant Height (cm)</th>
<th>Productive Tillers (m$^{-2}$)</th>
<th>Kernels per Panicle</th>
<th>1000 Grain Weight (g)</th>
<th>Economic Yield (Kg ha$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>31$^{st}$ May</td>
<td>92.80 a</td>
<td>311.0 c</td>
<td>71.90 b</td>
<td>18.17 bc</td>
<td>2555.0 c</td>
</tr>
<tr>
<td>10$^{th}$ June</td>
<td>87.73 b</td>
<td>321.7 b</td>
<td>72.29 b</td>
<td>19.35 b</td>
<td>3286.0 b</td>
</tr>
<tr>
<td>20$^{th}$ June</td>
<td>85.87 b</td>
<td>335.0 a</td>
<td>84.90 a</td>
<td>20.99 a</td>
<td>4291.0 a</td>
</tr>
<tr>
<td>30$^{th}$ June</td>
<td>78.53 c</td>
<td>272.3 d</td>
<td>64.12 c</td>
<td>17.99 c</td>
<td>1932.0 d</td>
</tr>
<tr>
<td>10$^{th}$ July</td>
<td>70.03 d</td>
<td>230.0 e</td>
<td>58.83 c</td>
<td>17.67 c</td>
<td>1270.0 e</td>
</tr>
<tr>
<td>20$^{th}$ July</td>
<td>69.37 d</td>
<td>200.0 f</td>
<td>46.57 d</td>
<td>16.31 d</td>
<td>743.0 f</td>
</tr>
<tr>
<td>LSD (p=0.05)</td>
<td>3.011</td>
<td>2.508</td>
<td>7.14</td>
<td>1.35</td>
<td>499.0 f</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Gross Income (Rs)</th>
<th>Total Expenditure (Rs)</th>
<th>Net Profit (Rs)</th>
<th>Benefit Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>31$^{st}$ May</td>
<td>84617</td>
<td>68178.22</td>
<td>16438.78</td>
<td>1.24</td>
</tr>
<tr>
<td>10$^{th}$ June</td>
<td>106647</td>
<td>73360.28</td>
<td>33286.72</td>
<td>1.45</td>
</tr>
<tr>
<td>20$^{th}$ June</td>
<td>137736</td>
<td>80807.33</td>
<td>56928.67</td>
<td>1.71</td>
</tr>
<tr>
<td>30$^{th}$ June</td>
<td>65876</td>
<td>63092.49</td>
<td>2783.506</td>
<td>1.04</td>
</tr>
<tr>
<td>10$^{th}$ July</td>
<td>45124</td>
<td>58187.07</td>
<td>Loss</td>
<td>0.78</td>
</tr>
<tr>
<td>20$^{th}$ July</td>
<td>28423</td>
<td>54282</td>
<td>Loss</td>
<td>0.52</td>
</tr>
</tbody>
</table>

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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.

**REFERENCES**


Effect of sowing dates on yield and components of direct seeded coarse rice

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 total.