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Impact of Different Levels of Phosphorus on Growth and Yield of Mungbean Genotypes

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Abstract: Response of ten mungbean genotypes 98-CMG-003, 98-CMG-016, 98-CMG-018, L1/P5/89, NM-1, BRM-195, BRM-202, M-1, M-6 and NM-92 to three phosphorus level viz. 30, 60 and 90 kg ha^{-1} was studied under field conditions during kharif 2001. The genotype BRM-202 gave significantly highest grain yield of all other genotypes due to higher leaf area index. Various levels of phosphorus significantly affected the number of plants m^{-2}, number of pods $plant^{-1}$, plant height, number of grains pod^{-1}, 1000 grain weight, grain yield, total biomass and leaf area index. phosphorus level of 90 kg ha^{-1} produced the maximum grain yield.

Key words: Mungbean, genotypes, phosphorus levels, growth , yield components, Pakistan

Introduction

Mungbean (*Vigna radiata* L.) is an important pulse crop in many Asian countries including Pakistan. Its seed contains 24.7% protein, 0.6% fat, 0.9%fiber and 3.7% ash (Potter and Hotchkiss, 1997). In vitro protein digestibility of genotypes of mungbean ranged from 67.2 to 72.2%, which is greater than urd bean and soybean (Chitra *et al.*, 1995).

In Pakistan, mungbean is grown on area of 219.2 thousand ha.with total production of 104.5 thousand tonnes making an average of 477 kg ha^{-1} (Anonymous, 2002). This average yield is much lower than most of leading countries of world.

The use of fertilizer is considered to be one of the most important factor to increase crop yield on per unit basis. The application of phosphorus to mungbean has been reported to increase dry matter at harvest, number of pods $plant^{-1}$, seeds pod^{-1} , 1000 grain weight, seed yield and total biomass (Mitra *et al.,* 1999).

Borah (1997) found that best cultivars in terms of seed yield were AAU-39 and ML-131. Mimber (1995) reported that cultivar walet has given higher yield than small seeded local cultivar. Lateef *et al.* (1998) found that mungbean genotypes varied in yield as response to phosphorus application and mungbean genotypes i.e. Kawmy-1, V-2010, VC-2719, M-57 and T-44 differed significantly for plant height and number of branches $plant^{-1}$ and observed greatest number of pods in cultivars M-53 and Kawmy-1.

Present experiment was conducted to study the impact of phosphorus application on different genotypes of mungbean and to find out the best combination of phosphorus and genotype suited to agro-ecological conditions of Multan.

Materials and Methods

The study was conducted at the experimental farm of University College of Agriculture, Bahauddin Zakariya University , Multan during kharif 2001 .The experiment was laid out in a randomized compete block design (RCBD) in factorial fashion with three replications, having a net plot size of 4x1.2 m.

The factors studied were genotypes and levels of phosphorus fertilizer on the yield of mungbean. Response of ten genotypes 98-CMG-003, 98-CMG-016, 98-CMG-018, L1/P5/5/89, NM-1, BRM-195, BRM-202, M-1, M-6 and NM-92 to three levels of phosphorus at the rate of 30, 60 and kg ha^{-1} were observed. The seed was drilled on a well-prepared seedbed with a single row hand drill. Rows were kept 30 cm apart. Recommended dose of nitrogen at the rate of 20 kg ha^{-1} was applied equally to all treatments. Whole quantity of P_2O_5 and nitrogen was side drilled at sowing time. All other agronomic practices were kept normal and uniform for all the treatments. Growth and yield parameters studied were number of plants m^{-2}, number of branches $plant^{-1}$, number of pods $plant^{-1}$; number of grains pod^{-1} plant height (cm), leaf area index, 1000 grain weight (g), grain yield (kg ha^{-1}), total biomass (kg ha^{-1}) and harvest index (%). Standard procedures were adopted for recording data on various growth and yield parameters. Data collected was analyzed statistically using Fisher's analysis of variance technique and Least Significant Difference test at 0.05 probability level was employed to compare the differences among the treatments means (Steel and Torrie, 1984).

Results and Discussion

Various genotypes were significantly different as regard the number of plants m^{-2} (Table1). Maximum number of

Table 1: Impact of different levels of phosphorus on growth and yield of mungbean genotypes

Treatments Genotypes	No. of plants m^{-2}	No. of branches $plant^{-1}$	No. of pods $plant^{-1}$	Leaf area index	Plant height (cm)	No. of grains pod^{-1}	1000 grain weight (g)	Grain yield (kg ha^{-1})	Total biomass (kg ha^{-1})	Harvest index (%)
98-CMG-003	7.56^{e}	7.89^{fg}	8.00^{de}	25.77^{g}	13.22^{e}	12.67^{a}	64.89^{a}	146.29^{d}	689.47^{d}	20.88
98-CMG-016	9.89^{de}	10.44^{cde}	11.00^{b}	41.55^{def}	25.44^{abc}	5.87^{e}	56.89^{b}	196.44^{cd}	1799.79^{ab}	19.52
98-CMG-018	13.89^{bc}	18.00^{a}	10.56^{bc}	32.96^{fg}	23.33^{bcd}	9.00^{c}	31.89^{h}	278.95^{b}	1407.0^{abcd}	19.77
LI/P5/589	10.22^{de}	8.00^{efg}	19.44^{a}	47.51^{cde}	28.78^{ab}	12.22^{a}	45.67^{e}	195.98^{cd}	985.23^{cd}	20.04
NM-1	21.44^{a}	12.44^{bc}	9.33^{cd}	66.13^{ab}	29.22^{ab}	6.78^{d}	46.22^{e}	400.52^{a}	2011.26^{a}	19.94
BRM-195	15.00^{b}	11.00^{bcd}	7.44^{e}	50.77^{cd}	18.89^{cde}	6.33^{de}	53.89^{c}	301.15^{b}	1512.39^{abc}	19.88
BRM-202	20.67^{a}	9.67^{def}	11.33^{b}	73.25^{a}	16.89^{de}	10.89^{b}	37.56^{g}	426.17^{a}	2147.25^{a}	19.87
M-1	19.33^{a}	10.44^{cde}	10.44^{bc}	59.94^{bc}	30.11^{a}	9.00^{c}	39.11^{f}	421.33^{a}	2113.00^{a}	19.93
M-6	11.56^{cd}	13.00^{b}	6.89^{e}	37.16^{efg}	21.44^{cd}	11.11^{b}	51.11^{d}	241.74^{bc}	1212.62^{bcd}	19.67
NM-92	11.89^{bcd}	6.11^{g}	11.11^{b}	48.71^{cde}	32.00^{a}	5.78^{e}	51.44^{d}	235.96^{bc}	1185.37^{bcd}	19.87
Phosphorus levels (kg ha^{-1})										
30	9.90^{c}	10.00	9.80^{b}	34.35^{c}	19.33^{b}	8.43^{c}	46.63^{c}	192.47^{c}	970.06^{b}	19.87
60	14.27^{b}	10.80	10.20^{b}	51.36^{b}	22.83^{b}	8.83^{b}	47.83^{b}	277.96^{b}	1639.98^{a}	19.83
90	18.27^{a}	11.30	11.67^{a}	59.41^{a}	29.63^{a}	9.60^{a}	49.13^{a}	382.93^{a}	1908.97^{a}	20.10
Interaction	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Means sharing same letters are statistically non-significant at 5% probability level; NS=Non-significant

plants m^{-2} were observed in genotype NM-1 (21.44), which was statistically at par with that of BRM-202 (20.67) whereas the minimum number of plants m^{-2} (7.56) were found in genotype 98-CMG-003. Various levels of phosphorus fertilizer significantly increased the number of plants m^{-2}, being maximum (18.27) at 90 kg ha^{-1} and minimum (9.90) at 30 kg ha^{-1} (Table1). Interaction between genotypes and phosphorus levels remained non-significant.

All the genotypes produced statistically different number of branches $plant^{-1}$. Maximum number of branches $plant^{-1}$ (18.00) were produced by the genotype 98-CMG-018 and minimum number of branches $plant^{-1}$ (6.11) were observed in genotype NM-92. These results are line with those of Lateef *et al.* (1998). The number of branches $plant^{-1}$ were not influenced significantly by the application of different levels of phosphorus (Table 1). Interaction between genotypes and phosphorus fertilizer levels was found to be non- significant.

Different genotypes affected significantly the number of pods $plant^{-1}$. Maximum number of pods $plant^{-1}$ (19.44) were observed in the genotype L1/P5/5/89 and minimum number of pods $plant^{-1}$ (6.89) were obtained in case of genotype M-6. These results are in agreement with those of Lateef *et al.* (1998). Various levels of phosphorus significantly increased the number of pods $plant^{-1}$ (Table 1). The maximum number of pods $plant^{-1}$ (11.67) were produced by application of 90 kg P_2O_5 ha^{-1} while the minimum (9.80) were given by supplying mungbean genotypes with 30 kg P_2O_5 ha^{-1}. Significant effect of application of phosphorus fertilizer levels on number of pods $plant^{-1}$ had also been reported by Mitra *et al.* (1999). The interaction between genotypes and phosphorus fertilizer levels was not significant.

All the genotypes varied significantly as regards the leaf area index. Maximum leaf area index (73.25) was observed in case of BRM-202 whereas the minimum leaf area index (25.77) was obtained in genotype 98-CMG-003. Various levels of phosphorus significantly increased the leaf area index, being maximum (59.41) at 90kg ha^{-1} and minimum (34.35) at 30 kg ha^{-1}. The interaction between factors under study was non-significant (Table 1).

Various genotypes influenced significantly the plant height. The genotype NM-92 achieved maximum plant height (32cm) but it was statistically at par with that of M-1 (30.11cm). The minimum plant height (13.22cm) was observed in case of 98-CMG-003. These results are in conformation with those of Lateef *et al.* (1998). Different levels of phosphorus significantly enhanced the plant height. The maximum plant height (29.63cm) was produced by application of 90 kg P_2O_5 ha^{-1} while the minimum (19.33 cm) was obtained by treating mungbean genotypes with 30 kg P_2O_5 ha^{-1}. Interaction between genotypes and phosphorus levels was not significant (Table 1).

All the genotypes were significantly different with regard to the number of grains pod^{-1} Maximum number of grains pod^{-1} (12.67) were observed in the genotype 98-CMG-003 which was statistically at par with that of L1/P5/5/89 (12.22). The minimum numbers of grains pod^{-1} (5.78) were obtained in case of NM-92. Various levels of phosphorus significantly influenced the number of grains pod^{-1} . The maximum number of grains pod^{-1} (9.60) were achieved by applying 90 kg P_2O_5 ha^{-1} whereas the minimum (8.43) were obtained in case of application level of 30 kg P_2O_5 ha^{-1} (Table 1). These results are similar to those of Mitra *et al.* (1999). The interaction between genotypes and phosphorus levels was not significant.

Different genotypes varied significantly with regard to 1000-grain weight. Maximum 1000-grain (64.89g) was observed in genotype 98-CMG-003. While the minimum 1000-grain weight (31.89g) was found in the genotype 98-CMG-018. Various levels of phosphorus significantly influenced the 1000-grain weight, being maximum (49.13g) at 90 kg ha^{-1} and minimum (46.63g) at 30kg ha^{-1} (Table1). Significant effect of Phosphorus application on 1000 grain weight had also been reported by Mitra *et al.* (1999).The interaction between factors under study was non-significant.

Various genotypes were significantly different as regards the grain yield. The maximum grain yield (426.17 ha^{-1}) was produced by the genotype BRM-202 but it was statistically at par with that of M-1 (421.33 kg ha^{-1}). The maximum grain yield of genotype BRM-202 was due to higher leaf area index which resulted in greater interception of solar radiation by foliage leading to greater production of photosynthates and ultimately the maximum grain yield per unit of land (Table 1). Mimber (1995) and Borah (1997) had also reported significant differences among the genotypes for grain yield. Various levels of phosphorus significantly enhanced the grain yield. The maximum grain yield (382.93kg ha^{-1}) was produced by application of 90kg P_2O_5 ha^{-1} whereas the minimum grain yield (192.47kg ha^{-1}) was obtained by fertilizing mungbean with 30 kg P_2O_5 ha^{-1}. The application of 90 kg ha^{-1} had resulted in a significant increase in number of plants m^{-2}, number pods $plant^{-1}$, 1000-grain weight, number of grain pod^{-1} and ultimately the maximum grain yield. These results are in conformation with those of Lateef *et al.* (1998). The interaction between the genotypes and phosphorus levels was found to be non-significant.

All the genotypes varied significantly with regard to total biomass. The maximum biological yield (2147.25 kg ha^{-1}) was observed in genotype BRM-202 which was statistically at par with that of M-1 and NM-1.The minimum biological yield (689.47 kg ha^{-1}) was produced by the genotype 98-CMG-003.All the levels of phosphorus significantly influenced the total biomass, being maximum (1908.97 kg ha^{-1}) at application level of 90 kg P_2O_5 ha^{-1} and minimum (970.06 kg ha^{-1})at application rate of 30 kg P_2O_5 ha^{-1} (Table 1). These results are in line with those of Mitra *et al.* (1999) who had also reported significant effect of phosphorus applications regarding total biomass. Interaction between genotypes and phosphorus levels was revealed to be non-signicicant.

Non-significant differences were observed among genotypes and phosphorus levels with regards to harvest index (%). Interaction between factors under study was also non-significant (Table 1).

It is concluded that the cultivars BRM-202 and M-1 can be preferred over other cultivars due to higher yield and it should be fertilized at the rate of 90kg P_2O_5 ha^{-1}.

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