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Population density of *Meloidogyne incognita* under stress of different cropping sequences

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Abstract

Five different cropping sequences including cucumber, dry common bean, cowpea, maize and sesame plants replacing sugar beet for controlling root-knot nematode, *Meloidogyne incognita* resulted that sugar beet-Hybrid maize and sugar beet-sesame cropping sequences proved most effective against root-knot nematode as they reduced nematode parameters as indicated by the number of galls, egg-masses and hatched juveniles on roots. Consequently, they lowered rates of nematode population ranged from 0 and 0.01, respectively. However, the higher nematode populations were supported rest crops. It is concluded that use of poor or non host crops may be beneficial for controlling root-knot nematode population densities in intensive cropping system.

Keywords: Cropping sequence, vegetable and field crops, *Meloidogyne incognita*.

Extent damage to any crop depends upon the population of plant parasitic nematodes in the soil. Nematode population in the soil is affected by the type of crops grown. Non-host plants reduced nematode populations to below the damaging levels. Rotation of crops is one of the most important management practices for reducing population of plant parasitic nematodes under economic threshold levels. Considerable works have been done in that trend (Brown, 1984; Srivastava & Seti, 1986; Hassabo & Ameen, 1995; Youssef *et al*., 1997). Despite those studies, there is a continuous need for evaluating more and more cropping regimes that are acceptable to Egyptian farmers. Midha & Chhabra (1974) reported that *Sesamum indicum* decreased *Meloidogyne* population to 3.8%. However, this population increased when brinjal was planted. Rodriguez-Kabana *et al*., (1988) reported limited reproduction of *M*. *incognita* and *M*. *arenaria* on four sesame cultivars. Starr & Black (1955) when tested 10 cultivars of sesame against *Meloidogyne incognita*, *M*. *arenaria* and *M*. *javanica* supported low final population. In view of this trend, the effect of different cropping sequences in soil planted previously with sugar beet on population of *M*. *incognita* was investigated in the present research.

Materials and Methods

Cropping sequences in this study were as below:
1. Sugar beet-cucumber
2. Sugar beet-common bean
3. Sugar beet-cowpea
4. Sugar beet-maize
5. Sugar beet-sesame

The initial population of root-knot nematode, *M*. *incognita* in soil was determined after sugar beet was harvested in June 16, 2014. Then the subsequent plants replacing sugar beet were sown at the same time. There were five replicates for each crop and plots were arranged in a randomized complete design on a bench under greenhouse conditions. Two months after planting the subsequent plants were harvested. Nematodes in the whole roots of each subsequent plant species were incubated in distilled water for seven days according to method described by Young (1954). The number of galls, egg-masses and hatched juveniles in plant roots were estimated. Rate of nematode build up was calculated by dividing final nematode population (Pf) on initial nematode population (Pi).

Results

Data on the effect of some subsequent vegetable and field crops planted in soil previously planted with sugar cane on final population of root-knot nematode, *M. incognita* are presented in Table 1. Results showed that sugar beet-Hybrid maize and sugar beet-sesame cropping sequences proved most effective against root-knot nematode as they reduced nematode parameters. Consequently, they lowered rates of nematode build up 0 and 0.01, respectively. However, cucumber, common bean and cowpea were found favourable hosts for root-knot nematode, as they favoured higher final nematode population on their roots as indicated by the number of egg-masses and hatched juveniles on their roots. In turn, rates of their nematode build up reached the maximum 2.52 and 2.38, respectively followed by cucumber 1.82. Number of galls differed on roots of the different subsequent plants according to degree of nematode infections. In other words, the highest number of galls were found on roots of common bean 74 followed by those on cucumber 70 and cowpea 53. The least number of galls were found on roots of maize 3 followed by sesame 8.

Table 1. Effect of different cropping sequences of some vegetable and field crops on final population of root-knot nematode planted in soil previously planted with sugar beet.

Crop rotation/ nematode parameters	Sugar beet cv.	Cucumber cv. Alpha				
	Initial population (Pi) (J_2 in soil)	No. of hatched J_2 on roots	No. of egg-masses	Final population (Pf)	Rate of build-up (Pf/Pi)	No. of galls
Sugar beet-cucumber	200	330	33	363	1.82	70
	Sugar beet	Common bean cv. Giza 2				
Sugar beet-common bean	200	454	49	503	2.52	74
	Sugar beet	Cowpea cv. Balady				
Sugar beet-cowpea	200	434	42	476	2.38	53
	Sugar beet	Hybrid maize				
Sugar beet-maize	200	0	0	0	0	3
	Sugar beet	Sesame cv. Shandawell				
Sugar beet-sesame	200	0	1	1	0.01	8

Discussion

It can be inferred that cropping sequences including sesame and Hybrid maize are most effective against root-knot nematode. Coinciding with the present results, Youssef & El-Nagdi (2004) revealed that when sesame (cv., Giza 32) plants were intercropped with susceptible squash (cv. Iskandarani) plants, they decreased reproduction and development of *M. incognita* on squash which may be attributed to the toxic nature of resistant sesame root exudates. Also, Araya & Caswell-Chen (1994) reported that *S. indicum* was resistant to penetration of *M. javanica* due to sesame roots contained or secreted toxins that inhibit nematode penetration or inhibit motility of invading nematodes. Tanda (1987) showed that intercropping with sesame resulted in decreased penetration of okra roots by *Meloidogyne incognita* second-stage juveniles (J_2) and delayed nematode maturation; it favoured development of *M. incognita* males and increased yields of okra and chickpea in field tests. Previously, maize was commonly regarded as a non host to *Meloidogyne incognita* (Idowu & Fawole, 1990; Rodriguez-Kabana, 1992), probably because yield losses may go unnoticed as a result of extensive root-systems as reported by Dickson & McSorley (1990). The extensive use of maize in rotation systems further necessitates a profound knowledge of the crop's host status to economically important nematode species.

These results indicated that *M. incognita* population densities increased rapidly on common bean, cowpea and cucumber and decreased with poor or non host plants. The impact of the cropping sequences may have been underestimated from the large production fields. An awareness of the host status of common agricultural crops to *M. incognita* should provide the basis for rational nematode management decisions in Egypt. Use of poor or non host crops may be beneficial for managing root-knot nematode population densities in intensive cropping system and reducing the dependence on nematicides.

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