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Effect of Seed Inoculation and Different Levels of Phosphorus on the Yield and Yield Components of Chickpea

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Abstract

Effect of inoculated and un-inoculation seeds of chickpea (*Cicer arietinum L.*) cultivar "Bital 98" with phosphorus level of 0, 60, 90 and 120 kg P_2O_5 ha^{-1} under field conditions was studied. Seed treatment with inoculum produced significantly higher seed yield (2525.92 kg ha^{-1}) than un-inoculated (2213 kg ha^{-1}). Seed yield was increased with P_2O_5. Maximum seed yield of 2825.76 kg ha^{-1} was obtained with 90 kg P_2O_5 ha^{-1}. The increase in yield was due to increased number of pods per plant, number of seeds per pod and 100-seed weight. The interactive effect of inoculation and 90 kg P_2O_5 ha^{-1} produced the maximum seed yield of 3013.48 kg ha^{-1}.

Key words: Chickpea, Inoculation, Phosphorus

Introduction

The average yield (581 kg ha^{-1}) of chickpea (*Cicer arietinum L.*) is low as compared to other chickpea growing countries of the world like China (3333 kg ha^{-1}), Lebnan (2310 kg ha^{-1}) Tunisia (1868 kg ha^{-1}). Our commercial varieties have maximum yield potential of 3325 kg ha^{-1} indicating a yield gap of 2744 kg ha^{-1}. The yield gap of chickpea may be attributed to improper agro-technology used by farmers. Yield gap can be abridged by adopting advance production technology comprising the use of inoculum, balanced nutrition, weed management and high yielding varieties.

Inoculation can substantially increase the nitrogen fixing potential of chickpea. Farmers have a wrong notion that chickpea, being a legume crops, does not need any nutrient and usually grow it on the marginal land, without applying any fertilizer. This seems to be an important reason for its low seed yield in Pakistan. Application of phosphorus to legume improves seed yield considerably (Hussain, 1983). If carefully handled, crop of chickpea can yield more than 3 tones ha^{-1} of grain and provide satisfactory profit for the growers (Keating and Cooper, 1983).

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Experimental studies have shown that seed yield was increased significantly with Rhizobium and phosphorus applicantion (Raut and Kohire, 1991). It has also been shown that nitrogen as starter dose along with phosphorus and seed inoculation has beneficial effect on the yield of chicpea (Patel and Patel, 1991). Sharsaretal (2000) studies the response of incoulated and un-inoculated seeds of gram cultivar paider-91 to N levels of 0-0, 13-45, 26-90, 39-135 and 52-180 kg ha^{-1} and reported that seed yield was increased with increase in NP levels and maximum seed yield of 1469.15 kg ha^{-1} was obtained with 52-180 kg NP ha^{-1}.

Keeping in view the importance of phosphorus and Rhizobium the present study was conducted to evaluate the yield response of chickpea cultivar "Bittal-98" to inoculation and different phosphorus levels under irrigated conditions of Faisalabad.

Materials and Methods

The experiment was conducted at the Agronomic Research Area, University of Agriculture, Faisalabad for two consecutive sessions during 1999-2000 and 2000-2001. Soil of the experimental area was sandy loam, having 0.96% organic, matter, 0.060% nitrogen, 6.20 ppm phosphorus and 18 ppm K_2O during (1999-2000). Soil analysis showed 0.81% organic matter, 0.050% nitrogen, 6.70 ppm phosphorus and 116 ppm K_2O during 2000-2001. Experiment comprised eight treatments and three replications with net plot size measuring 1.6 m x 5 m. Chickpea variety "Bitall-98" was used as a test crop.

The experiment was laid out in a randomized complete block design (RCBD) with factorial arrangement. The crop was sown in the first week of November 1999 and 2000 in 40 cm apart with a single row hand drill using a seed rate of 50 kg ha^{-1}. For inoculation the seeds were treated with Rhizobium culture. Phosphorus fertilizer was applied @ 0, 60, 90 and 120 kg ha^{-1}. Nitrogen at a constraint rate 30 kg ha^{-1} was also applied along with P_2O_5. Whole of the nitrogen and phosphorus was side dressed at the sowing time with a single row hand drill. Observation on the yield parameters like number of pods per plant, number of seeds per pods-1, 1000 seed weight and seed yield were recorded. To calculate number of pods per plant, number of pods from ten randomly selected plants were counted and then

average was taken. The pods of ten plants were threshed manually and seeds were counted. Three samples of 1000 seeds were taken at random from each plot. Sun dried crop was threshed with a stick on the cloth sheet. The seed yield per plot was recorded and then the seed yield per hectare was calculated.

The data collected on seed yield and yield components were analyzed using the computer statistical programme MSTAT-C and difference among treatment means were compared by least significance difference test at 5 percent probability level.

Results and Discussion

Seed inoculation with rhizobium had a significant effect on number of pods per plant during both the years. Significantly higher number of pods plnat-1 (77.33) was obtained in inoculated seeds than un-inoculated seeds (71.46). Seed inoculation had increase the N-supply to crop plants which ultimately resulted in more number of pods per plant. Konde and Deshmukh (1996) has reported the promotive effect of seed inoculation on number of pods plant-1. Phosphorus significantly affected the number of pods plant-1. The maximum number of pods plant-1 (86.79) was obtained with 90 kg P_2O_5 ha^{-1} against the minimum of 52.92 in control. More number of pods per plant in P treated plots was due to the reason that the Phosphorus improved the reproduction penitential plants. Jain *et al.,* (1991) stated phosphorus application increased number of pods per plant.

The individual as well as interactive effect of inoculation and phosphorus on 1000 seed weight were significant during both the years. The maximum 1000 seed weight (250.20 g) was recorded in inoculated x 90 kg P_2O_5 ha^{-1} which was on par with inoculation x 120 kg P_2O_5 ha^{-1} (249.10). On the contrary, in minimum was observed in un-inoculation x 0 kg P_2O_5 (control). Better growth and development of crop plants due to inoculation and phosphorus supply, N- uptake might have increased the supply of assimilates to seed which ultimately gained more weight. The individual as well as the interactive effect of seed inoculation and different level of phosphorus affected seed yield significantly during both the years. Significantly higher seed yield (3013.48) kg ha^{-1} was obtained in inoculation x 90 kg P_2 O_5 ha^{-1} which was on a par with inoculation x 120 kg P_2 O_5 ha^{-1} 2971-98 kg ha^{-1} and the minimum of 1561.05 kg ha^{-1} was observed in uninoculation x o kg P_2O_5 ha^{-1}. The increase in seed yield of plots treated with inoculation and higher rates of Phosphorus was due to increase in yield components of these plots. Similar promotive effect of inoculation and phosphorus on seed yield was observed in chickpea. The Rout and Kohire 1991, Bhuiyan *et al.,* 1990, Jain *et al.,* 1999.

Table: Effect of seed inoculation and different levels of phosphorus on the yield and yield components of chickpea

Treatments	Number of pods per plant	Number of seeds per pod	1000-seed weight (g)	Seed yield (kg ha^{-1})
Inoculation treatment Un-inoculation	71.4^{b}	1.7^{b}	235.4^{b}	2213.1^{b}
Inoculation	77.3^{a}	1.8^{a}	240.2^{a}	2525.9^{a}
LSD (0.05)	2.7	0.0	1.5	54.4
P_2O_5 Levels (kg ha^{-1})				
P_1 D	52.9^{c}	1.6^{c}	226.5^{d}	1615.6^{c}
P_2 60	72.2^{b}	1.7^{b}	233.7^{c}	2277.2^{b}
P_3 90	86.8^{a}	1.8^{a}	247.9^{a}	2825.7^{a}
P_4 120	85.6^{a}	1.8^{a}	242.9^{a}	2759.3^{a}
LSD (0.05)	4.9	0.1	2.1	77.00
Interaction				
Un-inoculation x P_1			226.4^{c}	1561.0^{f}
Un-inoculation x P_2			232.7^{d}	2106.3^{d}
Un-inoculation x P_3			245.7^{b}	2638.0^{b}
Un-inoculation x P_4			236.7^{c}	2546.8^{bc}
Inoculation x P_1			226.7^{c}	1670.1^{c}
Inoculation x P_2			234.6^{cd}	2448.1^{c}
Inoculation x P_3			250.2^{a}	3013.4^{a}
Inoculation x P_4			249.1^{a}	$2972.^{a}$
LSD (0.05)	NS	NS	2.9	108.9

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