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## Effect of different initial population densities of *Meloidogyne graminicola* on the plant growth of sorghum

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### Abstract

The present investigation was carried out to ascertain the effect of initial population densities of *Meloidogyne graminicola* on the root-knot development, nematode multiplication and plant growth parameters of sorghum under pot conditions, Department of Nematology, CCS HAU, Hisar during the month of June-August, 2017. Sorghum plants were grown in steam sterilized sandy loam soil and after germination was inoculated at different inoculum levels i. e. 0, 10, 100, 500, 1000 and 10000 j<sub>2</sub> of *M. graminicola*. An initial inoculum level of 500 j<sub>2</sub>/kg soil caused significant reduction in plant growth parameters and proved to be pathogenic to the sorghum plants. With the increase in inoculum level of *M. graminicola*, there was a progressive decrease in plant growth parameters viz., shoot length, fresh and dry shoot weight, root length and root weight at all initial population densities as compared to uninoculated control. Maximum number of galls/plant (125.3, 159.7) and final nematode in the population in the soil (495, 658.3) were recorded in 500 and 1000 j<sub>2</sub>/kg of soil, which subsequently decreases at 10000 j<sub>2</sub>/kg of soil.

**Keywords:** *Meloidogyne graminicola*, sorghum, initial population densities, pathogenicity plant growth parameters, nematode multiplication

### Introduction

Sorghum (*Sorghum bicolor*) is an important nutrition cereals constituting staple diet in the country [13]. It is a drought resistant fodder crop belonging to the family Gramineae/Poaceae. It is the fifth major cereal crop in the world after wheat, rice, maize and barley [2]. A number of plant parasitic nematodes have been reported to be associated with this crop. The species of *Meloidogyne* (root-knot), *Pratylenchus* (Lesion nematode), *Tylenchorhynchus* (stunt nematode) and *Heterodera sorghi* (sorghum cyst nematode) are considered most important [7]. *Meloidogyne graminicola* is known to infect and cause serious damage to cereals, especially rice, in many countries [1, 9, 11, 8, 10]. Apart from rice, the nematode has a wide host range of 40 Weeds and 18 crop plant species, mainly belonging to the families Cperaceae and Graminae including sorghum [12]. This nematode was reported from north Indian plains which has been a traditional wheat growing areas of the region as this nematode has also been found damaging the wheat crop [4]. There is no information on the pathogenicity of *M. graminicola* on sorghum in India and abroad. Therefore, the present investigation was carried out to determine the effect of *Meloidogyne graminicola* j<sub>2</sub> inoculum density on growth of sorghum.

### Material and Methods

The present experiment was carried out in screen house conditions, Department of Nematology, CCS HAU, Hisar during the month of June-August, 2017. Fifteen centimeter size earthen pots filled with steamed sterilized sandy loam soil were planted with three sorghum seeds. One plant was retained after seven days of germination. The experiment comprised of five levels of nematode inoculum viz., 10, 100, 500, 1000 and 10,000 j<sub>2</sub>/kg of soil. Besides, a suitable check (without nematode) was maintained. There were three replicates for each treatment. The experiment was terminated 45 days after inoculation and plants were depotted carefully with intact root system and washed free of soil for observations were recorded on plant growth characteristics i.e. shoot length, fresh and dry shoot weight, root length and root weight and also on nematode multiplication parameter such as no. of galls/plant and final nematode population in the soil.

### Statistical analysis

The data obtained in the experiment was analysed statistically design (CRD) was one factor analysis.

### Results and Discussion

Results presented in Table (-1-) indicated that with an increase in initial population densities of the *M. graminicola*, there was a corresponding decrease in all growth parameters viz., shoot length, fresh and dry shoot weight, root length and root weight. However, the maximum reduction in all the parameters was obtained at highest inoculum level i.e. 10000  $j_2$ /kg of soil. Significant reduction in shoot length, fresh and

dry shoot weight, root length and root weight was observed at 500  $j_2$ /kg of soil and considered as damaging threshold level of *M. graminicola*. The present findings are conformity with those of Tarafdar and Mian <sup>[17]</sup> who recorded 500  $j_2$ /3kg of soil, *M. graminicola* to be pathogenic on onion.

The maximum and significantly highest plant growth parameters were found in non-inoculated check which was statistically at par with inoculum levels of 10 and 100  $j_2$ /kg soil (Table 1). As inoculum level increased from 10-1000  $j_2$ , numbers of galls and final nematode population increased. Number of galls and final nematode population decreased at inoculum levels 10000  $j_2$ /kg soil.

**Table 1:** Effect of different inoculum levels of *Meloidogyne graminicola* on plant growth parameters and nematode multiplication on sorghum.

Inoculum levels ( $j_2$ /kg soil)	Shoot length (cm)	Shoot weight (g)	Dry shoot weight (g)	Root length (cm)	Root weight (g)	No. of galls/plant	Final nematode population ( $j_2$ )/kg soil
0	119.0	40.0	10.0	62.3	21.0	--	--
10	115.3	37.7	9.3	59.3	19.0	13.0 (3.7)	46.7 (6.9)
100	106.3	33.0	8.2	53.3	15.0	49.0 (7.0)	240.0 (15.5)
500	79.3	20.3	5.5	37.0	9.7	125.3 (11.2)	495.0 (22.2)
1000	66.7	14.3	3.7	20.7	7.3	159.7 (12.7)	658.3 (25.7)
10000	53.7	8.7	2.4	16.0	5.7	81.3 (9.0)	223.3 (14.9)
S. Em $\pm$	3.8	2.1	0.4	2.6	1.5	0.4	0.6
C. D. at 5%	11.8	6.5	1.4	8.2	4.7	(1.3)	(1.8)

\*Each value is an average of three replicates;

Figures in parentheses are  $\sqrt{n}$  transformed value

Number of galls and final nematode population was significantly different from each other at different inoculum levels but minimum number of galls was observed at 10  $j_2$ /kg soil. The lowest number of galls/plant and final nematode population in the soil recovered was at highest Pi, indicating effects of nutritional and space competition on nematode fecundity. Soomro and Hague <sup>[16]</sup> and Mian and Khan <sup>[6]</sup> also reported similar findings. Rao and Israel <sup>[14]</sup> also reported that the high rate of reproduction of *M. graminicola* in rice at low levels of inocula could possibly be due to the positive factors like abundance of food, lack of competition, ability of the host to support these levels of population, the negative density factor like crowding of endoparasites in the roots.

The present findings are in contrary with those of Jaiswal *et al.* <sup>[3]</sup> who observed that maximum reduction in all the plant growth parameters was recorded at 5000  $j_2$ /kg of soil. However, shoot length, root length, fresh shoot and root weight was observed at 1000  $j_2$ /kg of soil and considered as damaging threshold level of *M. graminicola* on rice. Root galls also increased significantly with the increased levels of nematode inocula with maximum at 2000  $j_2$ /kg of soil. Kumar *et al.* <sup>[5]</sup> also reported that plant growth parameters decreased significantly as inoculum levels increased from 100-10000  $j_2$  irrespective of soil types indicating 100  $j_2$  as damaging threshold level of *M. graminicola* on scented (var. Pusa 1121) and non-scented rice (PR 114). With increase in inoculum levels from 10-1000  $j_2$ , nematode multiplication and reproduction was increased but decreased at 10000  $j_2$  which is due to excess competition of food and space.

In other studies, Soomro and Hague <sup>[16]</sup> observed reduced plant height at higher inoculum level. Maximum reduction in growth parameters were observed at 8000  $j_2$ /pot and the seedlings did not tolerate even the lowest inoculums level of 125  $j_2$ /pot. Soomro and Hague <sup>[15]</sup> concluded that the highest

number of galls and nematodes occurred on sorghum roots. Growth of both the plants was reduced by nematode invasion but sorghum suffered more as compared to wheat, total root length of sorghum was reduced by 67 percent as compared to 54 percent reduction in wheat after inoculation.

### Conclusions

In this study, as inoculum levels of *M. graminicola* increase, there was a progressive decrease in plant growth parameters. The nematode population in soil increases with increase in inoculum levels as well as nematode multiplication rate was inversely proportional to the nematode inoculum level. The high damage potential populations of *M. graminicola* in sorghum and will require effective nematode management programmes to be put in place.

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