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Use of plant growth regulators in the control of root-knot incidences in okra plant

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Three plant growth regulators gibberellic acid, α– napthalene acetic acid and boric acid were used as foliar spray against the root-knot infestations in okra plants, in a pot culture experiment. The growth regulators in general, particularly the NAA was effective to reduce the disease intensity and to induce higher rate of growth in the plants.

Key words : Root-knot incidence, *Meloidogyne incongnita*, growth regulators

INTRODUCTION

The quest for nonphytotoxic materials to combat the plant parasitic nematodes has not been persued much. The inhibitory effect of foliar application of plant growth regulators have been reported by Davide and Triantaphyllou (1968), Orion and Minz (1968), Nelmes (1971) and Mishra and Prasad (1974). Prasadji and Sitaramaiah (1992) have reported about the effectiveness of lihocin and miraculan to reduce the galling incidences.

The present study was taken up to assess feasibility of using growth regulators like gibberellic acid, α– napthalene acetic acid and boric acid against the root-knot infestation (*Meloidogyne incognita*) of okra plants in a pot culture experiment. The objective was to see, whether the growth regulators, by means of manipulation of the internal physiology, can reduce the pathogenicity of the plants, or by enhanced rate of growth, the plants can overcome the losses incurred by the noxius nematodes.

MATERIALS AND METHODS

Two pot culture experiments (repetition of the same) were conducted in the month of July 1993 and October 1993, using okra [*Abelmoschus esculentus* (L) Moench] as host plants inoculated with *Meloidogyne incognita*. Sixty earthen pots (25 cm × 25 cm) were filled up with an autoclaved mixture of soil and compost manure 2 : 1. The pots were grouped into five batches of 12 pots. All the batches were separately labelled with aluminium foils. The batches were; (i) uninoculated untreated (control) (ii) inoculated untreated (2nd control) (iii) inoculated and treated with GA (50 ppm), (iv) inoculated and treated with NAA (50 ppm) and (v) inoculated and treated with BA (10 ppm).

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Three growth regulators were chosen with three different types of action on the plants. The gibberellic acid (GA) usually enhances the linear elongation of cells resulting in the increase of root and shoot length and enhances the flowering and fruiting time (Paleg, 1965; Cleland and Briggs, 1969) where as NAA increases the growth and branching of the roots and makes plant stronger and robust. (Sen *et al.*, 1961; Adlakha and Verma, 1965). Boron is essentially a micronutrient, very often interferes with protein and carbohydrate metabolism and helps in sugar translocation (Dennis, 1937; Sisler *et al.*, 1956).

Seeds of 'Pusa-sawani' variety of okra (*A. esculentus*) were taken and surface sterilised with 0.1% $HgCl_2$ solution and were sown, two in each pot. When the seedlings were in two leaf stage, one of the plant in each pot was cut at the base of the stem and removed. (This was done to ensure that each pot must have only one plant).

The larvae of *Meloidogyne incognita* for inoculation were collected by sieving the infected soil of green house pots. The screening obtained, were diluted with water, sampled for determination of the population of *M. incognita* and then applied as inoculum, 250 ml (= 800 larvae) in each pot (Sukul *et al.*, 1974). Altogether four batch of pots were inoculated. The rest 12 pots served as uninoculated control.

Each of the growth regulators was applied as foliar spray by means of a hand sprayer, three times upon particular batch on 10th, 20th and 30th days, from the date of planting.

The best plants were allowed to grow for sixty days, during which, they were regularly irrigated with clean tap water. The rate of growth of the host plants, were taken in account, in different parameters at every ten days interval; viz. height, number of branches, number of leaves, number of flowers and fruits. After sixty days, the host plants were harvested (ie. uprooted). The post-harvest data of final growth in different parameters, vig., root-weight (wt), shoot-weight (wt), root-length (ln) and shoot-length (ln) were recorded. Three types of galls, small, medium and large were counted (Sukul *et al.*, 1974). The final nematode population in the soil of rhizosphere was determined. The rate of change of growth of the host plants, i.e. regression of the growth (b) was established statistically. The test of significance, concerning the differences in final growth, between different treatments, was perfomed mainly by analysis of variance.

OBSERVATION

There was no adverse effect of growth regulators upon the plants. The changes of growth in the pre-harvest plants are shown in Table 1 and the post-harvest comparative record of root-wt, root-ln, shoot-wt and shoot-ln, number of galls and final rhizospheric population of the parasites are shown in Fig. 1 and 2 respectively. The rate of change in height was maximum among GA treated batch (b=0.92) followed by the NAA treated batch. The minimum rate was seen in BA treated batch (b=0.30). In regard of number of branches the uninoculated control plants showed maximum rate of growth (b=0.075) followed by NAA treated batch (b=0.073). The GA treated batch exhibited relatively lesser rate of branching (b=0.066) and the lowest rate was among inoculated control batch.

Table 1. Effect of growth regulators on the rate of growth of okra plants inoculated with *M. incognita*

Treatment		Days of growth						Reg. co-efficient (b)	Inter-cept
		10	20	30	40	50	60		
Height of Host Plant (cms)	UC	9.58	17.7	25.9	34.75	41.58	46.4	0.75	2.7
	IC	10.0	13.6	16.58	19.25	21.5	23.6	0.35	4.7
	IGA	9.25	17.4	28.08	37.5	47.33	54.25	0.92	0.1
	INNA	10.0	18.8	25.16	35.75	43.08	49.16	0.79	2.4
	IBA	9.8	14.0	16.75	19.6	22.5	25.25	0.30	7.4
No. of branches	UC	0	0.33	1.1	2.16	3.0	3.5	0.075	0.97
	IC	0	0	0.25	0.75	1.33	1.75	0.03	0.64
	IGA	0	0.25	1.0	2.1	2.38	3.16	0.066	0.84
	INNA	0	0.25	1.0	2.1	2.75	3.41	0.073	0.98
	IBA	0	0.16	0.58	1.0	2.25	2.66	0.057	0.89
No. of leaves	UC	4.33	6.1	7.75	9.16	10.41	11.5	0.14	3.18
	IC	4.24	5.16	6.1	7.16	8.0	8.16	0.08	3.5
	IGA	4.33	6.1	7.66	9.0	10.66	11.25	0.14	3.2
	INNA	4.33	6.25	7.9	9.41	11.0	12.4	0.16	2.9
	IBA	4.25	5.66	7.16	8.25	9.5	10.4	0.12	3.2
No. of flowers & fruits	UC	0	0	1.75	4.0	6.16	8.0	0.17	2.7
	IC	0	0	0.66	1.75	28.8	4.0	0.084	1.4
	IGA	0	0	1.16	3.33	5.33	7.5	0.15	2.6
	INNA	0	0	2.25	4.66	6.9	9.1	0.19	3.0
	IBA	0	0	0.5	2.1	3.75	5.5	0.11	2.0

UC = Uninoculate control; IC = Inoculated control; IGA = Inoculated and treated with GA; INAA = Inoculated and treated with NAA; IBA = Inoculated and treated with BA

The regression concerning number of leaves was miximum in NAA treated plants (b=0.16), which was more than that of GA treated batch and uninoculated control batch, both being equal (b=0.14). The minimum rate was among inoculated control batch. Maximum flowers and fruits were produced by the NAA treated batch (b=0.19) followed by uninoculated control (b=0.17), GA treated batch (b=0.15 and BA treated batch (b=0.11) respectively. The minimum was that of inoculated control (b=0.084).

The differences in root-wt of uninoculated control, GA and NAA treated batches, proved statistically significant against that of inoculated control. In regard of root-ln, the GA treated batch showed maximum increase, followed by NAA treated batch and uninoculated control and relatively less increase was noted in BA treated batch. Increase in all the treatments was statistically significant. The differences in shoot-wt and shoot-ln both were significant in GA and NAA treated plants, when compared with inculated control batch. The increases in shoot-wt and shoot-ln both in BA treated batch were insignificant (Fig.1).

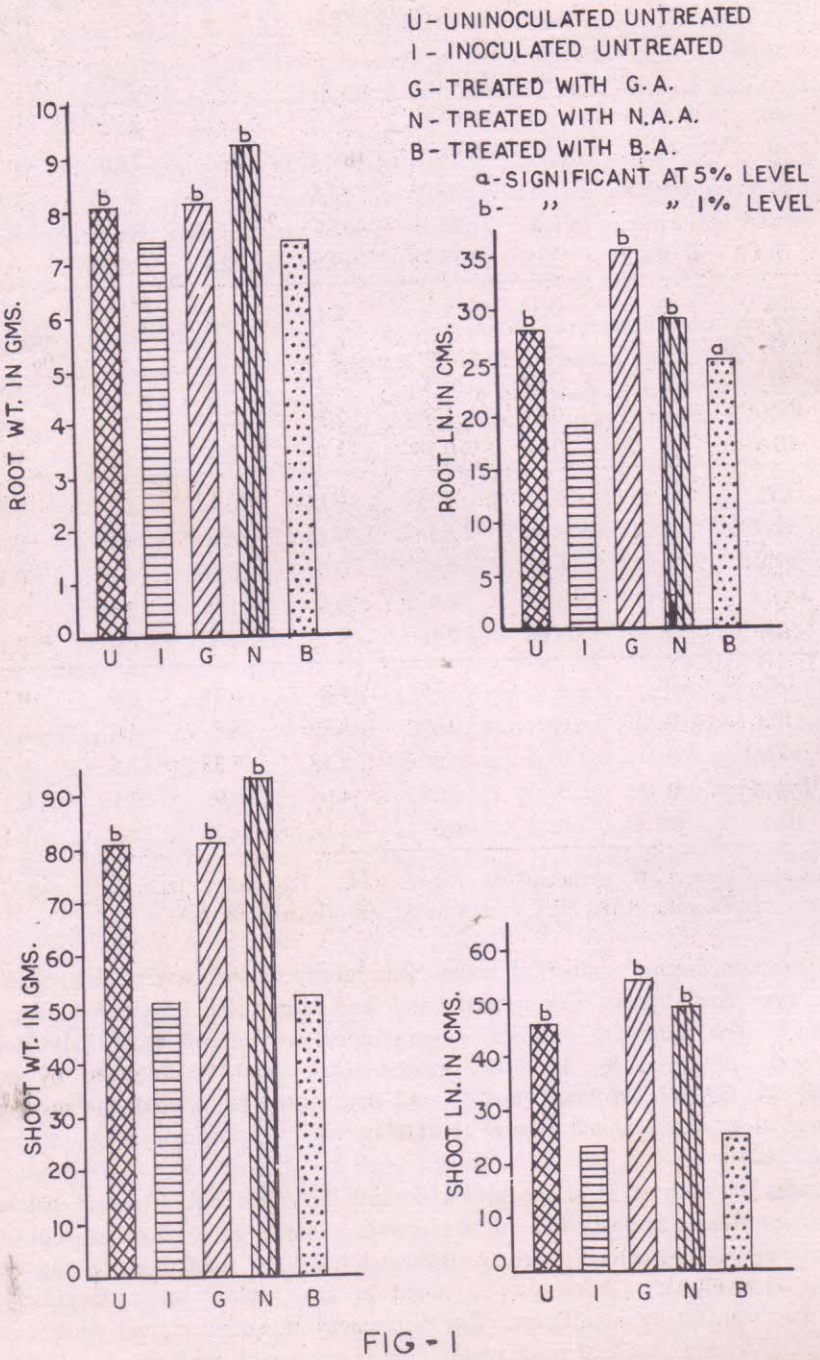

Fig. 1. Effect of th regulators on the final growth of okra plants inoculated with *M incognita*

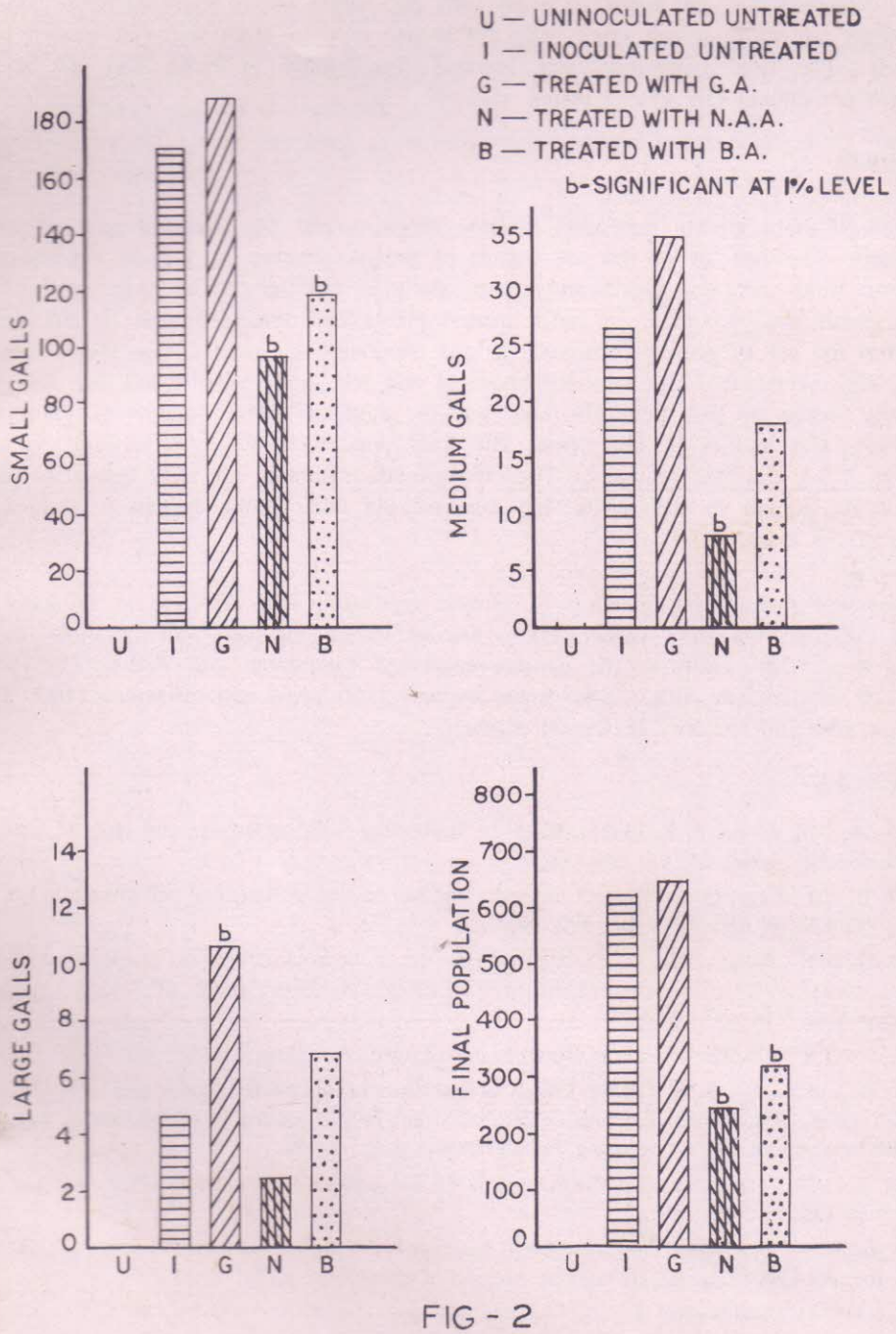

Fig. 2. Effect of growth regulators on the root galls of okra plants inoculated with and the final population of nematodes

The average number of galls and final population in rhizospheric soil are presented in Fig. 2. It was observed that gall index of small galls did reduce significantly in NAA and BA treated plants but medium and large galls did reduce only in NAA and GA treated batch respectively. The final population was reduced significantly in NAA and BA treated batches but not among GA treated plants.

DISCUSSION

Application of plant growth regulators brought about several physiological changes within plant system. The rate of growth in respect of height, number of leaves, branches and flowers and fruits increased significantly, particularly in GA and NAA treated plants. The average growth was maximum in NAA treated plants but relatively little in BA treated plants. Thus the use of growth regulators, helped the plants, to overcome in losses inflicted by the noxius nematodes. The root and shoot-wt and root and shoot-ln had also increased significantly, more or less with all three growth regulators. The number of galls were reduced with GA and NAA treatments. The final population was also reduced to some extent with NAA and BA treatments. Thus the growth regulators not only helped to infuse better rate of growth in the plants, but also on the other hand, helped to reduce the incidence of the disease.

The experiment proved that the use of growth regulators was effective in reducing the root-knot incidence in okra plants. NAA proved to be the best among three growth regulators used. This confirms the earlier reports of Sitaramiah and Pathak (1981) and Prasadji and Sitaramaiah (1992), who found cycocel (500 ppm) and miraculan (1000 ppm) reduced the root-knot severity in tomato plants.

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