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RESPONSE OF MUNGBEAN *(VIGNA RADIATA)* TO POTASSIUM FERTILIZATION

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The "f", of MtOrem po",,,I=, levels oo yield and quali'Y of mungb",o variety NM, 121-25 was dere nniu'd in a field oxP"im'm on, sandy day loam soil havlog nitrogen 0.035%, available pho,pho,"> , ppm and "o""bl, potasj, 123 ppm Po,""ium rates tested W,,, 0, 25, 50, ', 100 and 125 kg ha', ""id" this 20 kg N and 50 kg 1'_O, ha ' Wee, ""d' as a basal do" in all the """m,,,, Th, resutrs ,howcd rhat the numb" of poO, planr', ,mmb,,,;,; ",0, pod', ,"'0 yield I", ' and "'0 p"'uio com,o" we,e i,Kre"" 'igoificamly by pO"""ium applic"ioo · The high", seed yielO (16, '0 q ha') was ob",ined wirh the 'pph'ation 0' 75 kg K,O ha '.

Key words: mungbean. potassium fertilization. response

INTRODUCTION

Munghean *(l'igna radiata)* is an important grain legume crop and is Widely grown in Pakistan on a variety of soils under varying climatic conditions. It occupies an area of *(99.1* thousand hectares with an annual production of 90.6 thousand tonnes of seed with an average yield of 455 kg ha"1 in Pakistan *(A!lonyllIous. 1995-96).*

This average is far *below* the possessed potential of our mungbean varieties. The wide gap between potential and actual yield of munghean is attributed to poor fertility status of soils, as the farmers think that there is no need to fenilize the mungbean crop due to its restorative nature. However, the advanced production technology greatly stresses Upon for soil nutrition management which plays a vital role in Obtaining higher yields. Tomar *et at. (1985)* conducted experiments on green gram *(Vigna radiatai,* on farmer fields. Soil ranging from loamy sand to sandy loam, showed high yield responses to NPK fertilizer. Higher P rates decreased the yield responses to nitrogen, Fertilizers were highly profitable for Mung; the optimum economic rate was 20 kg N + 40 kg PcO, + 20 kg KO ha 1. Gupra (1988) applied 10 kg N, 40 kg P and 20 kg K in different comhinations with or without seed inoculation with rhizohium and found no significant effect on seed yield of *Vigna mungo.* Ahmad (1989) reported that the application of NPK level of 25-75-75 kg ha"1 is the best suitable and economical dose of fertilizer for enhancing the seed yield of lllungbean *(Vigna radiata).* Mahmood (1989) reported that basal dose of N, Pp, and K_2O (25-75-75 kg ha') was needed to harvest a good yield of lllungbean. Hussain (1990) observed that yield parameters such as the number of pods per plant, number of seeds pod'. 1000- seed weight and protein Contents of two different cultivars of lllungbean were signiflcantly affected by N. P and K. Consequently. it was Contemplated in this study to evaluate the effect of fertilization upon yield and quality of Illungbean under Faisalabad conditions.

MATERIALS AND METHODS

The effecl of potassiulll application on seed yield and quality of lllungbean *(Viglla radiata)* cv. NM. 1.:21-25 was studi::d at the Postgraduate Agriculture Research Station (PARS), University of AgriCUlture, Faisalabad. TIle crop was sown on a sandy clay loam *soil,* having 0.035% N, *7.21* ppm phosphorus and 123 pprn potassium, in the last week of July, 1990. A quadruplicated experiment was laid out in a randollllized complete hlock design using a net plot size of 2.4 m x 5m. Potassiumleve!s tested were 0.25.50,75. lOO and I25kg ha '. Besides a uniform dose of20-50 kg NP ha 'was Llsed in all the treatments.

The crop was SOwn with a single-row hand drill Llsing a seed rate of 20 kg ha' in 30 cm apart rows. Urea, SSP and SOP were used as the sources of N,P and K. respectively. The distance between the plants within the rows was maintained at lOcm by thinning, 3 weeks after sowing. *All* other agronomic practices were kept normal and uniform for all the treatments. The observations inclUding number of plants rn', number of pods per plant, number of seeds pod 1. IOOO-seed weight. seed yield ha" and seed protein Contents were recorded dllring the Course of this study. The data collected were analyzed statistically using Fisher's analysis of variance technique and Duncan's new multiple range test was applied to compare the differences among the treatmem means (Steel and Torrie. *1984).*

RESULTS AND DISCUSSION

The data presented in Table *l* revealed that the number of plants m' were not affected significantly by any of the treatments. This was due to uniform plant density maintained in all the plots after germinalion by adjustmell1 of imerplal1l distance by thinning. The data regarding [he number of pods plant 'showed that K application, in general, tended to affeet tillering, jointing, boot, and throughout vegetative growth, respectively. Decrease in DW due to drought was also reported by Ahmad *et al.* (1989). Pasban-90 excelled Barani-83 in producing DW plant". Differences among the combinations of various drought treatments and wheat varieties were also significant (data not shown). Pasban-90 with regular supply of water produced the maximum DW plant" (1.43 g), while Barani-83 subjected to drought throughout vegetative development showed the minimum DW plant.' (0.77 g).

Net Assimilation Rate: Net assimilation rate (NAR) was reduced significantly by drought impesed at different vegetative development stages. However, drought throughout vegetative development decreased NAR to the maximum extent (70.91 %) compared to control. These results were in conformity to those of Brooks *et al.* (1982). There were, however, non-significant differences in NAR of the two varieties. Differences among various combinations of drought treatments and wheat varieties were also non-significant.

Relative Growth Rate: Drought at different vegetative development stages decreased relative growth rate (RGR) significantly compared to control. Drought at tillering, jointing, boot and throughout vegetative development caused a reduction of 15.88,34.30,41.52 and 63.18%, respectively, against the control. n\ese findings were in line with those of Ahmad *et at.* (1989). Pasban-90 exhibited significantly higher RGR than Barani-83, indicating its better genetic potential for producing dry matter per unit plant biomass in a specific time interval. Various combinations of drought treatments and wheat varieties, by contrast, did not significantly differ from one another in RGR.

Leaf Area Index: All drought treatments reduced leaf area index (LAI) significantly. Drought at tillering, jointing, boot and throughout vegetative development decreased LAI by 16.92, 8.08, 20.38 and 22.69%, respectively. These results were in line with the findings of Jamal (1991). Barani-83 exhibited signilicantly higher LAI than Pasban-90 due to larger leaf area plant" in the former. Combinations of various drought treatments and varieties also differed significantly from one another.

The results pertaining to wheat yield, its components and harvest index are given in Table 2.

Fertile Tillers Per Unit Area: Drought at boot, jointing, and throughout vegetative development stages reduced number of fertile tillers per unit area. Compared to control, percent reduction was 3.16, 10.11, 14.61 and 31.80 respectively. This decrease in number of fertile tillers per unit area may be attributed to incomplete tiller development due to deficiency of available water at one or more than one of the aforementioned vegetative development stages of wheat. Barani-83 excelled Pasban-90 by producing 5.42 % more fertile tillers per unit area, indicating its better tillering potential. However, various combinations of the two factors did not differ significantly from one another.

Number of Grains Spike"! Drought at jointing, boot and throughout vegetative development period apparently caused a significant reduction in number of grains spike compared to control but statistically appeared to be the same. By contrast, drought at tillering did not significantly affect number of grains spike". These findings conformed to those of llahi *et al.* (1986) and Hassan *et at.* (1987). Pasban-90 produced higher number of grains spike than Barani-83. However, differences among the combinations of various drought treatments and varieties were non-significant.

lOOO-Grain Weight: Drought imposed throughout vegetative development resulted in the minimum WOO-grain weight. However, 10OO-grain weight of the crop subjected to drought at tillering was statistically not different from control. Reduction in WOO-grain weight under drought may be attributed to reduced supply of assimilates to grains which curtailed the grain filling duration. Similar results were obtained by EI-Monanyeral *et al.* (1982) and Ilahi *et al.* (1986). Barani-83 produced significantly heavier grains than Pasban-90, indicating its better grain development potential. Combinations of various drought treatments and varieties, however, did not differ significantly from one another.

Grain Yield: Drought at tillering, jointing, boot and throughout vegetative development reduced grain yield ha' significantly. The reduction amounted to 16.04, 14.08,25.31 and 32.98%, respectively, compared to control. Reduced yields due to drought may be ascribed to decrease in fertile tillers per unit area, number of grains spike and 1000-grain weight. Similar results were previously reported by Cheema *et al.* (1973), Sinha *et al.* (1986) and Jafari and Abd-Mishani (1987). Pasban-90 produced significantly higher grain yield ha' than Barani-83. Differences among the combinations of various drought treatments and wheat varieties were also significant. Pasban-90 given normal irrigation produced the maximum grain yield (5.94 t ha'), while Barani-83 subjected to drought throughout vegetative development produced the minimum grain yield of 3.46 t ha'.

Harvest Index: Wheat subjected to drought throughout its vegetative development showed the lowest harvest index (HI) of 29.00% and differed signilicantly from other drought treatments. Lower HI in drought treatments compared to control was due to proportionately lower grain yield ha' with these treatments. Similar suppressive effect of drought on HI was also reported by Arnon (1972), Shalaby *et al.* (1988) and Jamal (1991). Pasban-90 exhibited significantly higher HI than

Table 1. Impact of drought on dry weight plant^{-1}, net assimilation rate, relative growth rate and leaf area index of wheat varieties Pasban-90 and Barani-83

Treatment	Dry weight plant^{-1}	Net assimilation rate (mg cm^{2} day^{-1})	Relative growth rate (mg g^{-1} day^{-1})	Leaf area index (cm)
A. Drought				
D_1 = No drought	1.21a*	0.777a*	2.77a*	2.60a*
D_2 = Drought at tillering	1.12b	0.613b	2.33b	2.16c
D_3 = Drought at jointing	1.06b	0.394c	1.82c	2.39b
D_4 = Drought at boot	0.90c	0.286d	1.62c	2.07d
D_5 = Drought throughout vegetative development period	0.79d	0.226e	1.02d	2.01e
B. Variety				
V_1 = Pasban-90	1.16a*	0.462	2.25a*	2.23b*
V_2 = Barani-83	0.87b	0.457NS	1.57b	2.26a

*Any two means not sharing the same letter differ significantly from each other at P=0.05; NS = Non-significant.

Table 2. Impact of drought on number of fertile tillers m^{-2}, number of grains spike^{-1}, 1000-grain weight, grain yield and harvest index of wheat varieties Pasban-90 and Barani-83

Treatment	No. of fertile tillers m^{-2}	No. of grains spike^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Harvest index (%)
A. Drought					
D_1 = No drought	285.17a*	48.61a*	41.43a*	5.61a*	36.00a*
D_2 = Drought at tillering	243.50d	45.76a	40.28ab	4.71b	33.60b
D_3 = Drought at jointing	256.33c	39.53b	39.27b	4.82b	33.53b
D_4 = Drought at boot	276.17b	39.67b	32.38c	4.19c	33.22b
D_5 = Drought throughout vegetative development period	194.50e	37.03b	30.70d	3.76c	29.60c
B. Variety					
V_1 = Pasban-90	244.13b*	46.46a*	35.71b*	4.81a*	34.38a*
V_2 = Barani-83	258.13a	37.78 b	39.91a	4.43b	32.79b

* Any two means not sharing the same letter differ significantly from each other at P = 0.05.

Barani-83. By contrast, various combinations of two factors did not affect HI significantly.

Conclusions: The results suggest that wheat is more sensitive to drought at boot than at tillering or jointing. Although wheat variety Pasban-90 has smaller grain size. yet it exhibits higher yield potential than Barani-83. However, it seems essential to avoid drought at each development stage under study especially at boot to harvest, to exploit maximum potential of the wheat varieties Pasban-90 and Barani-83.

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