



Regione
Siciliana

EFFECTIVENESS OF BIOFUMIGATION TECHNIQUE TO CONTROL THE SOUTHERN ROOT-KNOT NEMATODE (*Meloidogyne incognita*) IN SICILY

Antonio Colombo¹, Salvatore Cataldi¹, Giuseppe Marano¹, Luca Lazzeri²

¹ Assessorato Regionale Agricoltura e Foreste, Dipartimento Interventi Strutturali, Servizio IV - Sviluppo locale e attività agro-ambientali, U.O. 21 - Osservatorio per le Malattie delle Piante di Acireale - Via Sclafani, 34 - Acireale (Italy)

² CRA - Research Center for industrial crops - Via di Corticella, 133 - Bologna (Italy)



Fig. 1 - *Brassica juncea* crop in plastic-house

INTRODUCTION

Root-knot nematodes (*Meloidogyne* species) are among the most wide spread and plant-damaging nematodes. They cause average annual yield losses of 20.6% in tomato crops, 16.9% in eggplant, 13.8% in melon and 12.2% in pepper. In southern Italy, severe damage is caused by *Meloidogyne incognita*, often occurring along with *M. javanica* and *M. arenaria*, especially in protected vegetable crops. It has been estimated that the average yield loss of fresh tomatoes is around 25% but greater losses are recorded in sandy soils. In Sicily, these soil-borne pests represent the main biotic factor limiting the yield of many vegetable crops in plastic-houses.

Research of alternative methods of control which are effective against nematodes and less toxic to humans and the environment is imperative. Among the alternatives, biofumigation has shown promising results in controlling soil-borne pathogens and nematodes.

During the years 2006-2008, two field trials in unheated plastic-houses in the southern part of Sicily (Italy) were carried out in order to verify the efficacy of different bio-fumigation strategies in managing nematode *M. incognita* in tomato crops. In the first trial, two accessions of mustard species selected for their high glucosinolate content were used in the form of pellets or as green manure. In the second trial, the oil extract of *Brassicaceae* species, distributed by drip irrigation, was tested.

MATERIALS AND METHOD

The trials were conducted during two autumn-spring cultivation cycles (2006-2007 and 2007-2008) on tomato crops [*Lycopersicon lycopersicum* (L.) Karsten ex Farw.], cv. Shiren F1 hybrid, with transplanting in September and harvest from January to May. In both fields the previous tomato crop had been found severely infested by the southern root-knot nematode.

In the first trial, pellets derived from the *Brassicaceae* species utilized at the rate of 2500 kg/ha 7-days before the transplanting were used to ascertain their effectiveness against the root-knot nematode in comparison with two accessions of mustard species of the *Brassicaceae* family (*Brassica juncea* sel. ISCI 99 and *Eruca sativa* cv "Nemat"). Each species was planted with an increasing quantity of seeds (10-20-30 kg/ha) in a plastic-house and grown until flowering, which occurred 55 days after the sowing. The green mass was then cut up, irrigated and incorporated into the soil. All thesis were successively treated with 15 days of soil solarization.

In the second trial, the tomato crop was treated with oil extract of *Brassicaceae* species, distributed by drip irrigation when the maximum development of nematode population in the soil was recorded. In total, four treatments with oil were carried out, two at the beginning of the growing season and the others each halfway through October and December, when the quantity of the juvenile form of the nematode in the soil was very high.

At the end of each crop cycle, the nematode infestation on tomato roots and in the soil was estimated.



Fig. 2 - *Meloidogyne incognita*: female (above) and galls (down).



Fig. 3 - *Brassica juncea* seedlings (above) and in plants in flowering (down).



Fig. 4 - The first field trial: value of the galls index (scale 0 - 5).

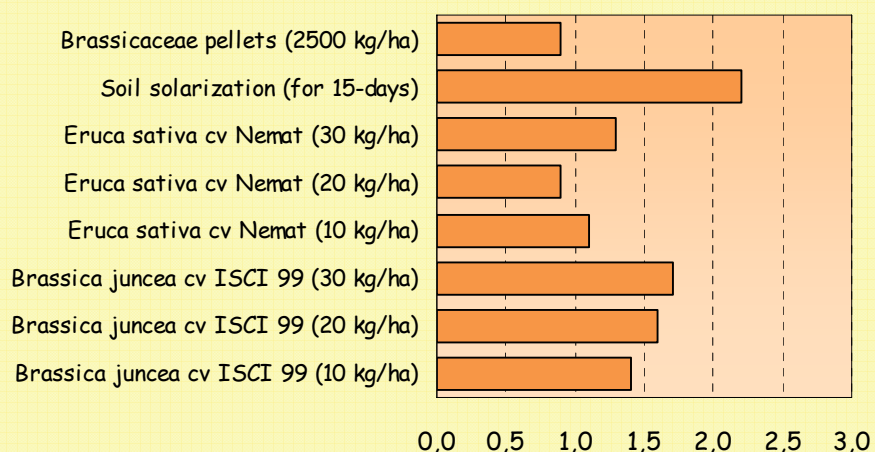


Fig. 5 - The second field trial: number of larvae of *M. incognita* in the soil during the tomato growing season.

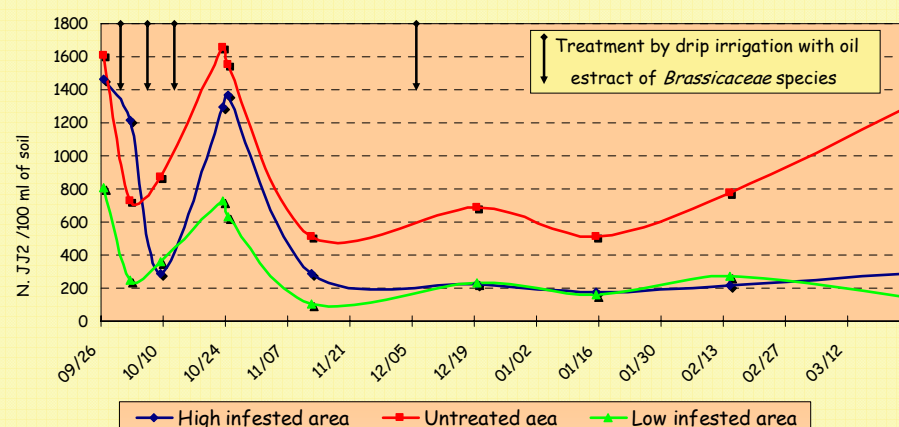


Fig. 6 - Tomato roots treated with oil extract of *Brassicaceae* species.

RESULTS AND CONCLUSIONS

All the nematode control techniques tested produced a tomato yield significantly higher than in untreated soil. In particular, *Brassica juncea* sel. ISCI 99 accession acted mainly as a bio-fumigant, while *Eruca sativa* cv "Nemat" revealed an interesting trap crop effect. Also the use of pellets derived from *Brassicaceae* species incorporated into the soil before transplanting resulted in a lower galls index in the tomato roots. The oil extract of *Brassicaceae* species reduced the juvenile nematode population in the soil during the whole tomato cultivation cycle (see the figures 4-5).

The green manuring with mustard species of the *Brassicaceae* family is a promising technique for the control of nematodes. However its application is time consuming and it can interfere with the intensive production cycle of protected vegetables crops. Better results can be obtained with either oil extract or pellets obtained from *Brassicaceae* species. Integration with other techniques (e.g. solarization) is recommended.