

Yield of Mungbean as Affected by Different Durations of Weed Competition under High Phosphorus Status

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ABSTRACT

A field experiment was conducted to determine the competitive behaviour of weeds at different levels of phosphorus, on the growth and yield of mungbean. Number of pods per plant, number of grains per pod, 1000-grain weight and grain yield of mungbean was found to be significantly higher with application of phosphorus. The application of phosphorus beyond 50 kg ha⁻¹ was not economical. Increase in weed competition duration decreased the number of pods per plant, number of grains per pod, 1000-grain weight and grain yield. Increase in grain yield was up to 44.95% over weedy plots. The effect of varying weed competition durations appeared to be more pronounced particularly where phosphorus was not applied and weed-crop competition was for longer duration.

Key Words: Mungbean; Phosphorus; Duration of weed competition

INTRODUCTION

Mungbean (*Vigna radiata* L. Wilczek) is a drought tolerant, short duration, early maturing legume crop, which can fit well in cropping system. It is grown in Pakistan on 197.6 thousand hectares with the production of 91.2 thousand tonnes of grain annually giving an average yield of 461.5 kg ha⁻¹ (Anonymous, 1998) which is below the potential of our existing varieties. It is estimated that annual losses caused by weeds may be more than 10 billion rupees in Pakistan (Ahmad, 1992). It is neither possible nor necessary to keep the crop free of weeds throughout its life. It is therefore, necessary to find out the critical period of weed crop competition, where there is a dire need of weed control. Such a span of critical period varies with the ecological relationship in weed-crop competition. An experiment was, therefore, conducted to determine the competitive behavior of weeds at different levels of phosphorus, on the yield of mungbean.

MATERIALS AND METHODS

Studies on yield response of mungbean to different durations of weed competition under high phosphorus status were carried out at the Agronomic Research Area, University of Agriculture, Faisalabad during spring 1992 and 1993. The soil of the field was sandy clay loam having an average 0.040 and 0.038% N, 7.10 and 7.15 ppm P₂O₅ and 151 and 158 ppm K₂O in 1992 and 1993, respectively. The experiment was conducted on a field heavily infested with weed flora comprising *Amaranthus*

viridis L. (Amaranth), *Chenopodium album* L. (Goosefoot), *Convolvulus arvensis* L. (bindweed), *Cynodon dactylon* (Bermuda grass), *Cyperus rotundus* L. (Purple nutsedge), *Heliotropium europium* L. (Heliotrope), *Melilotus indica* L. (Sweet clover), *Rumex dentatus* L. (Broad leaved dock). The experiment was conducted in split-plot design having four replications and net plot measuring 1.8 x 6 m. A recommended mungbean variety, 'NM-54' was sown in rows 30 cm apart, comprising six mungbean rows. The phosphorus rates were randomized in the main plots and different durations of weed competition were placed in subplots. The detail of the treatments is given below: phosphorus levels included control (0); conventional level (50 kg ha⁻¹); high phosphorus level (75 kg ha⁻¹) and weed crop competition treatments comprised: weed-free control; weed competition up to 20 days after emergence; then weed-free, weed competition up to 40 days after emergence; then weed-free and weed competition throughout growing season (weedy check).

Phosphorus was applied at the time of sowing in the form of single super phosphate. A starter dose of nitrogen @23 kg ha⁻¹ was applied in the form of urea at the time of sowing. All other cultural practices were uniform. The weed-free period was maintained by two hoeings with "kasola" and hand pulling. Observations were made on number of pods per plant, number of grains per pod, 1000-grain weight (g) and grain yield (kg ha⁻¹) during the course of experiment. All the data collected were analysed statistically by using analysis of variance technique and multiple comparison was made where necessary to test the significance of treatment means (Muhammad, 1995).

RESULTS AND DISCUSSION

Table I shows that there was significant increase in number of pods per plant with an increase in each level of phosphorus over control in both the years. Maximum 25.99 pods were produced in plots where 75 kg ha⁻¹ was applied against 18.08 pods in control or zero level of phosphorus in 1992. During 1993, similar kind of results were recorded for the number of pods per plant. The effect of weed competition on number of pods per plant was also significant in both the years. In 1992, the highest number of pods per plant (25.22) was recorded in weed-free control plots which was statistically equal to plots with weed-crop competition up to 20 DAE. There was gradual decrease in number of pods per plant

in plots kept weedy throughout growing season, which was at par with plot having weed competition up to 40 DAE. Identical results were observed in 1993. Phosphorus fertilizer and duration of weed competition interaction was significant in 1992 and 1993. The highest number of grains per pod was recorded in weed-free plots fertilized at the rate of 75 kg P₂O₅ ha⁻¹ which was at par with means recorded in plots where weed competition was allowed up to 20 DAE at same level of phosphorus fertilizer. Plots of weed-free and weed competition with mungbean up to 20 DAE under phosphorus level of 50 kg ha⁻¹ during both the years, with the exception of weed-free plots at control, also produced number of grains per pod at par with above interactions during 1993. Weedy plots throughout

Table I. Response of mungbean to different durations of weed competition

Treatments	Pods per plant		Grains per pod		1000-grain wt. (g)	
	1992	1993	1992	1993	1992	1993
Control	18.08 c	20.98 b	7.24 b	8.67 NS.	48.97 b	50.05 b
Conventional level	22.66 b	24.05 ab	8.80 ab	9.85	53.17 b	54.73 a
High phosphorus level	25.99 a	26.89 a	9.69 a	10.31	58.65 a	57.75 a
Weed-free control	25.22 a	26.60 a	10.11 a	11.19 a	59.05 a	60.04 a
Weed competition up to 20 DAE; then weed-free	24.04 ab	25.58 ab	9.59 a	10.75 a	59.04 a	59.49 a
Weed competition up to 40 DAE; then weed-free	20.88 bc	22.71 bc	7.69 b	8.32 b	49.87 b	49.48 b
Weed competition throughout growing season	18.84 c	21.00 c	6.92 b	8.18 b	46.42 c	47.70 b

Means not sharing a letter in common differ significantly at 0.05 probability; DAE = Day after emergence; NS. Non-significant

with increase in duration of weed competition. Minimum 18.84 pods were produced where weeds were allowed to compete throughout growth period. Identical trend was observed in 1993. Phosphorus fertilizer interaction with duration of weed competition was significant during both the years.

The data presented in Table I indicate that phosphorus application had a significant effect on the number of grains per pod. In 1992, the highest number of grains per pod was recorded where phosphorus was applied at the rate of 75 kg ha⁻¹, followed by 50 kg P₂O₅ ha⁻¹, while control plots produced significantly lower number of grains per pod. In 1993, the treatment receiving 75 kg P₂O₅ ha⁻¹ produced higher number of grains per pod than the rest of the treatments, but by contrast it was at par with other treatments. Regarding duration of weed competition, there was progressive decrease in grain number per pod with successive increase in duration of weed-crop competition in both the years. During 1992, statistically equal number of grains per pod was recorded in the case of weed-free and plots having weed competition up to 20 DAE. However, the lowest number of grains per pod (6.92) was recorded

growing season produced minimum number of grains per pod under control (zero level of phosphorus), in both the years.

Statistical means recorded for 1000-grain weight given in Table I reveal that the effect of phosphorus was significant. In 1992, phosphorus application at the rate of 75 kg ha⁻¹ produced the heaviest grains followed by 50 and 0 kg P₂O₅ ha⁻¹ which were at par with each other. By contrast in 1993, 75 and 50 kg P₂O₅ ha⁻¹ treatments increased 1000-grain weight significantly over control but the differences within the phosphorus levels were found to be non-significant. There was a linear and progressive decrease in grain weight with successive increase in duration of weed competition from weed-free and weed competition up to 20 DAE to weedy throughout growing season (weedy check). Weed-free plots and competition upto 20 DAE gave the highest 1000-grain weight (59.05 and 59.04 g) compared with the lowest (46.42 g) from weedy check. The data for 1993 indicate almost the same trend. The phosphorus application and duration of weed competition interaction was significant in both the years.

Table II. Yield of mungbean as affected by different durations of weed competition

Treatments	Grain Yield (kg ha ⁻¹)			
	1992	% increase over control	1993	% increase over control
Control	1169 b	-	1181 b	-
Conventional level	1202 a	2.82	1218 a	3.13
High phosphorus level	1220 a	4.36	1238 a	4.83
Weed-free control	1393 a	44.95	1407 a	44.46
Weed competition up to 20 DAE; then weed-free	1375 a	43.08	1390 a	42.71
Weed competition up to 40 DAE; then weed-free	1059 b	10.20	1077 b	10.57
Weed competition throughout growing season	961 c	-	974 c	-

Means not sharing a letter in common differ significantly at 0.05 probability; DAE = Day after emergence

Data on grain yield presented in Table II show that phosphorus application had significant effect on grain yield in both the years. Plots fertilized at the rate of 75 kg P₂O₅ ha⁻¹ gave the highest grain yield of 1220 kg ha⁻¹ which was statistically equal to plots receiving 50 kg P₂O₅ ha⁻¹ (1202 kg). Both levels of phosphorus produced significantly higher grain yield than control. This indicates that increasing phosphorus application beyond 50 kg ha⁻¹ is of no use for the mungbean. Sharma and Singh (1993) got maximum grain yield of *Vigna radiata* with the application of 50 kg P₂O₅ ha⁻¹. Further increase in phosphorus rates gave no additional benefit.

Weed competition duration had a significant effect on final grain yield per hectare in both the years. In 1992, the weed-free plots gave the highest grain yield of 1393 kg ha⁻¹ followed by competition 20 DAE with 1375 kg ha⁻¹ which was 44.95 and 43.08% higher than weedy check throughout growing season. The treatments where weeds were allowed to grow throughout growing season decreased the grain yield to 961 kg ha⁻¹. Similar trend was observed during 1993. The results further led to the conclusion that weed competition with crop up to 20 DAE did not interfere in the growth and development of mungbean to a significant extent, while extended competition duration had an adverse effect on yield potential of mungbean. Results of this study conform the findings of Musa *et al.* (1996).

The interaction of the both factors, phosphorus levels and duration of weed competition was significant

in both the years. It is evident from Table II that yield reduction, as a result of weed competition, was more severe in unfertilized plots. This indicates that under poor nutrition, the competitive ability of weeds was higher and more pronounced. However, weed interference was reduced considerably at 50 kg P₂O₅ ha⁻¹. Higher level of phosphorus (75 kg P₂O₅ ha⁻¹) could not improve competitive ability of mungbean further to be significant than conventional level, it is also indicated that grain yield of mungbean was dependent on different duration of weed competition even under high phosphorus status.

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