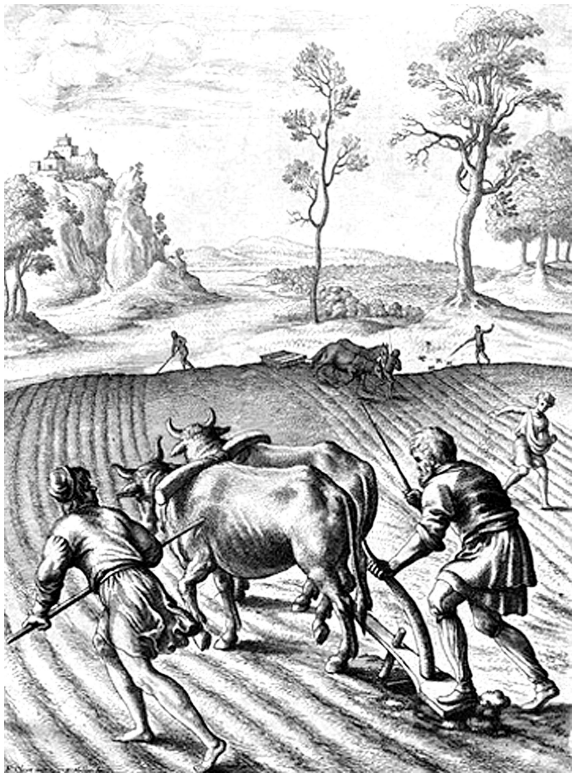
ISSN : 1812-5379 (Print)
ISSN : 1812-5417 (Online)
http://ansijournals.com/ja

JOURNAL OF AGRONOMY



ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Journal of Agronomy 6 (1): 222-224, 2007
ISSN 1812-5379

NP Requirement of Soybean Varieties for Yield and Yield Components

[1]M.H. Siddiqui, [2]F.C. Oad, A.M. Kumbhar and U.A. Buriro
[1]University College of Agriculture, Rawalakot, Azad Jamu and Kashmir, Pakistan
[2]Sindh Agriculture University, Tandojam, Pakistan

Abstract: An experiment was conducted at Students Farm, Sindh Agriculture University, Tandojam, Pakistan to assess the NP requirement (0-0, 50-25, 75-37.5 and 100-50 NP kg ha^{-1}) for soybean varieties (Bossier and Pelican). The highly significant differences for varieties and fertilizer combinations for plant height, index and seed yield per hectare were observed. Whereas, non-significant differences were recorded under number of pods per plant. The variety Pelican under 100-50 kg NP ha^{-1} produced taller plants (66. 25 cm) and more number of pods (55.00 $plant^{-1}$). However, the seed index (14.00 g) and seed yield (3007 kg ha^{-1}) were superior in variety Bossier with the application of 75-37.5 kg NP ha^{-1}.

Key words: Soybean, nitrogen, phosphorus, varieties, seed index, pods, yield

INTRODUCTION

Soybean, being a leguminous crop, fixes atmospheric nitrogen (N) with the help of the nitrogen-fixing bacteria *Bradyrhizobium japonicum*, which are present in nodules of soybean roots. Nodulation begins within a week after emergence (Bergersen, 1958) and N-fixation begins at about 14 days (Hardy *et al*., 1971). Thus, in the seedling stage N uptake is high and N deficiency is observed during the first two weeks of plant growth, before symbiotic N-fixation begins. Therefore, a starter application of N not exceeding 25-30 kg N ha^{-1} is recommended (Beg, 1984; Hussain, 1989; Quresh and Khan, 1985). The application of N fertilizer, aside from the starter dose mentioned above, is not advisable, as the amount of N fixed through bacteria is inversely proportional to the amount of N applied. Addition of N through fertilizers, FYM, or green manure simply replaces N-fixation and grain yield remains similar to that obtained only with inoculum. The total amount of N fixed by nodules ranges from 65 (Alexander, 1977) to 450 kg ha^{-1} (Hardy and Havekla, 1975), depending upon the method of estimation and environmental conditions. The crop can fix 300 kg N ha^{-1}, depending upon its yield potential, the availability of soil N and genetic interaction between the host genotype and the *Rhizobium japonicum* strain (Cassman *et al*., 1981). Generally, about one-third of the total N requirements of the plant are met through N-fixation and the other two-thirds from soil sources. The amount of N fixed is enough to produce a grain yield of 3000-4000 kg ha^{-1}. Intensive soybean production seldom includes application of N fertilizer, but rather relies on N fixation to supplemental uptake of residual N from the soil (Pepper, 1982). In an other study, it was reported that soybeans are highly susceptible to fertilizer burn, so care should be taken to avoid sowing the seed with the fertilizer. Soybeans can e susceptible to manganese deficiency; this can be corrected by applying up to 8 kg ha^{-1} manganese sulphate (Devine *et al*., 1998). Work in North Dakota found that grain soybeans had a residual N yield of 100 kg N ha^{-1} for subsequent crops. This may be higher for forage soybeans as it has not transferred much N from the nodules to grain by the time of harvest (Devine and Hatley, 1998). Thus, looking the above research, much work has been done on various agronomic aspects of soybean cultivation for assessing high yielding varieties with appropriate fertilizer doses.

MATERIALS AND METHODS

The field experiment was conducted at Students Farm, Sindh Agriculture University, Tandojam, Pakistan in RCBD. The details of the treatments used are as under:

Varieties	Two	
	V_1=	Bossier
	V_2=	Pelican
Fertilizer Rates	Four	
	F_1 =	Control
	F_2 =	50-25 NP kg ha^{-1}
	F_3 =	75-37.5 NP kg ha^{-1}
	F_4 =	100-50 NP kg ha^{-1}

Seedbed preparation: Land was ploughed thrice by crosswise plowing with the help of tractor followed by clod crushing and leveling to facilitate uniform distribution of irrigation water. Thus, a good seedbed was prepared.

Corresponding Author: F.C. Oad, Sindh Agriculture University, Tandojam, Pakistan

Seed sowing and fertilizers: The seed of soybean varieties viz: Bossier and Pelican was drilled by single coulter hand drill keeping the recommended distance of 30 cm between rows. The fertilizer doses applied are integrated in the treatments. Full dose of phosphorus and half of nitrogen was applied at sowing time and remaining half dose of nitrogen was given at second irrigation.

Irrigation: Soybean is very sensitive to heavy irrigation and care was taken to avoid the over irrigation. First irrigation was given after three weeks and subsequent irrigations were given as per need of the crop.

Care and maintenance: Crop was kept free from weeds and interculturing was performed to loosen the soil and to eradicate the weeds.

Data analysis: The data obtained was statistically analyzed for mean discrimination through Duncan's Multiple Test and for significant level by analysis of variance following the procedures of Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Plant height (cm): Plant height differed significantly for varieties and fertilizer combinations. Maximum plant height (58.96 cm) was recorded from variety Pelican, whereas 100-50 kg NP ha^{-1} produced taller plants (61.87 cm) (Table 1). The interaction (V×F) showed that variety Pelican × 100-50 kg NP ha^{-1} produced taller plants (66.25 cm) as compared to other varieties and fertilizer combinations Achakzai *et al.* (2002) suggested that plant height significantly and positively increased by added fertilizer over control. However, Menaria *et al.* (2003) reported that plant height responded upto 40 kg P ha^{-1}. These results are also supported by Akhtar *et al.* (1988) they reported that application of nitrogen improved vegetative growth of plant.

Table 1: Plant height (cm) of soybean varieties as affected by different fertilizer combination and their interactions

	Varieties		
Fertilizer levels	Bossier	Pelican	Average for varieties
(Control)	44.05	44.36	44.20c
50-25 NP kg ha^{-1}	54.00	64.75	59.37a
75-37.5 NP kg ha^{-1}	50.00	60.50	55.25b
100-50 NP kg ha^{-1}	57.25	66.25	61.87a
Average for fertilizer	51.2b	58.96a	--
	Varieties	Fertilizer	Interactions
SE	1.3088	1.8043	2.5406
Cdi	3.7302	5.3200	--
Cdii	5.080	7.2012	--

*Mean values withen same letter(s) are not significantly different

Pod number $plant^{-1}$: Statistically results for number of pods $plant^{-1}$ were non-significant. However, variety Pelican recorded maximum number of pods $plant^{-1}$ (53.00) as compared to Bossier. Fertilizer level of 75-37.5 kg NP ha^{-1} recorded maximum (54.00) number of pods $plant^{-1}$ (Table 2). The Interaction (VxF) showed maximum number of (55.00) pods $plant^{-1}$ under variety Pelican in the plots where 75-37.5 kg NP ha^{-1} was incorporated. Similar results were reported by Gan *et al.* (2002) that nitrogenous and phosphorus fertilizers significantly produced more number of pods in soybean crop.

Seed index (g): The seed index showed statistically different results for fertilizer combination, however, varieties and its interaction (V×F) were non-significant. More seed index (12.40 g) values were obtained under variety Bossier. Fertilizer level 75-37.5 kg NP ha^{-1} produced maximum seed index (13.87 g) (Table 3). The interaction, variety Bossier × 75-37.5 kg NP ha^{-1} recorded maximum seed index (14.00 g). Gurkirpal Singh *et al.* (2001), they reported that NPK at 90-60-35 kg ha^{-1} produced highest 100 grain weight.

Seed yield (kg ha^{-1}): The results were statistically highly significant for varieties, fertilizer combination and their interaction (V×F). Individually, the variety Bossier produced maximum (1685 kg ha^{-1}) and fertilizer combination of 75-37.5 kg NP ha^{-1} recorded higher

Table 2: Pods $plant^{-1}$ of soybean varieties as affected by different fertilizer combinations and their interactions

	Varieties		
Fertilizer levels	Bossier	Pelican	Average for varieties
(Control)	51.00	51.25	51.12c
50-25 NP kg ha^{-1}	53.00	55.00	54.00a
75-37.5 NP kg ha^{-1}	49.00	55.00	51.00c
100-50 NP kg ha^{-1}	51.25	53.25	52.25b
Average for fertilizer	50.56b	53.68a	--
	Varieties	Fertilizer	Interactions
SE	2.2907	2.233	4.6014
Cdi	--	--	--
Cdii	--	--	--

*Mean values withen same letter(s) are not significantly different

Table 3: Seed index (1000 seed weight, g) of soybean varieties as affected by different combinations fertilizer and their interactions

	Varieties		
Fertilizer levels	Bossier	Pelican	Average for varieties
(Control)	9.24	9.00	9.62b
50-25 NP kg ha^{-1}	13.12	13.42	13.27a
75-37.5 NP kg ha^{-1}	14.00	13.75	13.87a
100-50 NP kg ha^{-1}	13.25	13.00	13.41a
Average for fertilizer	12.40a	12.29b	--
	Varieties	Fertilizer	Interactions
SE	0.1314	0.1861	0.26320
Cdi	--	0.5561	--
Cdii	--	0.7440	--

*Mean values withen same letter(s) are not significantly different

Table 4: Seed yield kg ha^{-1} of soybean varieties as affected by different fertilizer combinations and their interactions

	Varieties		
Fertilizer levels	Bossier	Pelican	Average for varieties
(Control)	627	625	651c
50-25 NP kg ha^{-1}	1983	1396	1690b
75-37.5 NP kg ha^{-1}	3007	2390	2703a
100-50 NP kg ha^{-1}	1722	1722	1722b
Average for fertilizer	1835a	1548b	--
	Varieties	Fertilizer	Interactions
SE	35.942	51.8612	71.8903
Cdi	105.7420	149.5310	211.5046
Cdii	143.8550	203.4441	287.7032

*Mean values withen same letter(s) are not significantly different

(2704 kg ha^{-1}) seed yield. The over all results showed that variety Bossier under 75-37.5 kg NP ha^{-1} produced more seed yield as compared to variety Pelican and other fertilizer combinations (Table 4). Similar results were reported by Stefanesu and Palanciuc (2000); Achakzai *et al.* (2002) reported that grain yield increased with the application of 50-50 kg NP ha^{-1}. Further, Chorey *et al.* (2001) reported that 60-30 kg NP ha^{-1} recorded comparatively higher seed yield. Gan *et al.* (2002) revealed that yield increased at N and P supply and was mainly associated with more seeds, greater pod number plant^{-1} which confirm the results.

CONCLUSIONS

It was concluded that variety Pelican produced greater plant height and number of pods plant^{-1} under 75-37.5 kg NP ha^{-1}, where as variety Bossier produced heavy seed index and more grain yield per hectare with the incorporation of 75-37.5 kg NP ha^{-1}.

REFERENCES

Achakzai, A.K., 2002. Effect of fertilizer on growth, moisture contents, yield, yield attributes and correlation studies of non-inoculated and inoculated soybean grown under Quetta Climate. M.Sc. (Agric.) Hons. Agro. Thesis, submitted to Sindh Agric. Univ., Tandojam.

Akhtar, M., Z.I. Ahmed and M.S. Nazir, 1988. Effect of NPK application on seed yield and quality of soybean. J. Agric. Res., 26: 129-134.

Alexander, M., 1977. Introduction to soil microbiology 2nd Edn., New York: John Wiley and Sons.

Beg, A., 1984. Fertilizer trial on soybean after wheat. Annual Research Report. 1983. Tarnab: Agric. Res. Institute.

Bergersen, F.J., 1958. The bacterial component of soybean root nodules: Changes in respiratory activity cell dry weight and nucleic acid content with increasing nodule age. J. Gen. Microbiol., 19: 312-323.

Cassman, K.G., A.S. Whatney and R.L. Fox, 1981. Phosphorus requirements of soybean and cowpea as affected by mode of N nutrition. Agron. J., 73: 17-22.

Chorey, A.B., V.R. Thosar and A.N. Chimote, 2001. Effect of manures in combination with fertilizers and their method of application on the yield of soybean. J. Sopils and Crops, 11: 239-242.

Devine, T.E., E.O. Hatley and D.E. Starner, 1998. Registration of Tyrone forage soybean. Crop Sci., 38: 1720.

Devine, T.E. and E.O. Hatley, 1998. Registration of 'Donegal' forage soybean. Crop Sci., 38: 1719-1720.

Gan, Y.B., I. Stulen, H.Z. Keulen and P.J.C. Kuiper, 2002. Physiological changes in soybean (*Glycine max*) in Response to N. and P. Nutrition, Ann. Applied Biology, 140: 319-329.

Gurkirpal Singh, Harmeet Singh and J.S. Kolar, 2001. To evaluate the response of soybean to the combined application of NPK. J. Res. Punjab Agric. Univ., 38: 14-16.

Gomez, K.A. and A.A. Gomez, 1984. Statistical Procedures for Agricultural Research. 2nd Edn., John Willey and Sons, New York.

Hardy, R.W.F., R.C. Burns, R.C. Hahbert, R.D. Holsten and E.K. Jacson, 1971. Biological Nitrogen Fixation: A Key to World Protein. Plant Soil (Special Volume) pp: 561-591.

Hardy, R.W.F. and U. Havekla, 1975. Photosynethate as a Major Factor Limiting Nitrogen Fixation by Field-grown Legumes with Emphasis on Soybean In: Nutman, P.S. (Ed.), Symbiotic Nitrogen Fixation in Plants. Cambridge, England: Cambridge University Press.

Hussain, A., 1989. Fertilizer Trial on Soybean. Annual Report, 1988. Tarnab Agricultural Institute, Kharif Cropping Program, Oil Seeds Crop Section Tarnab.

Menaria, B.L., S. Pushpendra and R.K. Nagar, 2003. Effect of nutrients and microbial inoculants on growth and yield of soybean (*Glycine max* L. Merril). J. Soils and Crops, 13: 14-17.

Pepper, G.E., 1982. Illinois Grower's Guide to Superior Soybean Production. Circular 1200, Co-operatives Extension Service, Urbana-Champagne Univ. Illinois.

Quresh, Z. and M.S. Khan, 1985. Phosphorous fertilizer trial on soybean. In: Final progress report 1984. Maximization Strengthening Research Program, Oil-seed Crops Section. Tarnab: Agricu. Res. Institute.

Stefanesu, M. and Palanciuc, 2000. The efficiency of bacterization and mineral fertilization with nitrogen and phosphorus on soybean crop, under dry land conditions. Analele Institutului de Cercetari pentru Cereale si Plante Tehnice, Fundulea, 67: 149-159.