Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

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

Asian Journal of Plant Sciences 3 (2): 254-255, 2004
ISSN 1682-3974

Economics of Inoculated and Un-inoculated Soybean under Different Nitrogen Levels

M.H. Siddiqui, A.A. Lakho and [1]F.C. Oad
University College of Agriculture Rawalakot, Azad Kashmir, Pakistan
[1]Sindh Agriculture University, Tandojam, Pakistan

Abstract: The field study was conducted to assess the economic value of inoculated (Rhizobium japonicum) and un-inoculated soybean under different nitrogen levels (0, 50, 75 kg ha^{-1}) at Rawalakot Experiment Farm, Azad Kashmir. The partial economic analysis showed the superiority of the field having inoculum + 50 kg N ha^{-1}, where the physical productivity (1522.34 kg ha^{-1}), revenue productivity (Rs. 13320.47 ha^{-1}), net returns (Rs. 3220.47 ha^{-1}) and cost-benefit ratio (1:1.31) were higher as compared to other treatments. Thus, it is recommended that bio fertilizer should be inoculated which fix atmospheric nitrogen in the root nodules with the in-organic nitrogen at the level of 50 kg ha^{-1} where maximum output could be achieved.

Key words: Soybean, economics, inoculum, *rhizobium japonicum*

INTRODUCTION

Rhizobia are very minor component of the soil microflora and reach their maximum numbers in association with plant roots. They are stimulated by carbon compounds either leaked by or sloughed-off plant roots and are controlled by microbial competition, antagonism, lysis and predation as well as by their physical and chemical environment. Their ability to infect legume roots and multiply within the resulting root nodule, protected from the soil environment, provides a special advantage over their competitors[1]. Use of Rhizobium japonium in the establishment of soybean crop has been widely recognized. The act of inoculation leads to efficient nodulation and is a mean of conserving soil nitrogen which enhances the growth and yield of the crop. Kuykendall *et al.*[2] have demonstrated that when nodulating and non-nodulating isolines of soybean and other legumes are planted in soil inoculated with R. japonicum, best establishment of the bacteria occurs via the nodulating line of soybean. This suggests that rhizobia multiply more prolifically within the nodule than elsewhere. Once established in soil, R. japonicum appears to persist even in the absence of soybean crop[3], although there may be seasonal fluctuations in the size of populations[4]. Leguminous crops are the best known dinitrogen (N2) fixing system and are becoming important for sustainable agricultural system. Methods of enhancing N2 fixation continue to be of major importance in efforts to decrease N fertilizer use and minimize ground water pollution. To meet the goal of making agriculture systems more sustainable, it is of importance to maximize the use of N2 fixing systems to maintain crop yields while minimizing impact on the environment from loss of N from soil system. Looking the economic importance of the crop, the research will be undertaken to observe the economics of inoculum and nitrogen levels of soybean.

MATERIALS AND METHODS

The experiment to assess the economic value of inoculated and un-inoculated Bossier soybean variety under different nitrogen levels was conducted at Rawalakot Experimental Farm, Azad Kashmir. The field study was laid out in Randomized Complete Block design with three replications. The details of treatments are as under:

0 kg N ha^{-1}
50 kg N ha^{-1}
75 kg N ha^{-1}
0 kg N ha^{-1} + inoculum (*Bradyrhizobium japonicum*)
50 kg N ha^{-1} + inoculum (*Bradyrhizobium japonicum*)
75 kg N ha^{-1} + inoculum (*Bradyrhizobium japonicum*)

Land preparation: The crosswise dry deep plowings followed by clod crushing and land leveling were carried out. After soaking dose when land came into condition, one ploughing with rotary plough followed by leveling was given. The experimental plots were provided with bunds and channels, which were made properly.

Seed inoculum and sowing: Sugar solution was prepared and 500 g ha^{-1} of Rhizobium japonicum (Powder form) inoculum was mixed uniformly as the inoculum could stick the seed. The seed was put on paper under shade for

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

drying before sowing. The seed was sown in the morning by using single coulter hand drill at 45 cm row to row distance. The fertilizer applications were adopted throughout growing period according to crop requirements uniformly in all treatments. The 60 kg P ha^{-1} fertilizer was incorporated in the form of SSP at the time of land preparation. However, N fertilizer in the form of urea (integrated in treatments) was applied in three splits i.e. at the interval of 15-20 days during rain showers. All the cultural practices to maintain the experimental area were performed uniformly. The collected data were statistically analyzed following the method of Gomez and Gomez[5].

RESULTS AND DISCUSSION

Physical productivity: The results showed that inoculated soybean produced maximum yield (1522.34 kg ha^{-1}) with the application of 50 kgN ha^{-1}, followed by (1393.06 kg ha^{-1}) in the inoculated soybean under 75 kg N ha^{-1}. Whereas, minimum grain yield (973.25 kg ha^{-1}) was achieved in case of un-inoculated soybean receiving no nitrogen (Table 1).

Revenue productivity: According to the average per ha revenue productivities of soybean crop maximum revenue (Rs.13320.49) was obtained in case of inoculated soybean under 50 kg N ha^{-1}, followed by 75 kg N ha^{-1} with inoculum (Rs.12189.27) (Table 1).

Table 1: Partial economic analysis of inoculated and un-inoculated soybean under different nitrogen levels

Treatments	Yield (kg ha^{-1})	Value of yield (Rs. ha^{-1})	Cost of production (Rs. ha^{-1})	Yield increase/ decrease over 75kg recommended (kg ha^{-1})
0 kg N ha^{-1}	973.25	8515.93	9000	-324.2
50 kg N ha^{-1}	1287.55	11266.06	9900	-9.9
75 kg N ha^{-1}	1297.45	11352.68	10350	-
0 kg N ha^{-1} + inoculum	1185.41	10372.33	9200	-112.04
50 kg N ha^{-1} + inoculum	1522.34	13320.47	10100	+224.89
75 kg N ha^{-1} + inoculum	1393.06	12189.27	10550	+95.61

Table 1: Continue

Treatments	Value of yield increase (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	Cost-benefit ratio
0 kg N ha^{-1}	-2836.75	-484.07	1:0.94
50 kg N ha^{-1}	86.62	1366.06	1:1.13
75 kg N ha^{-1}	-	1002.68	1:1.09
0 kg N ha^{-1} + inoculum	-980.35	1172.33	1:1.12
50 kg N ha^{-1} + inoculum	1967.78	3220.47	1:1.31
75 kg N ha^{-1} + inoculum	836.58	1639.27	1:1.15

Increase/decrease in grain yield as compared to 75 kg N ha^{-1}: The partial economic analysis showed maximum increase in grain yield (224.89 kg ha^{-1}; Rs.1967.78 ha^{-1}) due to application of inoculum in the field treated with 50 kgN ha^{-1} as compared to 75 kgN ha^{-1} without inoculum. The plots treated with inoculum + 75 kg N ha^{-1} were at the second place (recorded 95.61 kg ha^{-1} with worth of Rs.836.58 ha^{-1}). However, the maximum decrease in grain yield was observed in un-fertilized and un-inoculated field (Table 1).

Net returns: It was exhibited that high net returns of Rs.3220.47 ha^{-1} were obtained in case of inoculated soybean under 50 kg N ha^{-1}. Whereas, 75 kg N ha^{-1} + inoculum earned average net returns at the rate of Rs.1639.27 ha^{-1}.

Cost-benefit ratio: The soybean crop earned revenue of Rs.13320.47 ha^{-1} with the cost of Rs.10100 under inoculated soybean + 50 kgN ha^{-1}. Thus, the inoculated soybean crop receiving 50 kgN ha^{-1} was efficient enough to exhibit better cost-benefit ratio in the production of 1:1.318 as compared to other treatments in soybean crop.

REFERENCES

1. Roughly, R.J., 1984. Effect of soil environmental factors on rhizobia. In: World Soybean Research Conference III, pp: 903-917.
2. Kuykendall, L.D., T.E. Devine and D.B. Cregan, 1982. Positive role of nodulation on the establishment of Rhizobium japonicum in subsequent crop of soybean. Curr. Microbiol., 7: 79-81.
3. Crozat, Y., J.C. Cleyet Marel, J.J. Giraud and M. Obaton, 1982. Survival rates of Rhizobium japonicum populations introduced into different soils. Soil Biol. Biochem., 14: 401-405.
4. Mahler, R.L. and A.G. Wollum II, 1982. Seasonal fluctuations of Rhizobium jamonicum under a variety of field conditions in North Carolina. Soil Sci., 134: 317-324.
5. Gomez, K.A. and A.A. Gomez, 1984. Statistical Procedures for Agricultural Research (2nd Edn). John Wiley and Sons. New York.