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Response of Mungbean Yield and Yield Components into Various Levels of Phosphorous

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Abstract

This study was aimed to help the farmers to decide the optimum dose of phosphorous fertilizer whether they can use the recommended dose for achieving higher yield of mungbean in agro climatic condition of Peshawar. Farmers need to know what fertilizer application rate they should use under their conditions for adequate productivity. To obtain these objectives an experiment was carried out at Agricultural Research Farm Agricultural University Peshawar during 2017. Five levels of P i.e. 0, 20, 40, 60 and 80 kg ha^{-1} on mung bean were studied in the experiment. Mungbean cultivar NM-92 was sown in the experiment. Phosphorus application was significant for all the parameters. Plots treated with 60 kg P ha^{-1} produced maximum nodules $plant^{-1}$ (25), pods $plant^{-1}$ (22), seeds pod^{-1} (11), 1000 grains weight (40.2 g), biological yield (4595 kg ha^{-1}), grain yield (1139 kg ha^{-1}) and harvest index (28.6 %) as compared with control plots but seeds pod^{-1}, 1000 grains weight, grain yield and harvest index was statistically at par when plots treated with 80 kg P ha^{-1}. Increased in fertilizer has increased these parameters up to some extent and a decreasing trend was observed beyond 40 kg ha^{-1} phosphorous application. Regarding yield 80% variations was accorded by the phosphorous application. Based on the above facts it is concluded that mungbean cultivar NM-92 applied with 60 kg P ha^{-1} was better in terms of yield and yield components and may be recommended for cultivation in agro-climatic condition of Peshawar.

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 (Vigna radiata L.) 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 [1]. It is highly prised for its rich protein contents 24% with excellent digestibility as compared with soybean [2]. 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 [3]. In Pakistan mungbean was grown on an area of 137.4 hectare with average production 76.2 tons per hectare during 2015. In Khyber Pakhtunkhwa the mungbean was grown on of 8.5 hectare with average yield 600 kg ha^{-1}[4]. 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 [5]. 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 [6].

Phosphorus (P) is an essential nutrient element for plant growth and development [7]. It is necessary for the formation and translocation of all intermediate end products. Also it plays a major role in stimulating early root growth, thus encourages P mineralization by plant as well as hastening plant maturity and improving good quality seed [8]. Mungbean is highly responsive to fertilizers and has a considerable response to phosphorus. Phosphorus (P) is frequently one of the most limiting nutrients for plant growth in the tropics, and it is estimated that over 50% of common bean production in tropical soils is limited by phosphate deficiency [9]. P is found in all living plant cell and resumes several key plant functions including energy transfer, photosynthesis, transformation of sugars and starches, nutrient movement within the plant [10]. The present study was therefore, undertaken to find out the optimum phosphorus levels required for obtaining high yield of mungbean under conditions prevailing in Peshawar.

Materials and Methods

The experiment entitled with Response of mungbean yield and yield components into various levels of phosphorous was carried out at New Developmental Farm of The University of Agriculture, Peshawar (34o 00' N, 71o 30' E, 510 MASL) Pakistan during summer 2017. The experiment was laid out in randomized complete block design and replicated thrice. five levels of phosphorus (0, 20, 40, 60 and 80 kg ha^{-1}) were used in experiment. Basal dose of Nitrogen was applied at 30 kg ha^{-1}

at the time of sowing. SSP and Urea were used as a source of phosphorous and Nitrogen. Mungbean cultivar NM-92 was sown in the experiment. Plot size of 3m x 3m with 10 rows, 30cm Row to row and 10cm plant to plant distance was maintained respectively. Seeds were sowed in the 2nd week of June at seed rate of 25 kg ha^{-1}. Agronomic practices were carried out uniformly for all the experimental units throughout the growing season. Nodules $plant^{-1}$ at the time of pod initiation was counted by uprooting five plants randomly in each subplot and then average was worked out. Number of pods $plant^{-1}$ was counted for ten plants selected randomly in each subplot. Seeds pod^{-1} was recorded by counting seed in ten capsules selected randomly in each sub plot. Four central rows in each sub plots were harvested, sun dried and threshed. Seed weight was taken with the help of electronic balance and then converted into kg ha^{-1} by the formula of grain and biological yield. All data collected were subjected to analysis of variance (ANOVA) with the help of statistical software, Statistix 8.1 USA [11]. Upon significant F-Test, least significance difference (LSD) test was used for mean comparison to identify the significant components of the treatment means.

Results and Discussion

Number of Nodules $Plant^{-1}$

Data presented in Table 1 showed that the different levels of phosphorus had significant effect on number of nodules $plant^{-1}$. Mean values of data indicated that plots treated with 60 kg P ha^{-1} produced maximum number of nodules $plant^{-1}$ (26), while minimum number of nodules $plant^{-1}$ (12) was recorded in control plots. Our results agree with [12] who reported that P application promotes early root formation and the formation of lateral fibrous and healthy roots, which had positive effect on nodules $plant^{-1}$.

Table 1: LSD (0.05) value of P for Pods $plant^{-1}$ = 0.61.

Yield and Yield Components of Mungbean as Affected by Various Phosphorous Levels			
Yield and Yield Components Parameters			
P Levels	Nodules	Pods	Seeds pod^{-1}
0	12	16	9
20	16	16	10
40	21	18	10
60	26	25	13
80	23	22	11
Mean	19.6	19.4	10.6

LSD (0.05) value of P for seeds pod^{-1} = 0.87.

LSD (0.05) value of P for Nodules $plant^{-1}$ = 0.63.

Number of Pods $Plant^{-1}$

Various Phosphorus levels on yield components of mungbean had significant effect on number of pods $plant^{-1}$. Mean values of data presenting in Table 1 showed that plots treated with 60 kg P ha^{-1} produced maximum number of pods $plant^{-1}$ (25), while minimum number of pods $plant^{-1}$ (16) were recorded in control plots. These results agree with [13] who reported that P induced significant increase in pods $plant^{-1}$ [14]. Who also reported that phosphorus up to 65 kg ha^{-1} significantly increase number of pod $plant^{-1}$.

Number of Seeds pod^{-1}

Statistical analysis of the data revealed that phosphorus levels had significant effect on number of grains pod^{-1}. Data presenting in Table 1 showed that Grains pod^{-1} was increased with increase in phosphorus levels. Mean value of the phosphorus level indicated that plot treated with 60 or 80 kg P ha^{-1} produced maximum grains pod^{-1}, while minimum grains pod^{-1} (9) were recorded in control plots. These results also in line with the results of [15] who reported that significant differences in number of grains pod^{-1} with various P levels.

Thousand Grains Weight (g)

Statistical analysis of the data showed that phosphorus levels had significant effect on thousands seed weight. Data showed in Table 2 revealed that Plots treated with 60 kg P ha^{-1} produced the heaviest grains (39.3 g) being at par with 80 kg P ha^{-1}, while lighter grains (33.4 g) was recoded in control plots which is at par with 20 kg P ha^{-1}. These results agree with the results of [16] who reported that increasing phosphorus application up to 65 kg ha^{-1} significantly increased the seed weight as compared with control plots.

Grain Yield (kg ha^{-1})

Grain yield of mungbean was significantly affected by different phosphorous levels. Data presenting in Table 2 shows Mean value of phosphorus levels indicated that plots treated with 60 kg P ha^{-1} produced maximum grain yield (1067 kg ha^{-1}) being at par with 80 kg P ha^{-1}, while minimum grain yield (645 kg ha^{-1}) was recorded in control plots. These results agree with those of [17] who reported increase of grain yield with increasing the phosphorous levels upto 65kg ha^{-1} further increase in P level slight decrease recorded in grain yield. The increase in grain yield might be due to phosphorus application was performed to more in number of branching, good fruiting, increased number of seeds pod^{-1} and heavier grains as a result grain yield increased as compared with control plots.

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Table 2: LSD (0.05) value of P for 1000 seed weight = 1.23.

Yield and Yield Components of Mungbean as Affected by Various Phosphorous Levels				
Yield and Yield Components Parameters				
P Levels	1000 GW	GY kg ha^{-1}	BY kg ha^{-1}	HI (%)
0	33.4	645	2513.45	22.9
20	35.2	734	2784.59	26.4
40	36.5	852	3094.24	25.3
60	39.3	1067	3682.51	29.5
80	37.4	974	3419.93	27.6
Mean	36.36	854.4	3098.944	26.34

LSD (0.05) value of P for Grain yield (kg ha^{-1}) = 29.16.

LSD (0.05) value of P for Biological yield (kg ha^{-1}) = 88.17.

LSD (0.05) value of P for Harvest index (%) = 0.98.

GW= Grain weight, GY= Grain Yield, BY= Biological yield, HI= Harvest index

Biological Yield

Biological yield data of mungbean as affected phosphorous application rate are given in Table 2. Statistical analysis of the data showed that phosphorous application had significantly affected biological yield of the mungbean crop. According to the mean values of the data shows addition of P fertilizer had increased biological yield from (2513.45 kg ha^{-1}) recorded in control plots to (3682.51 kg ha^{-1}) recorded in plots applied with higher dose of phosphorous i.e. 60 kg ha^{-1}. The higher dose of fertilizer has probably delayed maturity in crops and improved vegetative growth by providing a balance levels synchronized nitrogen availably. These results are in line with [12] who reported that mungbean growth and total dry matter production was higher in plots treated with P fertilizer (either from organic or inorganic source) as compared to control. Phosphorus fertilizer helps the crop to produce more seed and other reproductive parts that ultimately contributed to total biological yield and other yield components. Our results are confirmed by the findings of [11].

Harvest Index (%)

Statistical analysis of harvest index data showed that various levels of phosphorus (P) had significant effect on harvest index. Data presenting in Table 2 shows with the increase of phosphorus level harvest index increasing significantly and plots treated with 60 kg P ha^{-1} produced the maximum harvest index (29.5%) being at par with 80 kg P ha^{-1}, while minimum harvest index (22.9%) was recorded in control plots. These results agree with the findings of [17] who reported that increasing rate of phosphorus application significantly increased harvest index over control plots.

Conclusion and Recommendation

From the results of our experiment it is concluded that for higher yield mungbean should be sown with best phosphorous level 60 kg P ha^{-1} in agro climatic condition of Peshawar. The results obtained from the present research work indicated that cultivar NM-92 treated with 60 kg P ha^{-1} produced maximum nodules plant^{-1}, pods plant^{-1}, seeds pod^{-1}, 1000 grain weight, grain yield, biological yield and harvest index significantly and therefore, it is recommended that cultivar NM-92 should be sown under the Peshawar valley condition with the application of phosphorus 80 kg ha^{-1} for higher yield and yield components.

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