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EFFECT OF NP APPLICATION AND INOCULATION ON THE GROWTH AND YIELD OF GRAM *(Cicer arietinum* L.)

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Response of inoculated and uninoculated seeds of gram *(Cicer arietinum* L.), cultivar Paidar-91, was studied to NP levels of 0-0, 13-45, 26-90,39-135 and 52-180 kg ha" under field conditions. Seed yield was increased with the increase in NP levels. Maximum seed yield of 1479.15 kg ha" was obtained with the application of 52-180 kg NP ha:', The increase in yield was mainly due to increased 1000-seed weight. Plant height was also significantly higher at the same level of NP. Seeds treated with inoculum produced significantly higher yield (1450.66 kg ha:') than uninoculated seeds due to higher number of pods plant' ı and number of seeds pod". Inoculated seeds also produced significantly taller plants than uninoculated seeds.

Key words: gram, growth and seed yield, inoculation, NP application

INTRObUcnON

Gram *(Cicer arietinum* L.) is mainly grown as a pulse crop in Pakistan. Although this crop is well adapted to the agro-ecological conditions of Pakistan, yet its average yield (780 kg ha') is much lower than the yield obtained by several other countries such as China (3333 kg ha'), Lebanon (2310 kg ha"), Egypt (1790 kg ha"), Sudan (1500 kg ha") and Israel (1490 kg ha") (Anonymous, 1998). Being a leguminous crop it is capable offixing atmospheric nitrogen in the soil and thereby,enriches the soil with tbis very important element. This aspect of legumes is of great significance in agriculture due to high cost of fertilizer. Rant and Kohire (1991) found an increase in nodule dry weight, number of nodules plant' ı and seed yield with Rhizobium inoculation. They further reported that number of dry weight of nodules per plant and N accumulation were also increased with increasing rate of P application and was higher with Rhizobium inoculation. Adequate supply of nitrogen has also' been found very necessary for obtaining high yields of gram (Dahiya and Singh, 1993). Crops raised from seeds treated with inoculum gave higher yields and increased nitrogen fixing efficiency (Roy et al., 1995). Nitrogen plays an important role. to 'activate Rhizobia for atmospheric nitrogen fixation (Gautam et al., 1995).

Khan et al. (1992) applied 20 kg N + 50 kg *PzO,* ha", Rhizobium inoculation of seed + SO kg *PzO",* Rhizobium inoculation + 5 kg N + 50 kg *PzO,* ha", and neither NP fertilizer nor inoculation. They reported that germination, plant height. number of primary branches per plant, number of empty pods per plant and harvest index did not differ significantly among the treatments. However, grain yields were significantly affected by inoculation and NP application. They obtained the highest grain yield by 20, kg N + 59 kg Pp, ha,l.

McKenzie et al. (1992) reported an increase in dry weight plant" and seed yield by nitrogen application up 10 100 kg ha" and noted no effect of rhizobial seed inoculation on seed yield. Shah et al. (1994) reported an increase in the number of nodules, per plant and seed yield of gram with Rhizobium inoculation. Kasole et al. (1995) applied 25 kg N + 50 kg P ha" or 75 or 50% of these NP rates to chickpea and obtained the highest grain yield (1.3 I ha") with 25 kg N+ 50 kg P. Kurhade et al. (1994) reported that application of 25 kg N ha" increased seed yield and seed protein content. However, these parameters were not affected by increasing N rate to SO kg ha^{-1} P application did not increase seed yield. The present study was conducted to evaluate the growth and yield response of chickpea cultivar Paidar-91 to inoculation and NP doses under irrigated conditions of Faisalabad.

MATE~ AND METHODS

A field experiment with split plot design randomizing fertilizer levels in main plots and inoculation treatments in subplots was conducted at the Postgraduate Agricultural Research, Station, University of Agriculture. Faisalabad. The net plot size measured 2.4 m x 6.0 m. Gram variety Paidar-91 was sown in the first week of November in JO cm spaced rows with single row hand drill using a seed rate of 55 kg ha". For inoculum, the seed was treated with Rhizobium culture by adopting standard procedure before drilling the seed, Fertilizer was applied @ 0-0. 13-45. 26-90. 39·135 and 52-180 kg NP ha". The whole quantity of nitrogen and phosphorus in the form of urea and single super phosphate respectively was applied at the time of sowing. All other cultural practices were kept uniform in all the plots. Observations on plant parameters like 'number of plants m", number of pods plant", number of' seeds pod'ı, lOOO-seedweight and seed yield were recorded using standard procedures. The data collected were analysed using Fisher's analysis of variance technique and the least

significant difference (LSD) test was employed at 0.05 probability to compare the difference among the treatment means (Steel and Tome, 1984).

RESULTS AND DISCUSSION

The data regarding various growth and yield parameters are given in Table 1. Plant height' was influenced signifi-cantly by fertilizer application. Plant height increased with increasing fertilizer levels, however, the plant height obtained at NP application of 26-90 kg ha" did not vary significantly from those of NP levels of 13-45 and 39-135 kg ha·'. The application of 52 kg N and 180 kg P lur' produced significantly taller plants than all other fertilizer levels. Inoculated seeds produced significantly taller plants than uninoculated seeds. The reason might be the increased availability of nitrogen due to greater atmospheric nitrogen fixation. These results are contrary to the findings of Khan et al. (1992) who reported no significant effect of NP application and inoculum on plant height. Such variation in results could be due to differences in genetic make up of the varieties and fertility status of soil.

Table 1. Response of gram to NP application and inoculation

	Plant height (an)	No. of pods plant ₁	No. of seeds pod":::	10OO-seed weight (g)	Seed yield (kg ha")
NP levels (kg ha")					
00	52.40 d	57.70[NS]	1.28[NS]	163.0 d	1059.0 d
13-45	60.35 c	64.85	1.34	rn.s c	135.35 cd
26-90	63.50 be	56.60	1.56	186.3 b	1276.9 be
39-135	66.20 b	60.50	1.48	193.0 a	1328.15 ab
52-18>	75.05 a	60.40	1.35	194.4 a	1479.15 a
Inocull\tion treatments					
No inoculation	6.82 b	54.08 b	1.33 b	181.18[NS]	1060.38 b
Inoculation	64.38 a	65.86 a	1.47 a	182.04	1450.66 a

Means followed by the same letters did not differ significantly at 5% probability level.

The application of fertilizer did not significantly affect the number of pods plant'. The reason for having statistically similar number of pods plant" could be unbalanced availability of nutrients. These results did not conform to those of Kar et al. (1989) who reported a significant effect of fertilizer application on number of pods plant", The number of pods plant", however, significantly increased by inoculation. A non-significant effect of fertilizer application was .also observed on the number of seeds pod". However. a slight increase was noted up to the application of NP at the level of 26·90 kg ha'₁ but a decrease occurred beyond this level. Inoculated seeds produced significantly higher number of seeds pod" than uninoculated seeds and number of seeds produced was 1.33 and 1.47 for uninoculated and inoculated seeds respectively,

The weight of seed was affected significantly by the application offertilizers. There had been a consistent increase in seed weight with each increase in NP levels. However, the increase between P levels of 39·135 and 52-180 kg ha" was not significant. These results are in accordance with those of Kar et al, (1989) who reported a significant effect of fertilizer application in 1000-seed weight. The difference between inoculated and uninoculated seeds for 1000-seed weight was not significant.

The seed yield was affected significantly both by fertilizer application and seed inoculation. Application of 52 kg N + 180 kg P ha" produced the highest seed yield of 1479, 15 kg ha". The effect of application of 39 kg N + 135 kg P ha·₁ did not differ significantly from NP application of 26-90 and 52-180 kg ha", The difference between NP levels of 13-45 and 26-90 kg ha·' was also non-significant. The increase in seed yield was due to tile beneficial effect of NP application on seed weight. The results are in accordance with those of Khan et al. (1992) and Kasolc et al. (1995) who also reported a significant effect of NP application on seed yield. The crop raised from inoculated seed had significantly higher seed yield due to its beneficial effect on number of pods plant"₁ and number of seeds pod", Rant and Kohire (1991) and Tippannavar and Desai (1992) also found an increase in seed yield of gram by inoculation, whereas McKenzie et al. (1992,)had reported a non-significant effect of rhizobial seed inoculation',on seed yield of gram. Contradiction in results might have been due to differences in soil fertility and/or climatic conditions.

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