EFFECT OF WATER LOGGING ON GROWTH AND YIELD OF MUNGBEAN CV. KANTI (VIGNA RADIATA)

Md. Jafar Ullah
Department of Agronomy,
Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka 1207, Bangladesh

ABSTRACT
One pot experiment was carried out during May, 2000 through July, 2000. Seeds were sown in soils of earthen pots and then the pots along with soil were dipped in water for 12, 24, 36 and 48 hours. Results showed that significantly lower values of almost all the growth and yield parameters were found with successive increase in duration of water logging. Highest number of leaves/plant (13.00), highest leaf area (1321 cm²), highest plant height (60 cm), highest dry matter (22.21 g/plant), highest 1000 seed weight (39.52g), highest number of pods/plant (18.70), highest seed yield/plant (7.06 g) and highest harvest index (31.78 %) were found when pots were not emerged in water. Whereas, lowest number of leaves/plant (5.00), lowest leaf area (862 cm²), shortest plant height (40.25 cm), lowest dry matter (13.17 g/plant), lowest 1000 seed weight (30.12g), lowest number of pods/plant (6.49), lowest seed yield/plant (1.81 g) and lowest harvest index (13.17%) were found when pots were emerged in water for 48 hours. Date of both flowering and maturity was also delayed due to water logging. However, days from flowering to maturity was hastened due to water logging by almost one day. Water logging for 12, 24, 36 and 48 hours showed reduced seed yield of 12.47, 27.17, 46 and 74.36 % respectively.

INTRODUCTION
Among pulses, mungbean (Vigna radiata) is very popular because of its palatable better nutritional value (Islam, 1983). However, in Bangladesh, due to the high demand of cereal foods, its position in existing cropping system is getting narrowed down day by day. As a result, annual acreage and production is decreasing which may be maintained by growing this crop in a short time space left between two long duration crops. Recently, some cultivars have been developed which are more productive with short duration of 60 days (Islam, 1983). In Bangladesh, they can be incorporated in between rabi/wheat and transplanted aman as summer pulses during April and May having the range of long term rainfall of 8 - 15 mm. However, during this pre monsoon time, there occur occasional heavy rains which cause serious damage to the crop. Before inventing techniques to overcome this problem, it is necessary to assess the losses due to water logging. Harmful effect of water logging on different physiological and yield attributes has been studied in oil crops (Feng, 1991) soybean (Sorte et al., 1996) and potato (Ekanayake, 1994). Keeping these points in view, a pot experiment was carried out to evaluate growth and yield of mungbean under different regime of water logging.

MATERIAL AND METHODS
The experiment was carried out at Sher-e-Bangla Agricultural University, Dhaka, Bangladesh. The experiment had 5 treatments (T) involving 4 water logging (12, 24, 36 and 48 hours) and one control (T0). Earthen pots having top diameter 12 inches were filled with dry soil. In each pot, 10 seeds of mungbean were sown at a depth of 2.5 cm. Water logging treatments (T) were imposed just after sowing dipping the pot alongwith soil and seeds in a water reservoir as per the timeframe of treatments mentioned above except the pot under control (T0). Earthen pots having top diameter 12 inches were filled with dry soil. In each pot, 10 seeds of mungbean were sown at a depth of 2.5 cm. Water logging treatments (T) were imposed just after sowing dipping the pot alongwith soil and seeds in a water reservoir as per the timeframe of treatments mentioned above except the pot under control (T0). Each treatment was replicated 15 times (12 for dry matter analyses and 3 for yield determination). The pots were arranged in completely randomized design at an open place having sunlight for the whole day. Extra plants were thinned out at 15 and 30 days after emergence keeping two and one
seedling per pot respectively. Data on plant height, number of leaves (trifoliate)/plant was taken at 5 days interval from 45 DAS. Data on first flowering, 50 % flowering, first maturity, and 80 % maturity were also taken. Matured pods were harvested two times from first flush only and was cumulated. Dry matter analyses were made at 45, 50, 55 and 60 DAS using three pots at each stage. All data were averaged and statistically analyzed and are presented in the following section.

**RESULTS AND DISCUSSION**

Plant height continued increasing up to maturity (Fig. 1). Control plants showed the highest plant height at all the growth stages. It decreased significantly as the length of water logging was increased. At maturity, control showed highest plant height (60 cm), whereas, T48 showed shortest plants (40.25 cm).

Leaf number decreased progressively with increasing the duration of water logging (Fig. 2). However, magnitude of difference in leaf number as were shown by different treatments was found to greatest at 50 DAS. At this stage, highest number of leaves were obtained which decreased afterwards. Almost at all the stages, leaf number decreased significantly as the length of water logging increased. However, at 60 DAS the leaf number of T12, T24 and T36 were statistically at par, although were significantly lower than that of control and significantly higher than that of T48. Leaf number was found to be reduced drastically with T48 at all the growth stages. Leaf area almost followed the trend as was shown by leaf number and plants behaviors in response to the water logging treatments were also similar as were seen in case of leaf number (Fig. 3). However, at 60 DAS, T36 showed significantly higher leaf area than T48, but lower leaf area than T24.

Like plant height, dry matter/plant also increased up to maturity (Fig. 4). Dry matter decreased significantly with increasing the extent of water logging at all the growth stages except at 45 DAS. Dry matter was found to be reduced drastically with T48. At 60 DAS, this treatment showed dry matter of 13.74 g/plant which was not comparable to any other treatments. Reduction in vegetative growth in crops due to flooding has been attributed to decrease in leaf water potential (Ekanayake, 1994), nitrogen leaching (Gao et al., 2002), less functioning of some useful hormones in plants (Jackson et al., 1994) and retardation in root growth (Mridha et al., 2001).

Results regarding first flowering, 50 % flowering, first maturity and 80 % maturity are given in Fig. 5. Flowering and maturity were found to be significantly delayed as the length of water logging was elongated. However, duration of pod development (Days from 50 % flowering to 80 % maturity) was hastened due to increased period of water logging. T0 took about 16 days whereas, T48 took about 15.20 days to mature after flowering.

Pod length ranged from 6.13-6.23 cm and number of seeds/pod ranged from 9.26-9.55 and these two parameters were not found to differ significantly (Table 1). However, 1000 seed weight and number of pods/plant significantly decreased with successive increase of water logging regimes. T0, T12 and T24 were at par showing significantly higher 1000 seed weight than T36. T48 showed significantly the lowest 1000 seed weight when compared to others. Control plants showed the highest 1000 seed weight (38.52 g) and number of pods/plant (18.70). Whereas, T48 showed the lowest 1000 (30.12 g) seed weight and pods/plant (6.49/plant).

Number of pods was found to decrease significantly and successively with the successive increase in water logging. Among the water logged plants, the plants under water logging for 12 hours (T12) had 16.52 pods/
Fig. 1. Effect of water logging on plant height of mungbean cv. Kanti

Fig. 2. Effect of water logging on number of leaves of mungbean cv. Kanti

Fig. 3. Effect of water logging on leaf area of mungbean cv. Kanti
Table 1. Effect of water logging on yield parameters of mungbean cv. Kanti

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Pod length (cm)</th>
<th>No. of seeds per pod</th>
<th>1000 seed weight (g)</th>
<th>No. of pods per plant</th>
<th>Seed yield per plant (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>6.13</td>
<td>9.55</td>
<td>39.52</td>
<td>18.70</td>
<td>7.06</td>
</tr>
<tr>
<td>T12</td>
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<td>9.53</td>
<td>39.25</td>
<td>16.52</td>
<td>6.18</td>
</tr>
<tr>
<td>T24</td>
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<td>9.32</td>
<td>39.07</td>
<td>14.12</td>
<td>5.14</td>
</tr>
<tr>
<td>T36</td>
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<td>9.31</td>
<td>33.43</td>
<td>12.25</td>
<td>3.91</td>
</tr>
<tr>
<td>T48</td>
<td>6.21</td>
<td>9.26</td>
<td>30.12</td>
<td>6.49</td>
<td>1.81</td>
</tr>
<tr>
<td>CD (0.05)</td>
<td>NS</td>
<td>NS</td>
<td>1.23</td>
<td>1.71</td>
<td>0.36</td>
</tr>
</tbody>
</table>

Fig. 4. Effect of water logging on dry matter accumulation of mungbean cv. Kanti

Fig. 5. Effect of water logging on flowering and maturity of mungbean cv. Kanti

Fig. 6. Effect of water logging on per cent yield decrease over control and harvest index of mungbean cv. Kanti
plant and those under 24 hours (T24) had 14.12 pods/plant. Water logging for 48 hours drastically reduced the pod numbers/plant (6.49). Like number of pods/plant, yield/plant significantly decreased with successive increase in water logging treatment. This is in agreement with the work of Sorte et al. (1996) who reported decreased yield in soybean by 7-33% imposing water logging for 4-8 days. In this trial, control plants showed the highest seed yield (7.06 g/plant). Whereas, T48 showed the lowest seed yield (1.81 g). T12, T24, T36 and T48 showed 12.47, 27.17, 46 and 74.36% yield decrease when compared with control (Fig. 6). Correspondingly, harvest index decreased significantly with successive increase in water logging treatment. The highest harvest index was shown by control (31.78%), whereas, T48 showed the lowest (only 13.17%). Reduction in reproductive growth in crops due to flooding has been attributed mainly to nutrient deficiencies which are one of the resultant effects of water logging (Watterauer and Killorn, 1996).

REFERENCES