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Contribution of flower removal on the performance of Mungbean

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ABSTRACT

*The farmers of Bangladesh cannot get the higher economic yield from Mungbean due to the tendency of shattering of immature flowers and dropping of flowers and pods from plant by pest damage. From this point of view a field experiment were conducted in Sher-e-Bangla Agricultural University; Dhaka, Bangladesh, to investigate the response of flower removal on the performance of Mungbean (**BARI MUNG 5**) during kharif-1season in 2014. There were seven levels of flower removal treatment in this experiment viz., 0, 5, 10, 15, 20, 25, 30 DAFI (Days after Flower Initiation). All the treatments were allocated as Randomized Complete Block Design (RCBD) with 3 replications. Results revealed that, with the increasing trend of deflowering activity, there was an increasing trend in the branch, leaf and dry matter production. But there was a negative response on seed yield with increasing removal trend. Reduced number of pod plant^{-1}, number of seed pod^{-1}, pod and seed sizes responded with the lower yield. Due to decreased flowering duration, the total flower production was reduced and resulted in poor pod and seed yields, although the racemes were enhanced following flower removal. Deflowering for 10 consecutive days has no significant response on TDM (Total Dry Matter) and seed yield plant^{-1} besides, resulted in about 80% of total flower abortion. But beyond this period (flower removal > 10 days) seed yield was significantly reduced. In respect of sink loss the contribution of high yielding Mungbean was lesser. From the economic point of view the findings from this experiment was also studied in case of pest and disease and also revealed that, flower removal at 10 DAFI was best for performances without imparting significant seed yield loss.*

Key words: Mungbean, Flower removal, Growth, Seed yield

INTRODUCTION

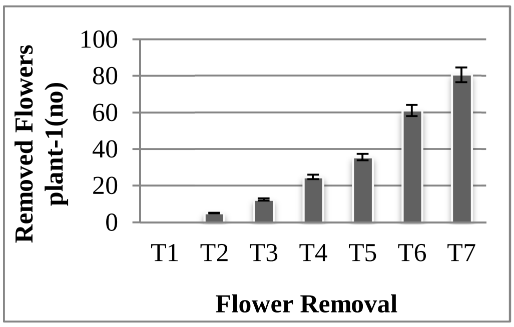
Among the entire pulses crop, there may get the yield within very short time from Mungbean under prevailing climatic condition of Bangladesh and generally it produces profuse flowers, but only a low portion of the flowers turns mature to pods [1]. Most abortion of reproductive parts of legume crops occurs during the bud and full bloom stages of development [2]. Due to indeterminacy of Mungbean, where flowering proceeds acropetally on the racemes and also on the branches as new racemes develop. Under favorable conditions, the earlier-formed flowers set more pods than the later- formed ones [1]. In general, most of the pods develop on the proximal nodes of the racemes, and flowers that produced at the distal nodes of racemes abort [2]. Source (leaves) or sink (flower and pod) were the most important limiting factors for crop yield [3]. Sink-limited lower yield is determined by pod and seed number [4]. In an attempt to reveal the compensatory mechanism in soybean yield, research observed the effects of removing reproductive organs at various stages of development on seed yield and reported that soybean plants tolerated pod removal up to 80% without significant loss of seed yield if carried out before the initiation of pod filling in soybean [5]. However, increasing source-sink ratios by decreasing sink size through pods and flowers removal usually results in increased leaf carbohydrate levels in soybean [6]. Economic yield is responded by photosynthetic area and its functional duration. The authors reported that the removal of flowers and young pods for two weeks did not affect the seed yield adversely in soybean, and this was due to increased flowers and pod production later. The principle objectives of this experiment was to investigate the intensity to which and what levels of flower removal in Mungbean affects growth, reproductive characters and seed yield under field condition with a view to evaluating its compensatory mechanism under Bangladesh mainly where the soil and climatic condition is favorable for pulse crop production to meet up the demand of protein requirement.

MATERIALS AND METHODS

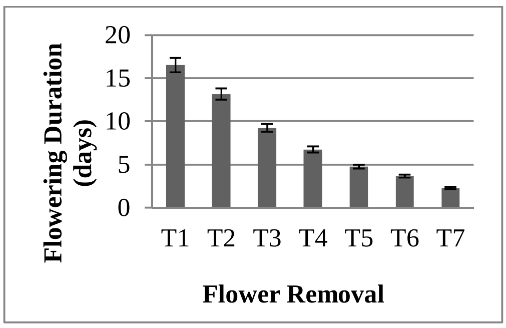
Experiments were conducted at the Agronomy field ($23^0 74^/$N latitude and $90^0 35^/$E longitude with an elevation of 8.2 meter from sea level under Madhupur Tract-AEZ 28), Sher-e-Bangla Agricultural University; Dhaka, Bangladesh in Kharif-I (March-May) season, 2014. One high yielding Mungbean variety (**BARI MUNG 5**) and seven flower removal treatments were used. Seeds were sown in rows, 1.2 m long with 30 cm apart between rows. Sowing was done on 1 march. The experimental design was simple RCBD (Randomized Complete Block Design) with three replications. Seeds were sown continuously in line and two weeks after germination, the plants were thinned and maintained to a uniform density of 30 plants m^{-2}. Cultural practices were the same in all the plots. Urea, triple super phosphate(TSP), muriate of potash (MOP), zinc sulphate and, boric acid were used as a source of nitrogen, phosphorus, potassium, zinc and boron at the rate of 50, 80, 35,5 and 5 kg ha^{-1}, respectively (Source: BARI KRISHI PROJOUKTI HATBOI) at the time of final land preparation. First weeding was done followed by thinning at about 21 days after sowing (DAS). One irrigation was given at 27 DAS in this season. Insecticide (Ripcord 20 EC @ 0.025%) was sprayed at flowering and fruiting stage (52 DAS) to control shoot and fruit borer. Marshal @3% was used for controlling the Mungbean yellow mosaic virus. The seven levels of flower removal treatments were employed at the beginning of first opened flower (at 45 DAS) were: (i) control (No flower removal), beginning from first day of flowering, all opened flowers were removed continuously for (ii) 5; (iii) 10 ; (iv)15; (v) 20; (vi) 25; and (vii) 30 days. A 1 m central section of each plot was harvested to avoid border effects. The harvested plants of each plot were separately bundled and tagged. After recording some necessary data, the harvested plants were threshed by hand and oven dry weight (80°C ± 2 for 48 hours) of grain and other plant parts was recorded per plot wise. Specific leaf weight (SLW) was determined four times at 5 days interval from the beginning of flowering to pod maturity in this season. Finally, at harvest, total reproductive unit (TRU), actual seed yield $plant^{-1}$, yield components and dry matter production were recorded. The TRU $plant^{-1}$ was determined by the number of inflorescence $plant^{-1}$ multiplied by the number of nodes $inflorescence^{-1}$. The collected data were subjected to statistical analysis (MStatC) as per the design used and different means were tested by LSD (Least Significant Difference) test methods.

RESULTS AND DISCUSSION

A)



B)



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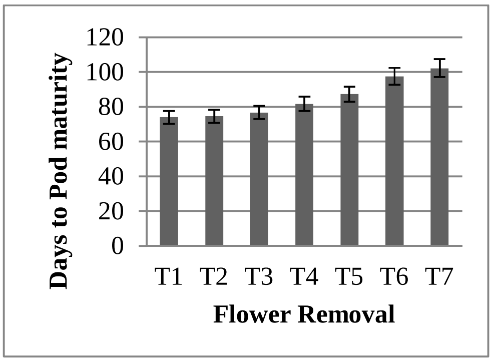
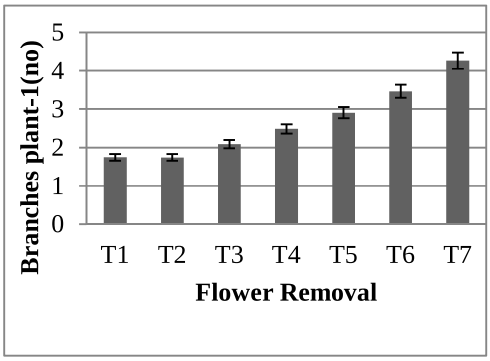
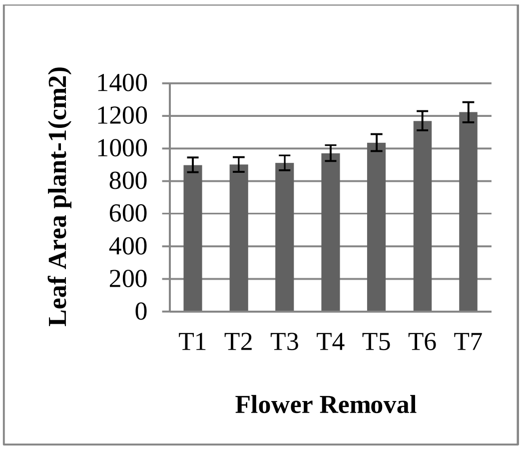
C)


Days to Pod maturity
120
100
80
60
40
20
0
T1 T2 T3 T4 T5 T6 T7
Flower Removal

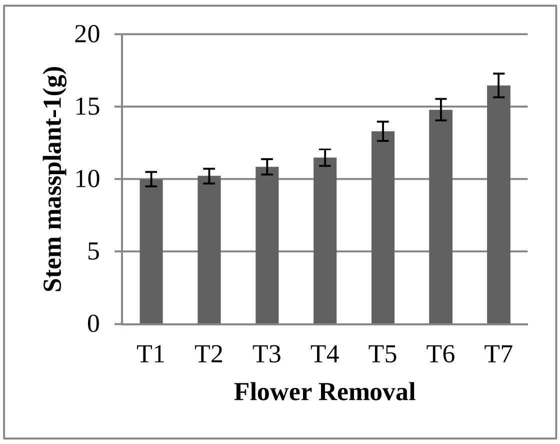
D)


Branches plant-1(no)
5
4
3
2
1
0
T1 T2 T3 T4 T5 T6 T7
Flower Removal

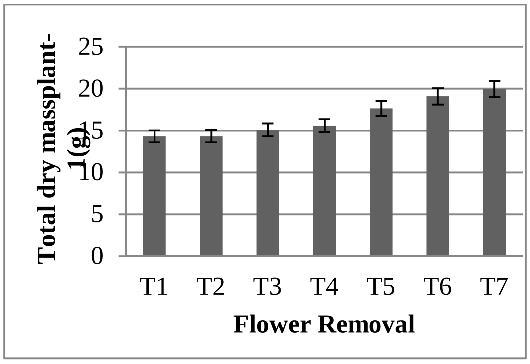
E)


Leaf Area plant-1(cm2)
1400
1200
1000
800
600
400
200
0
T1 T2 T3 T4 T5 T6 T7
Flower Removal

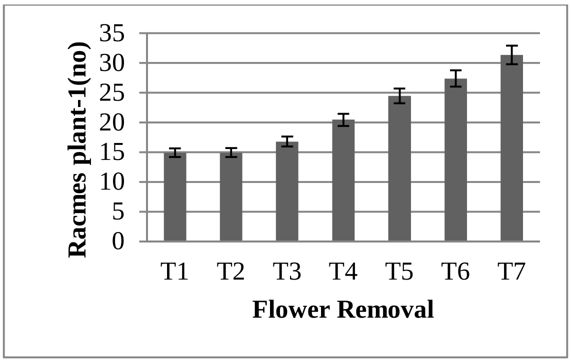
F)


Stem massplant-1(g)
20
15
10
5
0
T1 T2 T3 T4 T5 T6 T7
Flower Removal

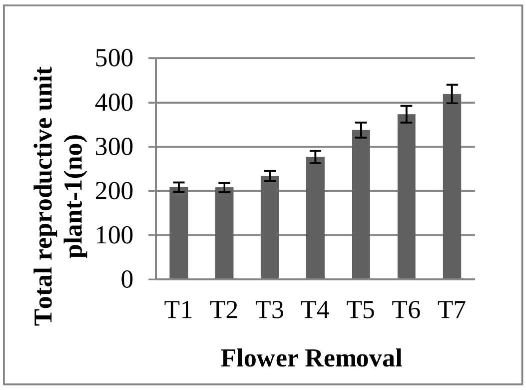
G)


Total dry massplant-1(g)
25
20
15
10
5
0
T1 T2 T3 T4 T5 T6 T7
Flower Removal

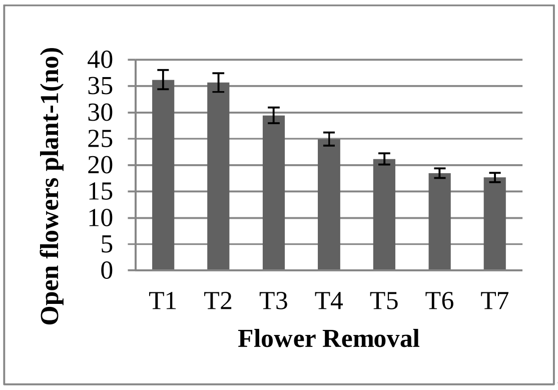
H)


Racmes plant-1(no)
35
30
25
20
15
10
5
0
T1 T2 T3 T4 T5 T6 T7
Flower Removal

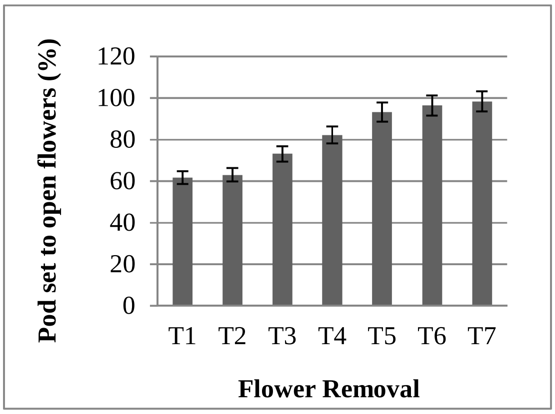
I)


Total reproductive unit plant-1(no)
500
400
300
200
100
0
T1 T2 T3 T4 T5 T6 T7
Flower Removal

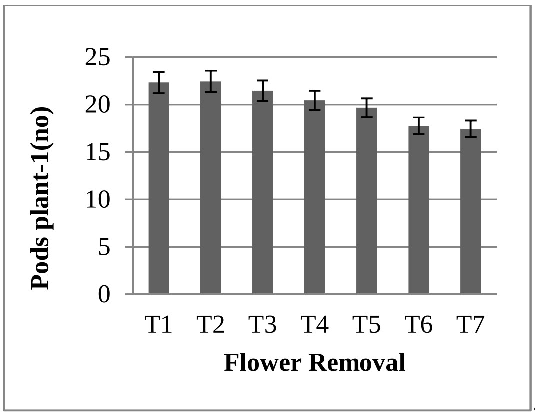
J)


Open flowers plant-1(no)
40
35
30
25
20
15
10
5
0
T1 T2 T3 T4 T5 T6 T7
Flower Removal

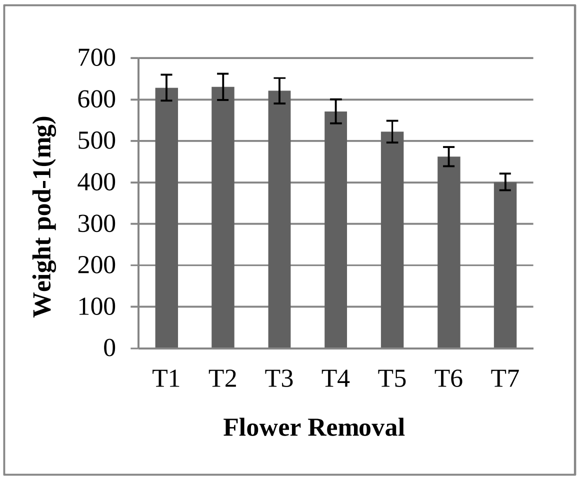
K)


Pod set to open flowers (%)
120
100
80
60
40
20
0
T1 T2 T3 T4 T5 T6 T7
Flower Removal

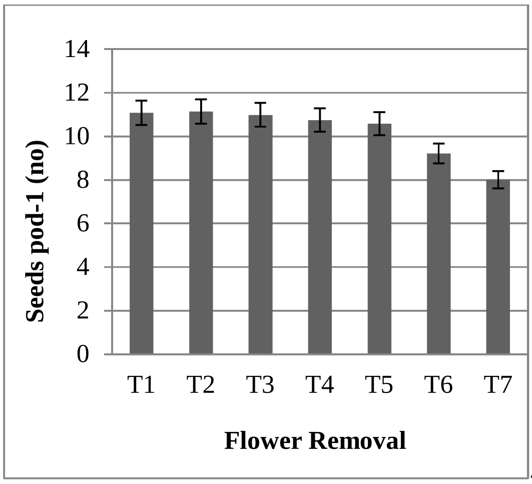
L)


Pods plant-1(no)
25
20
15
10
5
0
T1 T2 T3 T4 T5 T6 T7
Flower Removal

M)


Weight pod-1(mg)
700
600
500
400
300
200
100
0
T1 T2 T3 T4 T5 T6 T7
Flower Removal

N)


Seeds pod-1 (no)
14
12
10
8
6
4
2
0
T1 T2 T3 T4 T5 T6 T7
Flower Removal

O) P)

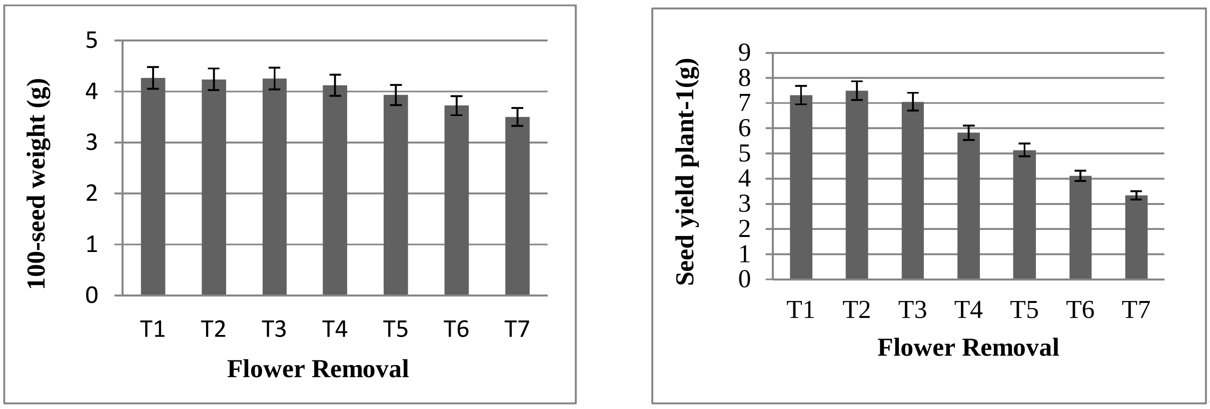


Figure 1(A-P): Effect of flower removals on phenology, vegetative, reproductive and yield traits of Mungbean during Kharif-I season of 2014. Vertical bar showing LSD (0.05) values

Phenological traits: Deflowering had shown highly significant response on number of removed flower, flowering duration and days required to maturity (Figure 1-A, B and C). The number of removed flowers and maturity duration were increased with increasing deflowering duration. The delayed maturation of the deflowered plants was not proportional to the length of flower removal period. Flowering duration was the longest in control plants (16.55 days) while shortest in 30-days deflowered plants (2.303 days). However, a reverse trend was observed in case of days required to pod maturity. The removal of flowers from the plants resulted in a protraction of flowering duration and accelerated the flower production (Figure 1-B). Additionally, after easement of flower removal, the flowering duration was reduced due to lengthening deflowering duration.

Vegetative traits: The branch number, leaf area (LA), stem mass and TDM plant^{-1} were increased with increasing deflowering duration. Deflowering for the first 10-days had just little effect on number of branches, LA, stem mass and TDM compared to control plants; thereafter deflowered plants accumulated dry mass rapidly and was increased with increasing degree of deflowering duration (Figure 1-D, E, F and G). The highest branch number (4.29 plant^{-1}), LA (1219 cm^2 plant^{-1}), stem mass (16.49 g plant^{-1}) and TDM (19.99 g plant^{-1}) were observed in 30-days deflowered plants while lower was recorded in control and 5-days deflowered plants. This was possibly because deflowered plants possess a capacity to produce more branches and leaf bearing nodes than the control plant. Similar results were also reported by other workers [7] in soybean, who reported that the number of branches, leaves and TDM were increased with increasing deflowering duration .Results revealed that branch number plant^{-1} was increased with increasing deflowering duration.

Reproductive characters: The influence of deflowering on number of raceme plant^{-1}, total reproductive unit (TRU) plant^{-1}, open flowers plant^{-1} and per cent pod set to opened flowers was significant (Figure 1-H, I, J and K). The number of raceme, TRU and RE were increased with increasing deflowering duration whilst number of opened flowers plant^{-1} showed the reverse trend. The raceme number (31.35 plant^{-1}), TRU (421 plant^{-1}) were the highest in 30-days deflowered plant whilst control and 5-days deflowered plants were alike in such effects and showed smaller values. Raceme number was increased in deflowered plants due to increased branches (Figure 1-H). However, RE was increased with increasing deflowering duration, meaning pod retention capacity was higher under deflowered condition.

Yield traits: The response of flower removal on yield and yield attributes were significant. Results showed that generally, number of pods plant^{-1} and seeds pod^{-1}, weight pod^{-1} and 100-seed weight was decreased (Figure 1-L, M, N, and O) with increasing deflowering duration except 5-days deflowering. But decrement of the above yield attributes was insignificant up to 10-days deflowering when compared with control followed by a significant decline on further deflowering duration. On the other hand, there was no significant adverse effect on 100-seed weight till 15-days deflowering after which it declined significantly. Results revealed that seed yield was not decreased significantly up to 10-days deflowering even slightly increased over control in 5-days deflowered plant indicating

Mungbean can compensate yield loss up to 10-days of deflowering. It is reported that the leguminous plant flowers profusely so that even if some flowers were lost by anyhow, the grain yield was not adversely affected [8]. The removal of all flowers and young pods for two weeks did not adversely affect seed yield in soybean [9]. The authors further reported that the plants were able to compensate the losses by setting new flowers and pod indicating soybean plant has substantial capacity to compensate the losses of flowers and pods by setting new ones under field conditions .The increasing deflowering duration beyond 10-days significantly reduced seed yield with being the highest reduction was recorded in 30-days deflowered plants. When flower removal continued beyond 2 weeks, seed yield was drastically decreased due to reduction in pods plant^{-1}. In the present experiment, when all flowers were removed up to 10 days, Mungbean plants generally, were able to compensate the losses of removed flowers (Figure 1-A). This was because all the yield traits *viz*., pods plant^{-1}, seeds pod^{-1}, pod and seed size remained uninfluenced when deflowered for 10 days. Further, the removal of flowers for longer period (beyond 10 days) caused a marked reduction in seed yield because of subsequent reduction of accompanied yield attributes occurred beyond 10 days deflowering. In case of severe deflowering such as 15 days and beyond, it would be seem that the plants already passed the active stage, i.e. depletion of leaf metabolic activity due to prolonged deflowering when they could develop enough new pods to prevent a decrease in seed yield. From the present studies it appears that Mungbean plant may be able to compensate sink (flower) losses for continuous 10 days deflowering, by producing new flowers and setting new pods, later (Figure 1 –L, M, N, O and P).

CONCLUSION

The phenology, vegetative, reproductive and yield performances of Mungbean were significantly influenced by flower removal. From the economic point of view, flower removal at 10 DAFI was best for performances without imparting significant seed yield loss.

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