EVALUATION OF GALLING INDEX ON PREVIOUS CROP AS A RELIABLE METHOD FOR CORRECT POSITIONING OF NEMATODE CONTROL TRIALS (*MELOIDOGYNE GENUS*)

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INTRODUCTION

During the activity of experimental services carried out since 2008 by the testing facility ARA srl – Catania, the researcher started to test a new procedure to select the sites in which to carry out the experimental efficacy trials against nematodes. He used an operating procedure based on the assessment of Galling Severity Index (GSI) on cycle ending crops. The outcome of this evaluation allowed him to position the experimental trials in the susequent crop cycle in areas homogenueosly and properly infested to garantee highly reliable results. Here are showed the results of performed experiences, analysing the data obtained from 91 experimental trials positioned using the mentioned strategy in the Sicilian greenhouses between 2011 and 2018.

MATERIALS AND METHODS

Relevant parameters considered for the different trials – year 2016 (example)

Cycle	Previous Crop	Sand %	Frequency PRE	Severity PRE	Assessment Date	Days from last crop	Sampling Date	J2 n° /100 cc	TEST Crop	Cycle duration (gg)	Frequency cycle end	Severity cycle end
Summer	Tomato	86	72	1,5	Mar-14	43	na	na	Pepper	110	88	4,4
	Aubergine	86	95	2,6	Mar-15	43	Apr-27	29	Tomato	110	100	8,7
	Tomato	84	100	6,5	Mar-06	46	Apr-21	25	Cucumber	90	100	4,8
	Zucchini	83	98	3,8	Feb-28	25	Mar-25	31	Cucumber	101	100	9,2
	Tomato	86	93	3	Apr-07	32	Mag-09	28	Tomato	115	100	7,5
Autumn	Tomato	79	100	4,9	May-17	135	Ott-01	11	Cucumber	100	100	6,5
	Tomato	80	96	3,8	Jul-28	45	Sep-13	5	Tomato	180	100	4,9
	Tomato	81	100	6,8	Jul-14	53	Sep-07	0	Tomato	170	100	7,5
	Tomato	82	87	1,8	Jun-24	88	Sep-21	71	Tomato	190	99	6,2
	Tomato	77	98	3,9	Jul-28	88	Ott-24	51	Tomato	215	98	3,9
	Tomato	74	100	6,7	Jul-15	94	na	na	Tomato	218	100	7,9

Test Crop	Distance plants/rows	Soil Type Sa - Si - C - pH - O.M.			Irrigation output – interval	Cultivation cycle	Specie
Pepper	30-80/120	86-11-3	7,8-1,3		1,8 l/h -10 cm	Apr-Aug	*Meloidogyne*
Tomato	35-75/120	85-11-4	7,7-1,2		2,0 l/h -15 cm	Apr-Aug	*M.incognita*
Tomato	40-80/120	86-9-5	8,1-0,6		2,1 l/h -10 cm	May-Jul	*M.incognita*
Cucumber	30-80/120	84-12-4	7,5-0,8		1,4 l/h -10 cm	Apr-Jul	*Meloidogyne*
Cucumber	30-80/120	83-13-4	7,4-0,9		2,0 l/h -10 cm	Mar-Jul	*M.incognita*
Tomato	30-80/120	79-16-5	7,9-1,1		2,1 l/h -10 cm	Oct-Jan	*Meloidogyne*
Tomato	30-80/120	80-13-7	7,5-0,8		2,1 l/h -10 cm	Sep-Mar	*M.incognita*
Tomato	30-80/120	84-12-4	8,1-1,9		2,0 l/h -10 cm	Oct-Apr	*M.incognita*
Tomato	35-80/120	74-20-6	7,4-0,9		2,1 l/h -10 cm	Oct-May	*M.incognita*
Cetriolo	30-80/120	79-16-5	7,9-1,1		1,3 l/h -10 cm	Oct-Jan	*Meloidogyne*

At the end of cultivation cycle of a previously selected crop, the roots were eradicated and the **Evaluation of the Galling Severity Index** was performed on the highest numer of root systems as possible, according to the Zeck scale, modified (0-10). Afterward the average percentage of infested roots and the average value of the Galling Index were calculated for the entire crop

The trials were always carried out according to the *EPPO guidelines*. 5 replications were realized (rarely 4), and plot applications were performed on two nearby double-rows (4 rows) with plots size of approximatively 20 sqm. At least two intermediate assessments of GSI were performed on no less than 8 plants/plot and the last one was performed on 20 plants at crop cycle end. The assessments on fruits production were performed along the crop cycle on 10 plants/plot. In some cases, at the beginning of the trial the number of nematode was counted in soil samples from all the control plots.

7	8	4	4	4	2	3	3	4	7	6	7	7	7	3	5	5	4	5	3	5	8	5	0
5	4	5	3	5	5	4	4	3	5	5	8	8	7	8	3	7	3	4	5	8	7	4	4
4	7	7	4	3	6	5	3	3	3	8	3	7	8	6	5	7	6	2	3	3	5	4	
7	6	3	5	7	4	4	6	5	4	6	4	6	7	7	7	7	2	3	3	2	7	6	6
5	8	4	5	6	2	4	5	2	4	7	3	8	7	7	7	8	2	3	3	3	4	5	3
8	4	8	4	4	3	3	5	8	4	5	6	3	4	8	8	5	3	4	3	3	3	3	3
3	4	7	3	3	3	5	6	7	2	8	4	2	5	3	5	7	4	5	5	4	8	4	4
4	5	8	5	3	3	5	7	4	3	8	6	7	6	8	5	6	8	4	6	4	7	7	4
6	7	3	7	6	8	6	5	7	7	5	5	3	6	8	6	7	7	7	6	8	7	5	3
8	5	8	3	4	7	7	6	7	8	6	7	8	6	5	4	7	8	8	5	7	6	2	5
8	8	3	6	8	8	8	7	7	6	7	8	4	4	7	6	8	8	7	7	5	6	7	7
7	8	5	7	7	8	6	8	8	7	8	6	3	4	8	4	5	6	7	6	8	8	8	7

Nematodes infestation assessed in the areas corresponding to the future plots according to a scale with classes 0 ÷ 10 (Zeck). Categories of infestation from 0 (no presence) to 10 (roots system completely deformed and dying/dead plant).

The compliance of the methodology was verified by comparing the parameters assessed at cycle end of the previous crop, considered as average values of the entire test site, with the average values of percentage of infested roots systems and of galling severity index assessed on all the untreated plots of the experimental trial.

CONCLUSIONS

The methodology of the preliminary survey on galling severity index of the previous crop, together with the knowledge of the history of the choosen greenhouse and of the other minor interfering factors, proved to be highly reliable as it allows proper positioning of experimental trials against nematodes in the greenhouses better than other methods . Average values of frequency of 80÷100 % on the previous crop have driven in 93,2% of cases to 90 ÷ 100% of symptomatic root systems in the test crop. An average galling severity index higher than 4 was observed in 88,9 % of cases in which on the previous crop had been assessed 80 ÷100 % of infested roots with an average GSI equal or higher than 3. Higher nematodes attack was observed when the test crop specie was the same of the previous one on which the survey on roots systems had been performed. The spring-summer cycle resulted as more favourable to the nematodes activity. Althought the entity of roots damage has yet to be considered, the homogeneity of symptoms distribution on previous crop is to be regarded as the most important factor for getting reliable data with significance from the statistical point of view.

References

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RESULTS

SEVERITY - Correlation (%), for sites number, between attack severity on the roots (GSI) assessed on previous crop and attack severity at trial end on the untreated plots of the test-crops (processing performed on the data related to 89 sites)

PREVIOUS crop		TEST crop			PREVIOUS crop		TEST crop		
Class (GSI)	Sites N°	Class (GSI)	Sites N°	%	Class (GSI)	Sites N°	Class (GSI)	Sites N°	%
> 7	20	> 7	7	35	4 ÷ 4,9	13	> 7	5	38,5
		> 5	13	65			> 5	10	76,9
		> 4	17	85			> 4	13	100
		3 - 3,9	0	---			3 - 3,9	0	---
		1,5-2,9	3(#)	15			1,5-2,9	0	---
6 ÷ 7	20	> 7	9	45	3 ÷ 3,9	15	> 7	7	46,7
		> 5	15	75			> 5	11	73,3
		> 4	18	90			> 4	13	86,7
		3 - 3,9	0	---			3 - 3,9	2	13,3
		1,5-2,9	2	10			1,5-2,9	0	---
5 ÷ 5,9	11	> 7	4	36,4	1 ÷ 2,9	10	> 7	2	20
		> 5	10	90,9			> 5	7	70
		> 4	10	90,9			> 4	8	80
		3 - 3,9	0	---			3 - 3,9	2	20
		1,5-2,9	1	9,1			1,5-2,9	0	---

(#): sites where the plant specie tested in the trial were never been cultivated before in the same soil

FREQUENCY - Correlation (%), for sites number, between frequency (%) of symptomatic roots assessed on previous crop and frequency (%) on the untreated plots of test-crops at the end of the trials

PREVIOUS crop		TEST crop		
Frequency (%)	Sites N°	Frequency (%)	Sites N°	%
90 – 100	83	90 – 100	78	94
80 – 89	5	90 – 100	5	100
80 – 100	*88*	*90 – 100*	*82*	*93,2*
72	*1*	*88*	*1*	---

Processing performed on the data related to 89 sites

Trend of Galling Severity Index (GSI) on succeeding crops with relationship to the family / specie of the test crop.

Summer trials (42 sites)				Autumn trials (47 sites)			
Same family	29	increased GSI	26	Same family	29	increased GSI	22
		decreased GSI	1 (same specie)			decreased GSI	2 (same specie)
			2 (different specie)				5 (different specie)
Different family	13	increased GSI	9	Different family	18	increased GSI	6
		decreased GSI	4			decreased GSI	12

Influence of other factors on the attack degree to the succeeding crops

Number of J2 larvae/100 cc of soil

Counting of nematodes before transplanting were related to the galling severity index assessed on check plots at trial end:

Summer cycle: - 1 ÷ 25 → 100 % with GSI > 4
- 51 ÷ 105 → 100 % with GSI > 5
- 106 ÷ 600 → 100 % with GSI > 5

Autumn cycle: - 1 ÷ 25 → 71,4 % with GSI > 5
- 51 ÷ 105 → 85,7 % with GSI > 4

Period of the year

Period of cultivation cycle was related to the galling severity index assessed on check plots at trial end:

Spring-Summer cycle (40 trials): - 60 % with GSI > 7
- 90 % with GSI > 5

Autumn-Winter cycle (42 trials): - 23 % with GSI > 7
- 69 % with GSI > 5

Soil characteristics

All the trials were grouped in 3 type of soil with regard to the sand content and this was related to the galling severity index assessed on check plots at trial end:

- Sand > 90 % (7 trials) → 100 % with GSI > 5
- Sand 81 ÷ 90 % (52 trials) → 82,7 % with GSI > 5
- Sand 70 ÷ 80 % (22 trials) → 63,6 % with GSI > 5