Pakistan J. Sci. Ind. Res., Vol. 29, No. 2, April 1986

YIELD AND QUALITY OF CHICKPEA AS INFLUENCED BY PLANT NUTRITION

Shamshad Hussain Shah, Muhammad Shabbir and Rana Muhammad Iqbal

Agronomy Department, University of Agriculture, Faisalabad (Pakistan)

(Received August, 1983 ; revised October 31, 1985)

Investigations to determine the effect of N,P and K on grain yield and quality of chickpea grown on a sandy clay loam soil revealed that the application of 20 kg N + 60 kg P_2O_5/ha was the best with regard to seed yield. The increase in seed yield was due to increased number of pods per plant and heavy seed weight. Moreover, the N,P and K contents of the grain were also improved by the addition of 20 kg N + 60 kg P_2O_5/ha over control.

INTRODUCTION

Chickpea (*Cicer arietinum* L.), also known as gram, is grown both under irrigated and non-irrigated conditions in Pakistan. Being a leguminous crop, it is capable of fixing atmospheric nitrogen through symbiosis and thereby enriches the soil. Its inclusion, therefore, in an exhaustive crop rotation is very useful. Its grain composition shows that on an average it contains 8.5 percent fibre, 4.3 percent fat, 2.9 percent mineral matter and 20.3 percent protein [7]. The protein level is about double that of cereals and, therefore, chickpea can form an essential part of the human diet.

Statistics show that the production of grain legumes has decreased to a considerable extent in our country. The reasons for low yields are many but the use of outdated susceptible, low productive varieties, and an insufficient application of fertilizers are of prime importance. The application of nitrogen along with adequate amount of phosphorus has been reported to improve the grain yield substantially [2]. Similarly Naeem [8] concluded that 75 kg N + 125 kg P_2O_5/ha increased chickpea yield by 10.7, 50.5 and 80.9 percent over 125 kg P_2O_5, 75 kg N/ha and control treatments, respectively.

The quality of the grain is also influenced by the application of fertilizers. Singh [11] reported that protein, carbohydrate and phosphorus contents of chickpea were increased with the application of nitrogenous and especially phosphatic fertilizers to the crop. In mung bean, seed protein and phosphorus contents increased with increasing levels of nitrogen and phosphorus [9]. Kumar *et al.* [6] noticed that use of nitrogen increased the uptake of nitrogen, phosphorus and potassium while phosphorus increased the uptake of nitrogen and phosphorus, whereas potassium had no significant effect on the uptake of any nutrient in cowpeas.

With this in view, the present investigations were carried to evaluate the effect of nitrogen, phosphorus and potassium application on grain yield and quality of AUG 480, a new high yielding and blight resistant chickpea variety, under Faisalabad conditions.

MATERIALS AND METHODS

The experiment was conducted with chickpea var AUG 480 on a sandy clay loam soil at the Agronomic Research Area, University of Agriculture, Faisalabad, during the year 1980-81. The experiment was laid out in a randomised complete block design with four replications with the net plot size of 4.8 x 7.0 m. The treatments included control; 20 kg N + 30 or 60 or 90 or 120 kg P_2O_5/ha and 20 kg N + 120 kg P_2O_5 + 30 kg K_2O/ha.

The crop was sown in rows 40 cm apart on a well prepared seedbed with the help of a hand drill on 18th November 1980 and twelve rows were maintained in each plot. The whole amount of the fertilizer, calculated for each treatment separately, was applied at the time of sowing. No irrigation except "Rauni" was given and 128.7 mm of natural precipitation was received during the crop growth period. The crop was weeded as and when required. Harvesting was done on 26th April 1981, and the harvest was tied into bundles and sun dried for a week. Later, the bundles were threshed manually and the grain weight was recorded in each treatment.

For grain quality, the seed from each treatment was ground and analysed for nitrogen, phosphorus and potassium [4,13] in the laboratory at the Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad. The data were

statistically analysed and the treatment means were tested by employing Duncan's Multiple Range Test at 5 percent level of significance. [12].

RESULTS AND DISCUSSION

The data on pods per plant (Table 1) revealed that the number of pods was significantly higher in all the treatments than that of control except 20 kg N + 120 kg P_2O_5 + 30 kg K_2O/ha. Within the fertilizer treatments, application of 20 kg N + 60 kg P_2O_5/ha significantly outnumbered the pods per plant over the treatments where 20 kg N was supplemented with 30, 90 and 120 kg P_2O_5/ha. Application of 90 and 120 kg P_2O_5/ha in addition to 20 kg N/ha remained at par with each other. The results suggest that the application of phosphorus beyond 60 kg/ha and even supplemented by potash in addition to 20 kg N/ha did not have any beneficial effect on the number of pods per plant in chickpea. These results are in conformity with those of Ahmad and Shafi [1].

Figures regarding 100-grain weight indicated that 20 kg N + 60 kg P_2O_5/ha significantly increased the seed weight over all the other treatments including the control. The grain weight remained significantly the lowest (12.53 g) of all the treatments with the application of a combination of N + P + K. It was also seen that 20 kg N + 30 kg P_2O_5/ha significantly increased 100-grain weight over 90 or 120 kg P_2O_5 supplemented with 20 kg N/ha, which remained at par with each other. These findings reveal that the application of phosphorus beyond 60 kg/ha in addition to 20 kg N/ha is not useful in increasing the seed weight, while the addition of potassium further lowered the weight of grains. These findings are in line with those of Kumar *et al.* [6].

The highest grain yield was obtained in the treatment with 20 kg N + 60 kg P_2O_5/ha. It was followed by treatment with 20 kg N + 30 kg P_2O_5/ha. Application of 90 and 120 kg P_2O_5/ha in addition to 20 kg N was at par with each other yielding significantly more than that of 20 kg N + 120 kg P_2O_5 + 30 kg K_2O treatment which yielded only as much as the control These findings indicate that the use of phosphorus beyond 60 kg in addition to 20 kg N had a suppressive effect on the chickpea yield and addition of K to N P further decreased the grain yield. These results are supported by the findings of Khan [5] and Kumar *et al.* [6].

In the grain N remained significantly higher in all the treatments as compared to the control. Application of 20 kg N + 60 kg P_2O_5/ha significantly increased N contents in seeds over the NPK treatment but it was at par with the three treatments where 20 kg N was supplemented with 30 or 90 or 120 kg P_2O_5/ha. The results indicate that application of phosphorus beyond 60 kg/ha with 20 kg N had unfavourable effects on N content in chickpea grains. The combination of 20 kg N + 60 P_2O_5/ha favourably affected the N content and these results favour those of Sabir [10] and Kumar *et al.* [6]

The phosphorus content in the grain was significantly increased by the application of 20 kg N + 60 kg P_2O_5/ha over N+P+K and that of check treatments. However, it was at par with the treatments where 20 kg N was supplemented with 30 or 90 or 120 kg P_2O_5/ha. The other treatments showed similar behaviour amongst themselves. These findings show that the use of phosphorus @ 60 kg/ha in addition to 20 kg N/ha favourably increased the phosphorus content of chickpea grains. These results are in agreement with those of others [3,6].

In the case of the potassium content in the grain, all the fertilizer treatments substantially boosted the K content over the control. The K content was the maximum (6.08 meq/lit) with application of N+P+K treatment and it

Table 1. Yield components and composition of chickpea influenced by nitrogen, phosphorus and potassium application

Treatments (N,P and K,Kg/Ha)	No. of pods per plant	100-grain wt. (g)	Grain yield (q/ha)	N (%)	P (X100 ppm)	K (meq/lit)
1. Control	89.90d*	13.28d*	10.53cd*	3.31c*	30.18ç*	4.75c*
2. 20 N + 30 P_2O_5	124.04b	15.54b	12.69b	3.52ab	34.05ab	5.55b
3. 20 N + 60 P_2O_5	142.46b	16.48a	15.48a	3.59a	35.93a	5.73ab
4. 20 N + 90 P_2O_5	113.43c	14.41c	11.46c	3.57ab	33.60abc	5.60b
5. 20 N + 120 P_2O_5	115.00c	14.45c	11.38c	3.56ab	33.53abc	5.60b
6. 20 N + 120 P_2O_5 + 30K_2O	82.38d	12.53e	9.79d	3.45b	31.95c	6.08a

(*) Entries not sharing a letter differ significantly at the 5 % level of significance (DMRT).

differed significantly from the treatments where 20 kg N in addition to 30 or 90 or 120 kg P_2O_5/ha was applied but it remained at par with that of 20 kg N + 60 kg P_2O_5 treatment. The highest K content in grain in N+P+K treatment was attributed to its application in addition to N+P. The result are in line with those of Enikov and Velchev [3].

REFERENCES

1. S. Ahmad and M. Shafi, Pakistan J. Agr. Res., **13**, 417 (1975).
2. Z.H. Bhuiya, M. Hussain and M.H. Mian, Thai J. Agr. Sci., **12**, 191 (1979).(Field Crop Abstr., **34**, 2792(1981).
3. K.Enikov and V. Velchev, Pochvoznamiei Agrokhimya **11** 19(1976). (Soils and Fert. Abstr., 41,1506 (1978).
4. M.L.Jackson. "*Soil Chemical Analysis*" (Prentic Hall Inc.,Englewood Califfs, New York, 1960).
5. R.A. Khan, "Ten years of Agronomic Research in the Dept. of Agronomy," Tech. Rep,1960-1970, W.P.A.U., Lyallpur (1970).
6. B.M. Kumar, P.B. Pillai and P.V. Prabhakaram, Agr. Res. J. Kerala, **17**, 289 (1979). Soils and Fert. Abstr., **44**, 2593; (1981).
7. B.F. Morrison, "*Feed and Feeding*"(Morrison Publishing Co., New York,1954), p.116-117.
8. M.A. Naeem, "Growth and Yield of Some Newly Evolved Gram Varieties as Influenced by Fertilizer Application, M.Sc.Thesis, Univ. Agr.,Faisalabad (1981).
9. J. Rajendran, A.N. Sivappah and K.K.Krishnamoorthy, Madras Agr. J,**61** 447 (1974).(Field Crop Abstr., **29**, 296, (1976).
10. A.A. Sabir, Effect of Different Forms of P on the Fixation of N by Legumes, M.Sc. thesis, W.P.A.U., Lyallpur (1968).
11. R.G. Singh, Indian J. Agron.,**9**, 104 (1971).
12. R.G.D. Steel and J.H. Torrie, "*Principles and Procedures of Statistics*" (McGraw Hill Book Co., New York, (1960).
13. US Salinity Laboratory Staff, "*Diagnosis and Improvement of Saline and Alkali Soils,*" (Handbook 60, USDA Washington D.C. 1954). pp.160.