MANAGEMENT OF *MELOIDOGYNE INCOGNITA* (KOFOID *ET* WHITE) CHITW. IN ORGANIC HORTICULTURE

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OBJECTIVE

To assess the effectiveness of combined management techniques (main crops rotation, intercropping and soil biofumigation) for the control of Southern Root-Knot nematode (*Meloidogyne incognita)* in organic farming

Trial characteristics

Location
Volania (Ferrara), North-Eastern Italy

Experimental design
8 combinations (thesis) of crop rotation, biocidal intercropping and biofumigation

Field surface
6,000 m^2

Trial years
From 2005 to 2007

Assessments on 4 plots per thesis (*plot* surface= 120 m^2)
To soil:
- checking 2nd stage larvae (J2) of *M. incognita*
- calculating Reproduction Factor (R)*

On roots:
- Galling Index (G.I.) on the roots according to the 0-5 scale (Lamberti, 1971)

On melon fruit yield:
- marketable production of melon (kg per plot)

*R = final population (PF) / initial population (PI)

MELOIDOGYNE INCOGNITA

Southern Root-Knot Nematode typical of sandy soils

Host crops:
Solanaceae: tomato, potato, pepper, eggplant.
Cucurbitaceae: watermelon, melon, cucumber, pumpkin, zucchini.
Leguminosae: bean, stringbean, vetch.
Compositae: chicory, lettuce...
Umbelliferae: carrot, celery, parsley
Chenopodiaceae: beet, spinach.
Rosaceae: strawberry, peach, apple, pear ..

Main crops in rotation

2005: tomato cv. Coimbra (thesis 1, 2, 3, 4) as good host
sorghum cv. Aralba (thesis 5, 6, 7, 8) as poor host

2006: melon cv. Baggio as good host

2007: melon cv. Bingo as good host

Intercropping

Eruca sativa cv. Nemat, as nematicidal catch-crop, sown in September 2006 (thesis 1, 3, 5, 7), cut and incorporated in the soil on April 2007 at full flowering when the plants reach highest glucosinolate content.

Biofumigation

A pellet based on *Brassica carinata* defatted seed meal, as bio-fumigant treatment, was broadcast 10 days before melon transplanting, at the rate of 2.5 ton ha-1, incorporated in the top 10 cm soil and immediately lightly irrigated for triggering the glucosinolate hydrolysis. Biofumigation was performed in spring 2006 on all surfaces that had been cultivated with tomato the previous year (thesis 5, 6, 7, 8), and in spring 2007 (thesis 1, 2, 5, 6).

Cropping system tested from 2005 to 2007

Thesis	2005	2006			2007	
	Summer	Spring	Summer	Autumn	Spring	Summer
1	Sorghum		Melon	*E. sativa*	Biofumigation	Melon
2	Sorghum		Melon		Biofumigation	Melon
3	Sorghum		Melon	*E. sativa*		Melon
4	Sorghum		Melon			Melon
5	Tomato	Biofumigation	Melon	*E. sativa*	Biofumigation	Melon
6	Tomato	Biofumigation	Melon		Biofumigation	Melon
7	Tomato	Biofumigation	Melon	*E. sativa*		Melon
8	Tomato	Biofumigation	Melon			Melon

Effect of biofumigant treatment on melon crop (year 2006)
left: untreated soil (thesis 1, 2, 3, 4); right: treated soil (thesis 5, 6, 7, 8)

Effect of main crop and soil biofumigation on *M. incognita* population (year 2005 and 2006).

Thesis	Main crop 2005	Biofumigation 2006	2005			2006		
			Pf	R	Galling index (G.I.)	Pf	R	Galling index (G.I.)
1-2-3-4	Sorghum	No	65	0.43 b	0 b	180	2.77 b	4.2 a
5-6-7-8	Tomato	Yes	200	1.33 a	2.9 a	2	0.01 a	0.3 b

All the values are means of 4 repetitions.
In the columns, mean values followed by different letters show a significant difference at P < 0.05 level (ANOVA and Fisher's test).

Effect of biofumigant treatment and *E. sativa* cv. Nemat incorporation into the soil, on melon crop (year 2007)

Thesis	J2 100 cm^{-3} soil (n°)	Galling index (G.I.)	Melon fruit yield (Kg per plot)
1	206 a	4.6 a	150.8 cd
2	137 a	4.7 a	138.9 d
3	42 b	4.9 a	137.8 d
4	115 ab	4.9 a	118.6 e
5	17 b	2.0 c	195.1 a
6	26 b	2.1 c	183.9 ab
7	80 ab	2.9 b	167.5 bc
8	75 ab	2.3 bc	157.2 c

ANOVA on not transformed data. Mean values followed by the same letter are not statistically different (P=0.05, LSD).

RESULTS

Effects of main crops in rotation
- tomato showed a G.I.= 2.9 and increased the *M. incognita* population (R = 1.3);
- sorghum reduced the nematode population (R = 0.43) while no galls were found on its roots.

Effects of biofumigant treatment with *B. carinata* pellet
In 2006:
- the spring treatment (thesis 5, 6, 7, 8) caused a strong decline in both melon G.I. and J2 population of the nematode in the soil;
- the biofumigation caused also an increase in the fruit mean yield, even if it was not statistically significant (306 kg in the treated plot vs. 280 kg in the untreated control);
- biofumigation was effective in obtaining one more harvest at the beginning of fruit cropping.

In 2007:
- biofumigation confirmed its good nematicidal effect;
- the best nematicidal performance was observed in the thesis 5 and 6 where biofumigation had been repeated in spring 2007
- the nematicidal effectiveness of *B. carinata* pellet coupled with its contribution in soil organic matter, resulted in great increase in yield of melon in all the treated plots;
- both nematode control and yield increases were related with the number of applications during the three years.

Effects of intercropping with *Eruca sativa* cv. Nemat
- the eruca cultivation and incorporation in the soil increased the melon yield (thesis 1, 3, 5, 7);
- the effect of eruca on reducing population in the soil was not significant.

Field experiment with melon

DISCUSSION

- The results of the triennial investigation demonstrated that, even in organic farming, it is possible to achieve a good control of *M. incognita* and attain satisfactory yields.
- The intrinsic characteristics of the pellet based on *B. carinata* defatted seed meals highlighted an excellent bio-fumigant effect and a noticeable increase in both organic matter and nitrogen content of the soil thus improving soil fertility.
- The high effectiveness of pellet in decreasing the nematode population, suggests that it could be applied every other years, in the presence of low nematode infestation of the soil.
- In this trial the effect of *Eruca* catch-crop on *M. incognita* population was not significant because of the period of cultivation (autumn-winter).
- The increase in organic matter was the prevalent effect of eruca cultivation.