EFFECT OF DETOPPING ON FORAGE AND GRAIN YIELD OF RICE UNDER AGRO-CLIMATIC CONDITIONS OF D.I. KHAN

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ABSTRACT
To study the effect of detopping on forage and grain yield of rice, an experiment was conducted at the Research Area, Faculty of Agriculture, Gomal University, D.I.Khan during Kharif 2004 in Randomized Complete Block design with three Replications. The experiment consisted of six treatments viz., Control (T1), detopping at 22 DAT (T2), 29 DAT (T3), 36 DAT (T4), 43 DAT (T5), and 50 DAT (T6). The effect of detopping was significant on all the yield and yield components of rice except 1000-grain weight. In respect of all the six treatments, the highest plant height (125 cm), number of productive tillers hill⁻¹ (9), panicle length (23.4 cm), number of spikelets panicle⁻¹ (106.8), number of grains panicle⁻¹ (90), number of sterile spikelets panicle⁻¹ (18), 1000-grain weight (22 g), biological yield (9.6 t ha⁻¹), straw yield (5.6 t ha⁻¹), grain yield (4.1 t ha⁻¹) and harvest index (42.70%) were obtained from control (no detopping). The yield and yield contributing characters decreased by detopping when compared with control. The results revealed that the highest green fodder yield (3.5 t ha⁻¹) was obtained from foliage cutting at 50 DAT with the lowest grain yield (3.0 t ha⁻¹). The highest grain yield (4.1 t ha⁻¹) was recorded in control, which was not significantly different from T2, T3 and T4. Detopping at 36 DAT (T4) gave an identical grain yield (3.5 t ha⁻¹) of control plot with higher additional forage yield (2.4 t ha⁻¹). Hence, it is concluded that detopping at an early vegetative stage of crop growth could produce almost similar grain or seed yield of control plot with the additional forage yield and reduce lodging in case of excessive vegetative growth.

INTRODUCTION
The economy of Pakistan is agricultural based; so general welfare of the country is largely dependent on sound development of agriculture. Population is sharply increasing, creating more pressure on agriculture to produce more food, animal protein and livestock feed. Food-cum forage crop like rice, seems to be one of the most feasible and economically viable practices to serve the needs of human food, cash income and animal feed, particularly for those with limited resources (Topark-Ngram et al.1988). Rice straw is the staple feed for the livestock, but this straw is not sufficient for livestock population during kharif season when the entire fields are occupied by wetland rice. Moreover there is a severe crisis of green fodder during this lean period. The only livestock feed supply are wheat straw and rice straw which are nutritionally poor and also less in quantity because of limited land holding. As a result, animals lose about 15-20 % body weight during this period (Saadullah, 1995). They suffer from weak health when their maximum draught power becomes essential viz. transporting harvested rice, cotton, land preparation for rabi crop etc. The farmers of Pakistan are not interested to grow forage crop in their land because most of the farmers are small land holders and they cannot afford to use their land for fodder instead of food crop. Only the dual-purpose rice crop production may be beneficial to the animal production system with instant supply of forage to all categories of livestock due to its succulent consistency and palatability as well as grains for human consumption or seed production. Usually, excess leaf growth of long duration rice plants is grazed at the early vegetative stage to avoid lodging in later stages and to meet feed requirements of the animals. In some deep-water areas of East Pakistan, Badala a traditional deep-water rice variety is grown as a fodder (Magor, 1986). Cutting long duration rice leaves at the vegetative stage is also practiced in India (Copeland, 1972) and is now more frequently done in Thailand (Kupkanchanakul et al.1991). If detopping really has no effect on the production of grains it may become one of the most economical ways of increasing the yield, with the additional advantages of controlling lodging in case of excessive vegetative growth and will provide the...
farmers with green feeding materials for their work animals, without sacrificing the grain yield. The success of rice cultivation as multipurpose is mostly dependant on different improved agronomic techniques and cutting time. Proper time of detopping seems to be very important for controlling lodging and obtaining enough forage without sacrificing grain yield. The present experiment is, therefore, undertaken with the objective to determine the effects of time of detopping on the forage and grain yield of transplanted rice variety.

**MATERIALS AND METHODS**

The experiment was conducted at the Research Area, Faculty of Agriculture, Gomal University, D.I.Khan during kharif 2004. The experiment consisted of six treatments viz., control (T1, no detopping), detopping at 22 DAT (T2), 29 DAT (T3), 36 DAT (T4), 43 DAT (T5) and 50 DAT (T6). The experiment was laid out in a RCB Design with three replications. The size of each unit plot was 4m X 2.5m. Thirty-two days old seedlings of rice were transplanted on 5th July 2004 maintaining 20cm X 20cm spacing and at the rate of 3 seedlings hill\(^{-1}\). Detopping was made at the height of about 15cm above soil level at different dates as per experimental specifications. Data on different plant characters and yield components before and after harvest were collected from ten randomly selected sample plants from each plot. Analysis of variance was done with the help of computer package MSTAT-C. The means differences among the treatments were adjudged as per Duncan, New Multiple Range Test (Steel and Torrie, 1980). Data were recorded on the following parameters:

1. Plant height (cm)
2. No. of productive tillers hill\(^{-1}\)
3. Forage yield (t ha\(^{-1}\))
4. Panicle length (cm)
5. No. of spikelets panicle\(^{-1}\)
6. No. of grains panicle\(^{-1}\)
7. No. of sterile spikelets panicle\(^{-1}\)
8. 1000-grain weight (g)
9. Grain yield (t ha\(^{-1}\))
10. Straw yield (t ha\(^{-1}\))
11. Biological yield (t ha\(^{-1}\))
12. Harvest Index

**RESULTS AND DISCUSSION**

Effect of detopping was significant on all the growth parameters except 1000- grain weight (at all dates of observations). The highest plant height (125cm) was obtained from control plot at plant maturity. The lowest value of plant height (108cm) was recorded in T6 (50 DAT), which was statistically different from all other treatments. It is also evident from the table that plant height decreased when detopping was done at later stages of crop growth and vice versa (Table I). Similar results were found by Roy and Pradhan (1992). The highest value of number of productive tillers hill\(^{-1}\) (9) was recorded in control followed by T2 (8.8) and T3 (8.6), respectively. The lowest number of productive tillers hill\(^{-1}\) was recorded in T6 (7) followed by T5 (7.5). The data further indicates that the number of productive tillers hill\(^{-1}\) decreased as detopping was delayed from early vegetative stage till late vegetative stage (Table I). The results are in full compliance with those of Hachiya (1989).

Forage yield in detopping at 50 DAT was 3.5 t ha\(^{-1}\), while it was only 1.0 t ha\(^{-1}\), 1.5 t ha\(^{-1}\), 2.4 t ha\(^{-1}\) and 3 t ha\(^{-1}\) in detopping at 22 DAT, 29 DAT, 36 DAT and 43 DAT, respectively (Table I). The highest panicle length (23.4cm), number of spikelets panicle\(^{-1}\) (106.8) and number of grains panicle\(^{-1}\) (90) was found in control. Gosh and Sharma (1998) reported higher number of grains panicle\(^{-1}\) from early detopping than late detopping. The decreasing values for all crop characters were observed when detopping was done at 22 DAT and onward (Table I and II). Similarly, the maximum sterile spikelets panicle\(^{-1}\) (18), 1000- grain weight (22 g), biological yield (9.6 t ha\(^{-1}\)), straw yield (5.6 t ha\(^{-1}\)), grain yield (4.1 t ha\(^{-1}\)) and harvest index (42.7%) were found in control. The highest value of sterility in control may be due to photo-sensitive and thermo-sensitive genetic male sterility, which is restored when the environmental conditions change as reported by Virmani, 1994. Bardhan and Mondal (1988) observed that panicle length decreased due to detopping. Increasing days of detopping gradually decrease the panicle length. Das and Mukherjee (1992) reported that late detopping reduces the grain yield. The possible reason for lower values of crop characters is attributed to the well-known effect of detopping. As detopping retards the vegetative growth of a crop, the yield and yield components of a crop are ultimately affected and this was also true for the present experiment.
Table I  Effect of detopping on different crop characters of transplanted Rice.

<table>
<thead>
<tr>
<th>Treatments (Detopping)</th>
<th>Plant height (cm)</th>
<th>No. of productive tillers hill⁻¹</th>
<th>Panicle length (cm)</th>
<th>No. of spikelets panicle⁻¹</th>
<th>No. of grains panicle⁻¹</th>
<th>Forage yield (t ha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>125.0 a</td>
<td>9.0 a</td>
<td>23.4 a</td>
<td>106.8 a</td>
<td>90.0 a</td>
<td>0.05</td>
</tr>
<tr>
<td>22 DAT</td>
<td>120.0 b</td>
<td>8.8 a</td>
<td>23.1 a</td>
<td>106.0 ab</td>
<td>87.0 b</td>
<td>1.0 c</td>
</tr>
<tr>
<td>29 DAT</td>
<td>116.5 c</td>
<td>8.5 ab</td>
<td>21.8 b</td>
<td>105.0 bc</td>
<td>86.0 c</td>
<td>1.5 c</td>
</tr>
<tr>
<td>36 DAT</td>
<td>112.5 d</td>
<td>8.0 bc</td>
<td>21.4 b</td>
<td>104.5 c</td>
<td>80.0 d</td>
<td>2.4 b</td>
</tr>
<tr>
<td>43 DAT</td>
<td>110.0 e</td>
<td>7.5 cd</td>
<td>20.8 c</td>
<td>103.0 d</td>
<td>75.0 c</td>
<td>3.0 a</td>
</tr>
<tr>
<td>50 DAT</td>
<td>108.0 f</td>
<td>7.0 d</td>
<td>20.0 d</td>
<td>102.0 d</td>
<td>72.0 f</td>
<td>3.5 a</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>0.5458</td>
<td>0.7457</td>
<td>0.6006</td>
<td>1.082</td>
<td>0.1522</td>
<td>0.5894</td>
</tr>
</tbody>
</table>

Means followed by the same letters in same category do not differ significantly at 5% level of probability.

Table II  Effect of detopping on yield and yield components of rice

<table>
<thead>
<tr>
<th>Treatments (Detopping)</th>
<th>No. of sterile spikelets panicle⁻¹</th>
<th>1000-grain weight (g)</th>
<th>Biological yield (t ha⁻¹)</th>
<th>Straw yield (t ha⁻¹)</th>
<th>Grain yield (t ha⁻¹)</th>
<th>Harvest index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>18.00 a</td>
<td>22.00 a</td>
<td>9.60 a</td>
<td>5.60 a</td>
<td>4.10 a</td>
<td>42.70 a</td>
</tr>
<tr>
<td>22 DAT</td>
<td>17.68 a</td>
<td>21.90 a</td>
<td>9.49 a</td>
<td>5.51 a</td>
<td>3.98 a</td>
<td>41.90 b</td>
</tr>
<tr>
<td>29 DAT</td>
<td>15.56 b</td>
<td>21.89 a</td>
<td>9.31 a</td>
<td>5.41 a</td>
<td>3.90 a</td>
<td>41.80 b</td>
</tr>
<tr>
<td>36 DAT</td>
<td>13.94 c</td>
<td>21.88 a</td>
<td>8.73 b</td>
<td>5.23 ab</td>
<td>3.50 ab</td>
<td>40.00 c</td>
</tr>
<tr>
<td>43 DAT</td>
<td>12.00 d</td>
<td>21.80 a</td>
<td>8.20 c</td>
<td>5.00 b</td>
<td>3.20 bc</td>
<td>39.00 d</td>
</tr>
<tr>
<td>50 DAT</td>
<td>11.50 d</td>
<td>21.70 a</td>
<td>7.80 c</td>
<td>4.50 c</td>
<td>3.00 c</td>
<td>38.40 d</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>0.7740</td>
<td>0.8706</td>
<td>0.4267</td>
<td>0.4027</td>
<td>0.7611</td>
<td></td>
</tr>
</tbody>
</table>

Means followed by the same letters in same category do not differ significantly at 5% level of probability.

** DAT= Days After Transplanting

CONCLUSION AND RECOMMENDATIONS

It is concluded from the present investigation that detopping at an early vegetative stage of crop growth produces almost similar grain or seed yield of control crop with the additional forage yield, and reduce lodging in case of over vegetative growth. Detopping can be practiced successfully up to 36 DAT having a little effect on grain yield. Moreover, it is the most economical way of increasing the yield, with the added advantage that it will provide to the farmers with green feeding materials for their animals.

REFERENCES


