Annals of Plant and Soil Research 17(3): 269-271 (2015)

EVALUATION OF INOCULUMS LEVEL OF *ROTYLENCHULUS RENIFORMIS* ON SOYBEAN CULTIVARS

OM PRAKASH BHARTI, S.P. TIWARI, S.L. PATIDAR AND DILIP BIRLA

Department of Plant Pathology, College of Agriculture, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur - 482004 (Madhya Pradesh)

Received: November, 2014; Revised accepted: May, 2015

ABSTRACT

This study aim was to evaluate soybean cultivars for their reaction (relative susceptibility and resistance) and effect of different inoculum levels against reniform nematode during kharif 2012 at Jabalpur (M.P.).Cultivars and line (25 total) were evaluated against Rotylenchulus reniformis inoculated with 1000N. Soybean cultivars viz., KALITUR, NRC-37 and MACS - 1254 showed resistance reaction and JS-335, BRAGG, MACS-1259, JS71-05, JS-2 were found highly susceptible against Rotylenchulus reniformis. Hence, highly susceptible cultivar JS -335 inoculated with inoculum levels 0N (Control), 10N, 100N, 1000N and 10000N recorded the severe effects on growth parameters.The progressive inoculum levels decreased shoot weight, foliage number, fresh and dry shoot and root weight and root length. The emergence of foliage also was delayed by few days in inoculated plants, while number of female per root and eggs per plant significantly increased.

Key words: Inoculum levels, reniform, female, soybean and nematode

INTRODUCTION

Soybean [*Glycine max* (L.) Merill] is grown as one of the man's principle food plant since ages and as well as host to many plant-parasitic nematodes. Obviously, the nematodes that demand most attention are the soybean cyst (SCN), root-knot, reniformis, lesion, lance, dagger, stunt, pin and spiral (Adegbite, 2007). Specific survey carried out in Madhya Pradesh revealed that reniform nematode is prevalent in all the districts with 30% frequency of occurrence in the oil seedand pulse crops. Thirty three per cent frequency of occurrence was recorded in soybean alone. The losses in yield due to reniform nematode (*Rotylenchulus reniformis)* are estimated 16% in soybean (Anon, 2000). The reniform nematode mostly affected and parasiting on root of annual and perennial plants. It infects on major host like pineapple,banana, coffee, caster bean, passion fruit, tomato but cause greatest damage to cotton and soybean. Economic threshold for reniform nematode is 310 nematodes per 250 cm^3 soil (Sipes and Schmitt, 2000). The objectives of the study were to isolate the resistance cultivar of soybean through growing on high inoculum pressure for release as a variety and reduce the losses due to *R. reniformis*.

MATERIALS AND METHODS

The experiment was conducted in net house at College of Agriculture, Jawaharlal Nehru Krishi Vishwavidhyalaya, Jabalpur (M.P.) during 2012. Reniform infested soybean plant roots were collected from the field.Extraction and purification of root knot nematode was made by Knobb's sieving and decanting method (Christie and Perry, 1957). Soil was mixed with well decomposed FYM (3:1) to prepare soil composite. Soil composite and 500 cm^2capacity pot were sterilized with 4 % commercial formaldehyde by sealing heap corners with polyethylene sheet for 15 days and later exposed to direct sunlight after spreading in a thin layer to allow complete evaporation of remnants of formaldehyde. Reform nematode population was multiplied and maintained on soybean cultivar for further use in experiment. Five days old seedling were individually inoculated with 5 ml of aqueous suspension containing 1000 reniform pre adult larvae through dispersed inoculation method to find relative resistance of cultivars against *R. reniformis*. Different inoculum levels viz., 0, 10, 100, 1000 and10000 reniform nematode inoculated in highly susceptible genotype JS -335 through serial dilution method and allow to grow. Observations viz., shoot height, number of foliage, fresh and dry shoot and root weight, root length, number of female and egg masses population were taken twenty days after inoculation. Rennee *et al.* (2009) reported that genetically diversity of soybean germplasm used for finding the resistance line. The roots of each plant was carefully washed and extraction of nematode population and observe the number of female per plant root and lesion on root. The data were subjected to determine CRD to measure significant differences between treatments.

RESULTS AND DISCUSSION

Data (Table 1 and 2) revealed that the effect of nematode inoculum on soybean growth parameters was more pronounced as evident with the progressive

Corresponding author e-mail:opbharti@gmail.com

decrease in soybeangrowth parameters with the increase in higher levels in logarithmic series, this parameter reflects degree of deficiency of nitrogen in terms of reduction soybean growth parameters. All the levels above 100 N resulted in reduction in growth parameter over control. Highest (10,000 N) and medium high (1000 N) levels exhibited severe pathogenic effect leading to drastic reduction in nodule number and fresh and dry weight of shoot and root. At lowest level of inoculum, the soybean growth parameter remained at par and stimulatory plant growth was the net effect of compensation against the nematode infection. However, with increasing levels, this effect was offset resulting in decrease of various growth parameters.

Table 1: Evaluation entries / germplasm of soybean against *Rotylenchulus reniformis*

Variety	Females / root	Egg masses population	Nematode population in soil	Reaction
BRAGG	32	609	315	HS
JS-2	38	1058	560	HS
JS-335	40	1225	680	HS
JS76-205	11	290	180	MR
JS20-09	23	458	200	MS
JS93-05	21	405	280	MS
JS90-41	22	430	310	MS
JS20-29	12	335	158	MR
JS71-05	35	740	350	HS
JS20-34	20	780	350	MR
JS20-35	21	430	230	MS
JS97-52	25	635	380	MS
JS72-280	12	640	300	MR
KALITUR	1	0	0	R
MACS-1254	3	340	120	R
MACS-1259	32	780	300	HS
MACS-1281	24	485	310	MS
NRC-2	24	680	300	MS
NRC-7	30	597	250	HS
NRC-12	15	630	290	MR
NRC-37	2	0	0	R
PK-472	26	670	380	HS
PS74-22	17	145	80	MR
PAU-1	23	605	300	MS
SL-710	24	780	300	MS

The stunt growth due to the nematode infection is in accordance with Stetina *et al.*(2014). Soybean cultivars KALITUR, NRC 37 and MACS 1254 were found resistance, whereas, cultivars JS 335, JS 71-05, Bragg, MACS - 1259 and JS -2 gave highly susceptible reaction against *R. reniformis*. Sharma *et al.*(2001) also reported similar results and Identification of resistance to reniform nematode (*Rotylenchulus reniformis*) resulted that both initial screening and subsequent confirmation tests.Gupta and Jain (2009) observed pathogenic potential and relative susceptibility of soybean cultivars to reniform nematode (*Rotylenchulus reniformis*). The influence of different levels of nematode population on growth parameters of soybean variety JS 335 revealed significant reduction in plant height, fresh and dry weight of shoot and root and pronounced decrease in nodulation at higher inocula i.e. 1000 and 10000 nematodes per plant. Further it was observed that the damaging threshold level was calibrated to 2 young female per g soil. Out of 25 screened soybean cultivars, JS 79-263 showed resistant reaction against reniform nematode. Nine cultivars namely JS 75-46, JS 72-280, JS 99-72, JS 95-51, JS 94-76, JS 187-13, JS 94-63, JS (IS) 90-5-12-1 and JS 76-205 showed moderately resistant reactions, whereas, remaining were susceptible and highly susceptible against reniform nematode.The maximum reduction in shoot height (19 cm), number of foliage (3), fresh and dry shoot weight (1.9 g and 0.55 g) was noted at the 1000 N, followed by 100 N inoculum level. Salliana *et al.* (2014) reported released germplasm lines D68-0099 (PI 573285) and LG01-5087-5 against *R. reniformis*. As the inoculum level progressively increased up to 100 N and 1000 N , reduction in shoot parameters and root length, fresh and dry weight and increase in number of female per plant root and egg masses population sequentially were recorded. However, non significant differences were observed at 10 N and 100 N levels. Treatments viz., 100 Nand 1000 N per pot showed inferior growth over rest of the treatments.

Table 2: Effect of different levels of inoculum of *R. reniformis* on growth and ematode parameters of soybean (JS- 335)

Inoculum levels	Shoot height (cm)	No. of Foliage	Fresh weight (g)		Dry weight (g)		Root length (cm)	Females / Plant Root	Egg Masses Population
			Shoot	Root	Shoot	Root			
10 N (10^1)	28*	7	3.2	3.45	1.2	0.75	12.2	6 (2.53)**	145 (11.95)**
100 N(10^2)	25	5	2.7	3.10	1.0	0.5	10.7	10 (3.22)	260 (16.12)
1000 N(10^3)	23	4	2.2	3.00	0.8	0.4	10	14 (3.80)	440 (20.96)
10000 N(10^4)	19	3	1.9	2.65	0.55	0.25	8.5	16 (4.05)	630 (25.09)
Control (10^0)	30	8	3.8	4.00	1.35	1.00	14.2	0 (0.707)	0 (0.70)
SEm±	1.00	0.48	0.08	0.21	0.06	0.05	0.69	0.966(0.14)	13.260(0.44)
CD (P=0.05)	3.014	1.45	0.26	0.63	0.20	0.15	2.10	2.912(0.43)	39.962(1.33)

** Mean of four replication * * Figure in parentheses is square root transformed values*

Treatments 10^2 and 10^3 per pot were statistically significantly inferior over control and 10Ninoculum levels. Zhang (2011) stated similar results. The reproduction of *R. reniformis* on the soybean including the number of nematodes in soil, females and egg masses of root system, eggs per egg mass, and fresh mass and dry mass of soybean shoots and roots were measured at 80 days after inoculation with 10, 100, 1 000 and 10 000 J_2pot^{-1}. The reproductive factors, eggs per egg mass decreased with an increase in the inoculum levels, whereas the others were increased with increase of the inoculum levels. The highest reproductive factor was about 48 times of the lowest one, the highest and lowest being 140.4 and 2.9, respectively. The growth of soybean was affected and its fresh and dry mass decreased with increase of the inoculum levels.Development of females on root was maximum (16) at 10^4 N followed by 10^3 (14), 10^2 (10), 10^1 (6). The positive correlation was noticed at increased inoculum levels. At 10^1 and 10^2 levels, no significant difference was recorded. It is evident from present studies that the threshold damage of reniform nematode, *Rotylenchulus reniformis* was 2 females per g soil.Maximum (530) egg masses were observed at 10 ^{4} N followed by 10^3 (440), 10^2 (260) and 10^1 (145). Significant differences in egg mass development was noticed at all the inoculums levels. Vadhera *et al.*(2001) and Cardoso *et al.* (2010) reported similar results on the effect of inoculum level on plant growth, nematode population of inoculated plants.

REFERENCES

Adegbite, A.A. (2007) Screening of soybean varieties.Nematology **1**(9):713-718.

Anon (2000) Quiquiennial Report All India Co-ordinated Research Project on Nematode, Center JNKVV, Jabalpur pp 97.

Cardoso, P.C., Asmus, G. L. and Goncalves, M. C. (2010) Effect of inoculum concentration about the reproduction of Rotylenchulus reniformis in soybean cultivars. Revista Agrarian **3** (7): 51-55.

Christie, J.R. and Perry, V.G. (1957) Removing nematodes from soil. Proc. Helminthol. Soc. Wash. **18**.106-108.

Gupta, A.K. and Jain, A. K. (2009) Pathogenicity and relative susceptibility of soybean cultivars to reniform nematode.*Current Nematology* **20**(1/2):21-25. 11

Renée S. Arias, Salliana R. Stetina, Jennifer L. Tonos, Jodi A. Scheffler, and Brian E. Scheffler(2009) Microsatellites reveal genetic diversity in *Rotylenchulus reniformis* populations *Journal of Nematology* 41 (2), 146-156.

Salliana R. Stetina, James R. Smith, and Jeffery D. Ray (2014)Identification of *Rotylenchulus reniformis* resistant glycine lines *Journal of Nematology* **46** (1), 1-7.

Sharma, R.D.; Junqueira, N.T.V.; Gomes, A.C. (2001) Reaction of passionfruit genotypes to the reniform nematode, Rotylenchulus reniformis. Nematologia Brasileira. **25**(2):211-215. 17.

Sipes, B.S. and Schmitt, D.P. (2000) Rotylenchulus reniformis damage thresholds on pineapple. Acta Horticulturae 529: 239-245.

Stetina, S.R.; Smith, J.R.; Ray, J.D. (2014) Identification of Rotylenchulus reniformis resistant glycine lines. *Journal of Nematology* **46**(1):1-7. 44.

Vadhera, I.; Shukla, B.N.; Jayant Bhatt (2001) Studies on Rotylenchulus reniformis - a review.Agricultural Reviews. **22**(3/4):222-227.

Zhang Yan;ShiHongLi; Guo Kai; ZhengJingWu (2011) Life cycle and reproductive capacity of Rotylenchulus reniformis [Chinese]. *Journal of Zhejiang University, Agriculture and Life Sciences* **37** (1):7-12.