Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

ANSInet
an open access publisher
http://ansinet.com

Asian Journal of Plant Sciences 3 (3): 370-371, 2004
ISSN 1682-3974

Yield and Yield Components of Inoculated and Un-inoculated Soybean under Varying Nitrogen Levels

S.K. Agha, F.C. Oad and U.A. Buriro
Sindh Agriculture University, Tandojam, Pakistan

Abstract: The field research was conducted at Student's Experimental Farm, Sindh Agriculture University, Tandojam, Pakistan to assess the suitable nitrogen level for inoculated and un-inoculated soybean. The treatments 0, 50 and 75 kg N ha^{-1} were applied to the inoculated and un-inoculated soybean. The results of the experiment exhibited more pods per plant, maximum seeds per pod, heavier seed weight, seed index, highest nodule number and outstanding seed yield performances were observed in the plots treated with 50 kg N ha^{-1}+inoculum (*R.japonicum*), followed by 75 kg N ha^{-1}+inoculum. However, yield and yield components showed less response in the un-inoculated plots receiving no fertilizer application. The results further revealed that as the fertilizer levels increased or decreased from 50 kg N ha^{-1} in the inoculated plots all the observed plant characters significantly decreased. Thus, 50 kg N ha^{-1} and seed inoculation are recommended for achieving maximum seed yield and its contributing components.

Key words: Soybean, nitrogen, rhizobium japonicum, seed, yield, components

INTRODUCTION

Soybean (*Glycine max* L.) a crop of worldwide importance is today the major source of edible oil. The leading countries in soybean production are the USA, Brazil, Argentina and China, the first three of that account for more than 80% of world soybean production[1]. Its seed contains about 20% of oil and has been considered to be the best of all pulses due to its high protein content (about 40%). It has great nutritional value as a source of minerals and vitamins. Soybean proteins contain all the essential amino acids for animal feed and human food[2]. Soybean is the most important for oil and protein crop throughout the world. The major use of soybean meal is in livestock and poultry feed. Intensive soybean production seldom includes application of N fertilizer, but rather relies on N fixation to supplemental uptake of residual N from the soil[3]. Seed inoculation with specific *Rhizobium* sp. increased nodulation by absorbing atmospheric nitrogen symbiotically. The crop can fix 14 and 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[4]. Looking the economic importance of oils in the country, this study is an attempt to explore the yield potential of inoculated and un-inoculated soybean under different nitrogen levels.

MATERIALS AND METHODS

The experiment to evaluate the effect of nitrogen levels of the inoculated and un-inoculated soybean was conducted at Student's Experimental Farm, Sindh Agriculture University. The experiment was laid out in RCBD with three replications. The treatments were: 0, 50, 75 kg N ha^{-1}, 0 kg N ha^{-1}+inoculum (*Rhizobium japonicum*), 50 kg N ha^{-1}+inoculum (*Rhizobium japonicum*) and 75 kg N ha^{-1}+inoculum (*Rhizobium japonicum*). The data on plant parameters were analyzed through MSTATC statistical package.

Seed inoculum: About 78 g of sugar was dissolved in 70 ml of water. The solution was heated until the sugar was completely dissolved and then cooled to room temperature. The 20 g of *Rhizobium japonicum* (Powder form) inoculum were mixed as to make slurry. About 3 kg of soybean seed was dipped in inoculum slurry and mixed uniformly with hands as that the inoculum could stick to seed. The seed was put on paper under shade for drying before drilling. All the other cultural practices were adopted for area maintenance.

RESULTS AND DISCUSSION

The statistical analysis of variance for pods per plant, seeds per pod, seed weight per plant, seed index, nodules

Corresponding Author: Dr. Fateh Chand Oad, Assistant Professor, Department of Agronomy, Sindh Agriculture University, Tandojam, Pakistan Tel: 0221-765857 E-mail: F_oad@hotmail.com

Table 1: Plant parameters of inoculated and un-inoculated soybean as affected by different nitrogen levels

Treatments	Pods per plant	Seeds per pod	Seed weight per plant (g)	Seed index (g)	Seed yield (kg ha^{-1})
0 kg N ha^{-1}	51.60e	2.130c	17.90f	66.88d	973.25e
50 kg N ha^{-1}	58.30d	2.560bc	27.93d	74.44cd	1287.55c
75 kg N ha^{-1}	62.60c	2.860b	30.97c	80.00bc	1297.45c
0 kg N ha^{-1}+	55.86d	2.260c	22.13e	71.64cd	1185.41d
50 kg N ha^{-1}+Inoculum	86.06a	4.000a	52.72a	115.16a	1522.34a
75 kg N ha^{-1}+inoculum	69.86b	3.060b	36.08d	88.93b	1393.06b
S.E.	1.16	0.163	0.60	2.98	15.85
LSD @ 5%	3.66	0.514	1.89	9.41	49.95
LSD @ 1%	5.21	0.731	2.69	13.38	71.05

per plant and yield kg ha^{-1} exhibited significant differences under different treatments (Table 1).

The results of experiment revealed that maximum pods per plant (86.06), more number of seeds per pod (4.00), heavier seed weight (52.72 g), satisfactory seed index (115.16) highest number of nodules (6.83) and grain yield (1522.34) were achieved under 50 kg N ha^{-1}+inoculum application, followed by 75 kg N ha^{-1}+inoculum. However, minimum values of these parameters were observed under 0 kg N ha^{-1} without inoculum application. The results further revealed that as the fertilizer levels increased or decreased from 50 kg N ha^{-1} to 75 kg N ha^{-1} in the inoculated plots all the observed plant characters significantly decreased.

Pod formation: The reason for more pod formation was adequate fertilizer application that enhanced growth of plant and positively contributed more pods. These results are in agreement with the results reported by Akhtar *et al.*[5] they were in the idea that combine application of NP increased pods per plant.

Seeds per pod: Gan *et al.*[6] reported that the yield increase at N and P supply was mainly associated with more seeds and a larger pod number per plant, which confirmed the results form the field experiment.

Seed weight per plant: The reason for maximum seed weight per plant was application of 50 kg N ha^{-1} with inoculum that produced bold seeds and increased seed weight. Zhang, *et al.*[7] they attempted to find *Brdyrhizobium japonicum* strain that can fix more N than strain 532 C under low temperature conditions. They selected 40 *B. japonicum* strains from the USDA collection based on their isolation from soils of northern locations in the USA. These 40 strains were tested for their ability to grow at a low (15°C) temperature and the best two (USDA 30 and USDA 31 selected for evaluation under field condition. Inoculation with USDA 30 and USDA 31 resulted in greater soybean yields (an 8% increase, average over the 2 years) than inoculation with 532 C strain.

Seed index: The trend of effectiveness of various N levels depicts that increasing N with inoculum proportionally increased seed index. Whereas, reducing N fertilizer and inoculum depressed the seed index. Akhtar *et al.*[5] who observed that N application alone or in combination with P and K increased 1000 seed weight significantly.

Seed yield: The increase in seed yield under inoculated plots receiving 50 kg N ha^{-1} was due to the contribution of all the crop parameters viz.: germination, plant height, number of branches, seed per pod, seed weight per plant and seed index which were also superior under inoculum and application of 50 kg N ha^{-1}. Akhtar *et al.*[5] viewed that nitrogen application increased nodulation which turn increased grain yield. Further, Zhang *et al.*[7] pointed out that the increase yield was due to the formation of more pods per plant and more seeds per plant, but not due to an increase in seed index.

REFERENCES

1. Hatam, M., 1994. Crop Production, National Book Foundation Islamabad, Pakistan, pp: 331-335.
2. Martin, J.H., W.N. Leonard and D. Stam, 1976. Principles of Field Crop Production (3rd Edn.) Mc. Million New York.
3. Pepper, G.E., 1982. Illinois Grower's Guide to Superior Soybean Production. Circular 1200, Co-operatives Extension Service, Urbana-Champagne Univ. Illinois.
4. 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.
5. Akhtar, M., Z.I. Ahmed and M.S. Nazir, 1988. Effect of NPK application on seed yield and quality of soybean. J. Agri. Res., 26: 129-134.
6. Gan, Y.B., I. Stulen, H.V. Keulen and P.J.C. Kuiper, 2002. Physiological changes in soybean (*Glycine max*) in response to N and P nutrition. Annals of Applied Bio.,140: 319-329.
7. Zhang, H., T.C. Charles, B.T. Driscoll, B. Prithiviraj and D.L. Smith, 2002. Low temperature-tolerant *Bradyrhizobium japonicum* strains allowing improved soybean yield in short-season areas. Agron. J., 94: 870-875.