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Production Potential of Mash Bean Genotypes in Response to Phosphorus Application

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ABSTRACT

The effect of various phosphorus levels *viz.*, 0, 30, 60, and 90 kg P_2O_5 ha^{-1} on the yield and quality of two mash bean genotypes namely 6065-5 and Mash-97 was studied at the University of Agriculture, Faisalabad, during 1999. Significant differences for plant height, number of pods and seed yield were observed between the genotypes. The genotype 6065-5 produced significantly higher seed yield (1479.25 kg ha^{-1}) than Mash-97 (1343.83 kg ha^{-1}). A non-significant yield increase was recorded for P_2O_5 application beyond 60 kg ha^{-1}. It is concluded that the genotype 6065-5 should be fertilized @ 60 kg P_2O_5 ha^{-1} for getting higher yield of mash bean under Faisalabad conditions.

Key Words: Mash bean; Phosphorus; Production potential

INTRODUCTION

Mash bean is an important pulse crop that can be grown twice in a year i.e. during spring and autumn. Its seed contain 24% protein and 50% carbohydrates. Mash bean is grown on an area of 43.4 thousand hectares with annual production of 23.7 thousand tonnes and an average yield of 547 kg ha^{-1} (Anonymous, 2000). Its yield in Pakistan is far below than the potential yield. The main reason of this low yield is poor nutrient management especially inadequate use of phosphorus fertilizer. Phosphorus fertilizer favours root development, reproductive growth and fastens maturity. Singh and Tripathi (1992) reported that application of 40 to 60 kg P_2O_5 ha^{-1}increased the seed yield of mash bean up to 916 kg ha^{-1}. Application of 30 and 60 kg P_2O_5 ha^{-1} increased the seed yield of mash bean by 27 and 30%, respectively (Jaggi & Sharma, 1992). Singh and Sudhakar (1991) stated that seed yield of 1.32, 1.49 and 1.66 t ha^{-1} was obtained at 0, 20 and 40 kg P_2O_5 ha^{-1}, respectively. Maqsood *et al.* (2001) reported that two mash bean genotypes differed significantly for yield and all yield components except grains per plant. They further reported that the maximum seed yield 1832 kg ha^{-1} was recorded with 75 kg P_2O_5 ha^{-1}.

MATERIALS AND METHODS

The studies were undertaken at the Agronomic Research Area, University of Agriculture, Faisalabad, during the year 1999. The experiment was laid out in randomised complete block design with split plot arrangement having three replications and a net plot size of 1.6 x 5.0 m. Treatments comprised of phosphorus levels of 0, 30, 60 and 90 kg P_2O_5 ha^{-1}, and two varieties namely; 6065-5 and Mash-97. Varieties and phosphorus levels were randomised in the main and sub plots, respectively. Nitrogen @ 25 kg ha^{-1} and phosphorus as per treatment were side drilled at sowing using single row hand drill in the form of urea and single super phosphate, respectively. All other agronomic practices were kept normal and uniform for all the treatments. Observations were recorded on yield and yield components during the course of studies following the standard procedure. Total nitrogen of the seeds was determined by digestion using Gunning and Hibbard method and then by distillation using Micro Kjeldhal's apparatus (Jackson, 1962). The protein contents were calculated by multiplying total nitrogen with a constant factor of 6.25. The data obtained were analysed using Fisher's analysis of variance technique and treatment means were compared with least significance difference test (LSD) at 5 % probability level (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

Data on different yield components and yield are presented in the Table I and are discussed as under.

Plant height (cm). Mash bean genotypes differed significantly from each other in plant height and 6065-5 genotype produced significantly taller plants (31.58 cm) than Mash-97 (26.04 cm). The variation in plant height can be attributed to difference in the genetic makeup of the genotypes. Various phosphorus fertilizer levels did not show significant effect on plant height. Plant height varied from 24.7 to 34.20 cm. Maqsood *et al.* (2001) has also reported a non-significant effect of phosphorus levels on plant height of mash bean.

Number of pods plant^{-1}. Statistically similar number of pods per plant were recorded for both the varieties under study. Addition of P_2O_5 increased the number of pods per plant over control. P_2O_5 @ 60 and 90 kg ha^{-1} produced statistically similar number of pods per plant. However, P_2O_5 @ 30 kg ha^{-1} resulted in lower number of pods per plant (15.12).

Table I. Effect of various levels of phosphorus on growth, yield and quality of mash bean genotypes

	Plant Height	No. of pods plant^{-1}	No. of seeds pod^{-1}	1000-seed weight (g)	Seed yield (kg ha^{-1})	Protein contents
Genotypes						
6065-5	31.58 a	16.28 ^{NS}	5.00 a	49.56 ^{NS}	1497.25 a	25.13 ^{NS}
Mash-97	26.40 b	15.32	4.69 b	48.65	1343.83 b	25.47
LSD α 0.05	4.99	-	0.25	-	125.00	-
Phosphorus (kg ha^{-1})						
0	31.06 ^{NS}	13.40 b	4.03 b	47.64 c	1012.00 b	25.03 ^{NS}
30	28.19	15.12 b	4.95 a	48.46 bc	1434.67 b	25.27
60	28.86	17.10 a	5.18 a	49.83 ab	1587.50 a	25.18
90	28.18	17.58 a	5.20 a	50.50 a	1648.00 a	25.70
LSD α 0.05	-	1.83	0.34	1.39	84.04	-
G x P Interaction		Non-significant				

Number of seeds pod^{-1}. Genotype 6065-5 produced greater number of seeds pod^{-1} (5.00) than Mash-97 (4.69). However, Maqsood *et al.* (2001) reported non-significant differences among genotypes of mash bean for number of seeds pod^{-1}.

Phosphorus application significantly increased the number of seed per pod over control. However, non-significant differences were recorded for all the P_2O_5 levels. Reddy *et al.* (1990) and Maqsood *et al.* (2001) have also reported increase in number of seeds per pod due to P_2O_5 application.

1000-Seed weight. Both the genotypes exhibited statistically similar 1000-seed weight. P_2O_5 @ 30 kg ha^{-1} gave a low 1000-seed weight (48.46 g) as control (47.64). However, further increase in P_2O_5 level brought a significant increase in 1000-seed weight. Similarly P_2O_5 @ 60 and 90 kg ha^{-1}produced statistically similar 1000-seed weight of 49.83 and 50.50 g, respectively. Reddy *et al.* (1990) have also reported a significant effect of phosphorus application on 1000-seed weight of mash bean. The interaction between genotypes and phosphorus levels was found to be non-significant.

Seed yield (kg ha^{-1}). Genotype 6065-5 produced significantly higher seed yield (1497.25 kg ha^{-1}) than Mash-97 (1343.83 kg ha^{-1}). P_2O_5 @ 30 kg ha^{-1}gave seed yield (1434.67 kg ha^{-1}) that was statistically similar to control (1012.00 kg ha^{-1}). Application of 60 and 90 kg ha^{-1} resulted in statistically similar seed yield of 1587.50 and 1648.00 kg ha^{-1}, respectively. The differences in seed yield can be attributed to variable number of pods plant^{-1}, number of seeds pod^{-1} and 1000-seed weight. Similar results have also been reported by Rao *et al.* (1993) and Maqsood *et al.* (2001). The interaction between genotypes and phosphorus levels was found to be non-significant.

Protein contents. Both genotypes exhibited similar protein contents. The protein contents, however, varied from 25.03 to 25.70% for different phosphorus levels which were statistically non-significant. These results are in contrast with Shard *et al.* (1991) who reported significant effect of phosphorus on protein contents. The differences in results can be attributed to variation of genetic makeup.

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