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Studying the Yield and Yield Parameters of Mungbean in Response to Different Weed-Crop Competition Periods

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ABSTRACT

Impact of weed-crop competition periods on the yield and yield parameters of mungbean was investigated during the spring and summer season of 2018 at Agronomic Research Farm, Bahauddin Zakariya University, Multan. Treatments comprised of different weed-crop competition periods, weeds were allowed to compete for 15, 30, 45 and 60 days with mungbean after sowing. For comparison, weed free and weedy check plots were also maintained. Results revealed the importance of controlling weeds for getting better grain and other yield contributing traits during both the seasons. Uncontrolled weeds caused about 50 percent yield losses. Whereas similar results of grain yield and other yield related parameters were also recorded in weed free plots and weed-crop competition period for 15 days after sowing plots, while there is a gradual decline in yield and other yield related parameters if weed-crop competition periods were prolonged. These studies highlighted the importance of controlling weeds with further indication of controlling weeds till 15-30 days after sowing to get better yield of mungbean crop in both the spring and summer seasons.

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INTRODUCTION

Green gram or mungbean (*Vigna radiata* L.) is an ancient legume crop traditionally used in daily diet as important source of protein and starch in Indian sub-continent. In comparison to other pulses mungbean has high protein contents, less carbohydrates and important for patients suffering from stomach and digestibility problems (Mondal *et al.*, 2012). In Pakistan, mungbean is second dominant legume crop after chickpea and has two growing seasons, spring and summer crop (Amin *et al.*,

2019). It is a short duration crop and mature within 100 days after sowing (Aziz ur Rehman *et al.*, 2019). Mungbean can be successfully adaptable in spring and summer cropping systems due to short growing season and limited water demand (Raina *et al.*, 2016). In Pakistan, mungbean is cultivated on an area of 3.02 thousand hectares, while total production is 2.64 thousand tonnes (GOP, 2022). As a legume crop mungbean has ability to fix the atmospheric nitrogen and on an average, it can fix 34 kg ha⁻¹ atmospheric

nitrogen annually (Khan *et al.*, 2020). When intercropped with other crops like sugarcane, sunflower and cereals, it increases the overall productivity of land, though mungbean yield is compromised (Awaad and El-Naggar, 2018).

Among the yield limiting factors, weeds are considered as a major reason causing as maximum yield loss as up to 87% (Chauhan *et al.* 2017; Jabran and Chauhan, 2015). Weed causes yield losses due to competition (Pynenburg *et al.*, 2011) and allelopathy (Oueslati, 2003; Turk *et al.*, 2003). Whereas on seasonal basis, weed competition reduce the yield of summer planted mungbean from 30 to 80% while in spring planted mungbean 70 to 80% respectively (Algotar *et al.*, 2015). In Pakistan, *Cyperus rotundus* L., *Trianthema portulacastrum* L., *Cynodon dactylon* L., *Dactyloctenium aegyptium* L., and *Echinochloa colona* L. are the dominating weeds of mungbean. For getting higher yield, weeds should be controlled before the critical damaging period and it has been previously reported in many studies (Mahajan and Chauhan, 2022; Nagender *et al.*, 2017; Khaliq *et al.*, 2002).

Critical weed-crop competition period is the most sensitive time during the life cycle of any crop, when presence of weeds can harm maximum damage to the crop (Little *et al.*, 2022). This period is different in different crops, like in a field trial, first 30 days were recorded to be the most critical for weed-green gram competition (Singh *et al.*, 1991). Mungbean is grown in two season in Pakistan, as spring and as summer crop, so it has to compete with weeds of both season. Therefore, little information are available where, critical weed-mungbean competition period was studied for both the season. Therefore, field investigations were planned to record the critical weed-crop competition period for spring and summer planted mungbean.

MATERIAL AND METHOD

Field trials were performed at the Agronomic Research Farm, Department of Agronomy, Bahauddin Zakariya University, Multan in spring as well as in summer season of 2018. Soil sample was taken from the experimental field, and it was silt to clay type, having low organic matter content (0.10%). Experiment was laid out using randomized complete block design (RCBD) with three replications. Treatments were planned as weed competition for 15 days, weeds competition for 30 days, weeds competition for 45 days and weeds competition

for 60 days. While weedy check and weed free treatments were also included for comparison. Net size of experimental plot for individual treatment was 4m x 2m while seed rate used was 17.5 kg ha⁻¹ as recommended by Punjab Agriculture Department. Whereas sowing was done during March and July as spring and summer season crop respectively. Hand drill was used for sowing purpose while planting geometry of 10 cm plant to plant and 25 cm row to row distance was maintained. Fertilizers were added as per the recommendations (N-P at 20-60 Kg ha⁻¹) of Punjab Agriculture Department in the form Urea and DAP. Irrigations were applied as per the need of the crop during both season. Whereas, all other plant protection strategies were practiced as per the recommendations of Govt. Weeds were manually removed according to the each treatment plan.

MSTATC software was used for the analysis of all recorded data, while, for separation of means least significance difference (LSD) test was applied.

RESULTS

Data regarding all the yield and yield related parameters during both the seasons, spring and summer, was statistically significant (Table 1 and Table 2). In general, recorded values for all the parameters like plant height at maturity, reproductive, vegetative branches, No. of pods per plant, pod length, thousand grain weight, biological yield and grain yield showed maximum values where plots were kept weeds free for throughout the growing season and weeds competition remained for only 15 days. Whereas least values for these aforementioned parameters were recorded where weeds were remained present for competition with mungbean for the whole growing season (Table 1 and Table 2). Maximum plant height and reproductive branches were recorded where there were no weeds throughout the growing season followed by the plots where weeds were remained in competition for 15 only days followed by weeds competition for 30 days and 45 days. For other parameters like vegetative branches, No. of pods per plant, pod length, thousand grain weight and grain yield maximum values were recorded where mungbean was weeds free throughout the growing season but statistically similar results were recorded for vegetative branches, No. of pods per plant and pod length where weeds were in competition with mungbean for first 15 and 30 days (Table 1).

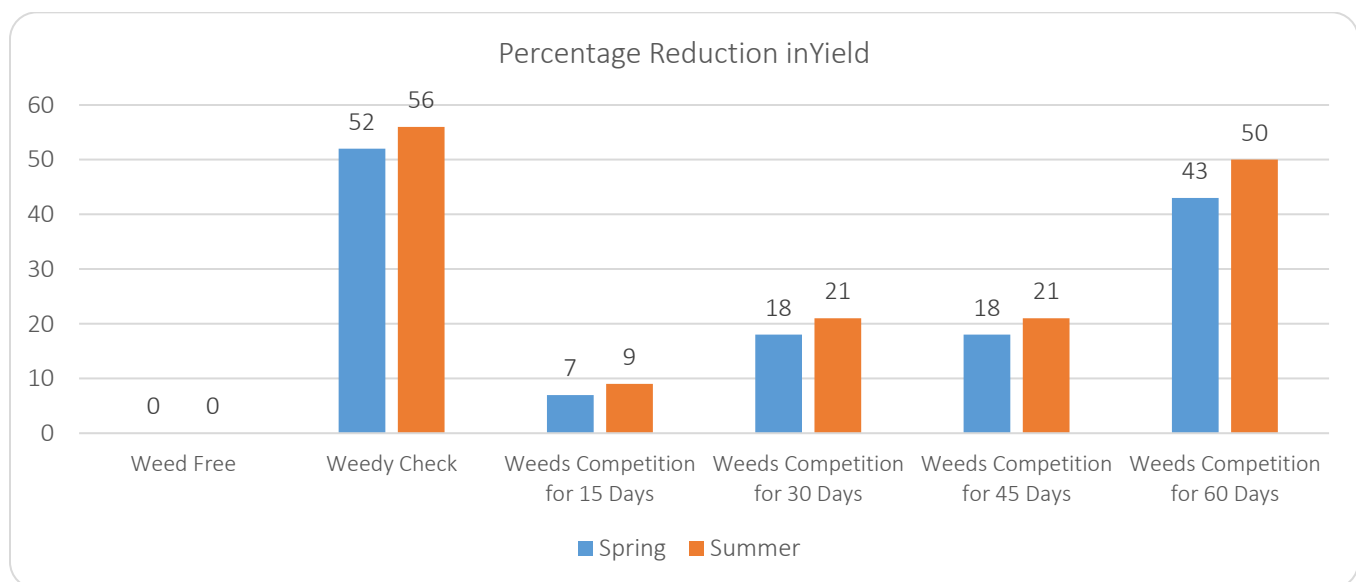
Table 1. Influence of various weed-crop competition periods on the yield contributing parameters of mungbean.

Treatments	Plant height (cm)		Reproductive branches		Vegetative branches		No. of pods per plants		Pod length (cm)	
	Spring	Summer	Spring	Summer	Spring	Summer	Spring	Summer	Spring	Summer
	Weed Free	36.2 a	34.00 a	4.3 a	3.3 a	4.7 a	3.7 a	8.7 a	7.5 a	8.1 a
Weedy Check	23.7 e	22.2 e	3.1 c	2.3 b	3.2 c	2.2 c	6.2 c	5.2 c	5.5 c	4.5 c
Weeds Competition for 15 Days	31.0 b	29.7 b	3.6 bc	2.6 b	4.4 a	3.4 a	8.3 a	7.3 a	7.5 ab	6.5 ab
Weeds Competition for 30 Days	29.2 c	27.0 c	3.7 b	2.7 ab	4.2 ab	3.2 ab	8.1 ab	7.1 a	7.26 b	6.26 b
Weeds Competition for 45 Days	26.9 d	24.98 d	3.51 bc	2.51 b	3.7 bc	2.7 bc	7.7 ab	6.7 ab	7.24 b	6.24 b
Weeds Competition for 60 Days	26.6 d	24.90 d	3.50 bc	2.50 b	3.5 c	2.5 c	7.0 bc	6.0 bc	6.1 c	5.1 c
LSD	1.4	1.8	0.57	0.59	0.6	0.6	1.18	1.13	0.7	1.13

Table 2. Influence of various weed-crop competition periods on the Grain yield and other parameters of mungbean.

Treatments	1000 Grain weight (g)		Biological Yield (Kg ha ⁻¹)		Straw Yield (Kg ha ⁻¹)		Grain Yield (Kg ha ⁻¹)	
	Spring	Summer	Spring	Summer	Spring	Summer	Spring	Summer
	Weed Free	7.00 a	6.00 a	5250.0 a	4416.7 a	3550.97 a	2987.35 a	1699.03 a
Weedy Check	3.00 d	2.00 d	2685.4 e	2062.5 e	1874.10 d	1439.39 e	811.30 d	623.11 d
Weeds Competition for 15 Days	7.00 ab	6.00 ab	4879.2 b	4045.8 b	3305.26 b	2740.70 b	1573.94 a	1305.10 a
Weeds Competition for 30 Days	6.00 b	5.00 b	4475.0 c	3641.7 c	3080.92 b	2507.21 c	1394.08 b	1134.49 b
Weeds Competition for 45 Days	4.50 c	3.50 c	4458.3 c	3625.0 c	3069.42 b	2495.72 c	1388.88 b	1129.28 b
Weeds Competition for 60 Days	4.00 cd	3.00 cd	3172.9 d	2339.6 d	2205.55 c	1626.31 d	967.35 c	713.29 c
LSD	1.00	1.00	284.00	243.30	236.25	221.21	131.21	125.10

While for thousand grain weight weeds free plots and weeds competition for 15 days gave statistically similar results (Table 2). Maximum biological yield and straw yield were recorded where there was no competition with weeds followed by the plots where weeds were in competition for first 15 days, however maximum grain yield was recorded under the plots facing no competition of weeds and in plots where weeds remained in competition for 15 days, while grain yield trend was followed by the plots where weeds were in competition for 30 as well as for 45 DAS (Table 2). In comparison to weed free treatment, different weed-crop competition periods reduced the grain yield of mungbean in varying percentages (Graph 1). Overall, if weeds are not controlled and allowed to compete for the whole crop growing season it caused 52 and 56 percent reduction in mungbean yield during spring and summer season respectively. Whereas weed-crop competition for 15 days caused grain yield reduction percentage of 7 and 9 percent during spring and summer season respectively, while weed-crop competition for 30 and 45 days caused grain yield reduction percentage of 18 and 21 percent during spring and summer season respectively. However, this reduction percentage was much increased up to 43 and 50 if weed-crop competition existed for 60 DAS.



Graph 1. Percentage reduction in yield in comparison to weed free treatment.

DISCUSSION

From the finding of these investigations, it was clear that with no doubt, weeds in competition are posing a serious damaging to crop yield and other yield related traits when we compare different treatments with control treatments of weed free and weedy check. Further if we compare different weed-crop competition treatments, as long as this period increases, yield and other yield related traits start decreasing. Similarly, this phenomenon was earlier recorded when weeds were controlled early in crop growth stage it gives better yield and yield related parameters whereas, where weeds were remained in competition for longer growth period of crops, response of above-mentioned parameters is reasonably less (Yadav *et al.*, 1983). Weeds are reported as the major yield limiting factor in all the field crops

(Farooq *et al.*, 2018; Gopakumar and Menon, 2022). Similarly, Ahmad and Gafoor, 2004 reported that black seed crop yield can be reduced by 60-85% due to weed interference whereas this competition can lead to complete crop failure if weeds were remained in competition with main crop for the entire growing season of crop (Iderawumi and Friday, 2018). Yield and yield related parameter like plant height, No. of vegetative and reproductive branches, pod length, 1000 grain weight, No. of pod per plant, grain yield and straw yield and all negatively responded to the prolonged weeds-crop competition period. In the recent studies, Mahajan and Chauhan, 2022 studied the interference of *Echinochloa colona* with mungbean and identified it as a major competitor for resources, responsible for low mungbean yield.

CONCLUSION

From the two season field investigation of weed-crop competition periods in mungbean, it was concluded that weeds pose a great threat to successful mungbean production. Uncontrolled weeds can cause 52 and 56 percent reduction in mungbean yield during spring and summer season respectively. Whereas, if weeds are competing with mungbean for 15 days, yield reduction percentage would be 7 and 9 percent during spring and summer season respectively and there is a gradual increase in yield reduction percentage if weeds are allowed to compete for 30, 45 and 60 days after sowing. So, weeds should be timely controlled to avoid losses in grain yield.

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