

RESPONSE OF MUNGBEAN (*VIGNA RADIATA*) TO PHOSPHATIC FERTILIZER UNDER ARID CLIMATE

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ABSTRACT

Phosphatic fertilizer has a great importance for Mungbean. It not only increases the yield and yield components of the crop but also improve the quality of the proroduce. A Field experiments were conducted under Adaptive Research Station, to evaluate the influence of three levels of phosphatic fertilizer on mung at Mianwali for two consecutive kharif seasons i.e. 2007 and 2008. The experiment comprised of four treatments viz, control, Phosphatic fertilizer @ 30 Kg ha⁻¹ with started dose of nitrogen, Phosphatic fertilizer @ 57 Kg ha⁻¹ and Phosphatic fertilizer @ 84 Kg ha⁻¹. Experiments were laid in randomized complete block design with three replications. The results revealed that all the levels of phosphatic fertilizer showed significant impact on mung compared to that of control plots, However, treatment of Phosphatic fertilizer @ 84 Kg ha⁻¹ out yielded rest of the treatments giving the maximum yield components and grain yield during both years.

Key words: Mungbean (*Vigna radiata*), phosphatic fertilizer, arid, gain yield, Pakistan.

INTRODUCTION

According to the nutritionists, pulses are an excellent source of dietary proteins and can play an important role in fulfilling requirements of rapidly increasing population. Mungbean is an important pulse crop that can be grown twice a year i.e. in spring and autumn. Among the grain legumes, it is one of the important conventional pulse crops of Pakistan. It ranks second to chickpea (*Cicer arietinum*) amongst grain legumes from production point of view. Its seed is more palatable, nutritive, digestible and non-flatulent than other pulses grown in country. It contains 24.7% protein, 0.6% fat, 0.9% fiber and 3.7% ash (Potter and Hotchkiss, 1997). Besides being a rich source of protein, it maintains soil fertility through biological nitrogen fixation in soil and thus plays a vital role in furthering sustainable agriculture (Kannaiyan, 1999). In Pakistan, during 2008-09, Mungbean was grown on an area of 231.1 thousand hectares with total production of 157.4 thousand tons which was -11.9 % less than previous year. (Anonymous, 2009). It is a short duration crop therefore has less water requirement as compared to summer crops. Moreover, it is drought resistant that can withstand adverse environmental conditions, and hence successfully be grown in rain fed areas (Anjum *et al.*, 2006).

Growth and development of crops depend largely on the development of root system. Phosphorus (P) is one of the three macronutrients that plants must obtain from the soil. It is a major component of

compounds whose functions relate to growth, root development, flowering, and ripening (Raboy, 2003). Most of the soils throughout the world are P deficient (Batjes, 1997), soils of Pakistan are generally alkaline in reaction and calcareous in nature. These types of soils usually contain traces of available micronutrients and macronutrients Moreover, with the introduction of high yielding varieties, increased cropping intensity and heavy applications of N and P fertilizers, the deficiency of some macronutrient have occurred in the country. The beneficial effects on the yield of different crops have been noticed from the soil application of the deficient macronutrient (Khan *et al.*, 2004), and the poor performance of fertilizer phosphorus is one of the major causes depressing the productivity of the crops. Hence, the effect of phosphorus on root development is well established (Hossain and Hamid, 2007). Addition of N and P fertilizer enhances root development, which improves the supply of other nutrients and water to the growing parts of the plants, resulting in an increased photosynthetic area and thereby more dry matter accumulation. The application of phosphorus to Mungbean has been reported to increase dry matter at harvest, number of pods per plant, seed per pod, 1000 grain weight, seed yield and total biomass (Mitra *et al.*, 1999). Non-addition of P to Mungbean will ultimately decreasing the yield and quality of the crop. Phosphorus fertilization is, therefore, very essential for exploiting maximum yield potentials of different crop plants. As the degree of P fixation depends on the ratio of applied

phosphorus, fixation of broadcast P is much greater than the fertilizer applied in bands because of narrow soil to fertilizer ratio in the latter situation (Rashid and Din, 1993).

Farmers have a wrong notion that green gram, being legume crop does not need any nutrient and usually grow it on the marginal lands without applying any fertilizer. This seems to be an important reason for low productivity in the country. Contrary to above notion, Hussain (1983) concluded that application of phosphorus to legumes improves seed yield considerably. Similarly, Akhtar *et al.*, (1984) found increased number of branches, yield components and yield of green gram compared with treatments given no phosphorus. Increased straw yield, number of pods per plant, number of seeds per pod and 1000-grain weight has also been reported by Rathore *et al.*, (1992). Adequate amount of phosphorus in soils favours rapid plant growth, early fruiting / maturity and improves the quality of the produce, hence the experiment was design to evaluate the different levels of phosphorus to increase the grain yield of Mungbean.

MATERIALS AND METHODS

The trails were laid out under Adaptive Research Station Mianwali, to study the response of Mungbean to phosphatic fertilizer in arid areas. The experimental soil (0-15 cm depth) was analyzed for initial soil physicochemical properties. Soil texture was loam having the following characteristics: sand 40.70%, silt 37.30%, clay 20%, pH 8.1, Organic matter 0.85%, CaCO₃ 5.5%, EC 1.5 dSm⁻¹, available N 0.60 g Kg⁻¹, available P 8.5 mg Kg⁻¹, exchangeable K 125 mg Kg⁻¹, AB-DTPA extractable Zn 0.93 mg Kg⁻¹, AB-DTPA extractable Fe 2.95 mg Kg⁻¹ and AB-DTPA extractable Mn 1.15 mg Kg⁻¹. Mungbean was sown during Kharif season 2007 and 2008 with hand drill using seed rate 25 Kg ha⁻¹. The experiments comprised of four treatments in RCBD having three replications. The four treatments were T₁ (Control), T₂ (Phosphatic fertilizer @ 30 Kg ha⁻¹), T₃ (Phosphatic fertilizer @ 57 Kg ha⁻¹) and T₄ (Phosphatic fertilizer @ 84 Kg ha⁻¹), were applied with started dose of nitrogen. TSP was used as a source of phosphorus. Soil was well prepared with three ploughing and two planking before final layout. Previous crop was wheat where trials were laid out. All other agronomic practices i.e. thinning, hoeing, eradication of weeds and irrigation was kept same for all treatments. Mungbean variety AZRI-2006 was used as a test variety. The trial was laid out on 13-05-2007 at Rakh Khasoor and on 11-05-2008 at Chack No.67. The plot size was 7.5mx20m at both locations. First irrigation was applied approximately 40 days after sowing and others after fifteen days intervals. Three irrigations were applied to the crop. Plant protection measures were adopted after pest scouting of

insects, pests and diseases. Imidachloprid @ 625 ml ha⁻¹ was applied to control the attack of sucking insects.

The yield data were recorded by harvesting randomly selected 3m x 3m from each treatment on 18-08-2007 & 06-08-2008 respectively, whereas number of pods was recorded on the average of ten plants from each treatment. Year wise data was subjected to statistical analysis separately by using Analysis of Variance technique. The difference among treatment means was compared by using least significant difference test at 5% probability level (Steel *et al.*, 1997).

RESULTS AND DISCUSSION

The effects of P on the yield of Mungbean were found to be positive and significant. Grain yield of mung bean crop is a function of cumulative effect of various yield components, which are influenced by genetic make-up of variety, various agronomic practices and environmental conditions. The mean grain yields as influenced by various phosphatic levels during both years are presented in the table 1 & 11. All the levels of phosphatic fertilizer showed significant impact on mung crop compared to that in control plots, but the treatment of Phosphatic fertilizer @ 84 Kg ha⁻¹ out yielded rest of the treatments. The application of phosphatic fertilizer @ 84 Kg ha⁻¹ gave the maximum number of pods per plant, number of grains per pod and 1000- grain weight resulting ultimately maximum grain yields i.e 2626.67 & 1500.00 Kg ha⁻¹ during 2007 & 2008 at both locations, respectively.

Our results are in accordance with Bhuiyan *et al.*, (2008) who conducted an experiment on four levels of phosphorus (P) (0, 20, 40, 60 kgha⁻¹) and 2 levels of molybdenum (Mo) (1.0 and 1.5 kg ha⁻¹) having a common Rhizobium inoculant, one control with no Rhizobium or fertilization and a Rhizobium inoculation only were applied. Rhizobium inoculation along with P and Mo significantly increased the growth of plants, number of nodules, dry matter production as well as grain yield of Mungbean significantly compared to uninoculated control. Norman. (2006) also studied a factorial combination of three levels of nitrogen and three levels of phosphate fertilizer on Mung bean. Mung showed independent responses to phosphate. Mean phosphorus contents increased with increasing level of applied phosphate and decreasing level of applied nitrogen; the changes were largely independent between fertilizers and total phosphorus yield increased with increasing level of applied phosphate. Emsley. (2000) reported that phosphatic fertilization have increasing influence in relation to growth and yield. Higher yields of mung bean have been reported by application of phosphorous @ 90 kg ha⁻¹ under field conditions. (Lange *et al.*, 2007). Maqsood *et al.*, (2001) investigated the effect of phosphorus rates on the agronomic traits of two

mashbean genotypes (Mash-97 and Mash-88). The phosphorus rates were 0, 50, 75 and 100 kg P₂O₅ ha⁻¹. Phosphorus application @ 75 kg ha⁻¹ gave significantly the highest seed yield of 1832 kg ha⁻¹. Malik *et al.*, (2002) also studied the effect of seed inoculation and phosphorus

levels viz., 0, 30, 50, 90 and 110 kg ha⁻¹ on growth, seed yield and quality of Mungbean cv. NM-98. Maximal 1000-grain weight, grain yield and protein contents were obtained from the plots where inoculated seed was grown with phosphorus applied @ 50 kg ha⁻¹.

Table 1: Effect of different levels of phosphatic fertilizer on the yield of Mungbean during the year 2007

Treatment	Germination (m ²)	No. of branches plant ⁻¹	No. of pod plant ⁻¹	No. of grain pod ⁻¹	1000-grain wt. (gm)	Yield (Kg ha ⁻¹)
T1=(Control)	42.67 b	1.72 c	27.47 d	42.67 a	41.67 d	2033.32 c
T2=(Phosphatic fertilizer @ 30 Kg ha ⁻¹)	46.00 ab	2.20 b	30.72 c	46.00 a	45.00 c	2400.00 b
T3=(Phosphatic fertilizer @ 57 Kg ha ⁻¹)	41.00 b	2.50 ab	32.60 b	41.00 a	48.32 b	2516.67 ab
T4=(Phosphatic fertilizer @ 84 Kg ha ⁻¹)	45.00 a	2.72 a	34.92 a	45.00 a	51.67 a	2626.67 a

Mean sharing the same letter are not significantly different than each other.

Table 11: Effect of different levels of phosphatic fertilizer on the yield of Mungbean during the year 2008

Treatment	Germination (m ²)	No. of branches plant ⁻¹	No. of pod plant ⁻¹	No. of grain pod ⁻¹	1000-grain wt. (gm)	Yield (Kg ha ⁻¹)
T1=(Control)	59.00 a	1.27 c	19.10 d	7.40 c	31.67 d	916.67 d
T2=(Phosphatic fertilizer @ 30 Kg ha ⁻¹)	55.32 a	1.60 b	20.32 c	8.60 b	35.00 c	1183.32 c
T3=(Phosphatic fertilizer @ 57 Kg ha ⁻¹)	58.32 a	2.27 a	24.27 b	9.32 b	40.00 b	1416.67 b
T4=(Phosphatic fertilizer @ 84 Kg ha ⁻¹)	60.00 a	2.52 a	27.47 a	9.47 a	46.67 a	1500.00 a

Mean sharing the same letter are not significantly different than each other.

Conclusion: Based on the present findings it is recommended that application of phosphatic fertilizer @ 84 kg ha⁻¹ should be applied in Mung for higher seed yield under the agro-ecological conditions of arid area.

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