CONTROL OF THE RICE ROOT-KNOT NEMATODE *MELOIDOGYNE GRAMINICOLA* USING RICE PLANTS AS TRAP CROPS

7th International Congress of Nematology
ICN 2022
Antibes Juan-les-Pins - France

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INTRODUCTION

Meloidogyne graminicola is one of the most important damaging nematodes for rice cultivation throughout the world, particularly in South and Southeast Asia. Italy is the main rice growing country in Europe, with 227,320 ha of rice in 2020.
In, 2016 *M. graminicola* was detected for the first time in mainland Europe (Northern Italy) and subsequently added to the EPPO Alert List. The Italian National Plant Protection Organization promptly implemented phytosanitary measures to limit *M. graminicola* spread into new areas. The rice field submersion is one of the phytosanitary measures foreseen in the Italian regulations to control the pest, but in the Lombardy region (where this pest has been detected in 2018), this practice is not applicable due to the sandy soil structure. For this reason, some field trials, using rice plants as trap crops, were conducted to identify new control strategies against this pest. The proposed innovative agronomic technique aims to stimulate juveniles to hatch and invade the roots of rice plants and, before the nematodes complete their life cycle, requires the destruction of the crop thus significantly reducing the nematode population in the soil.

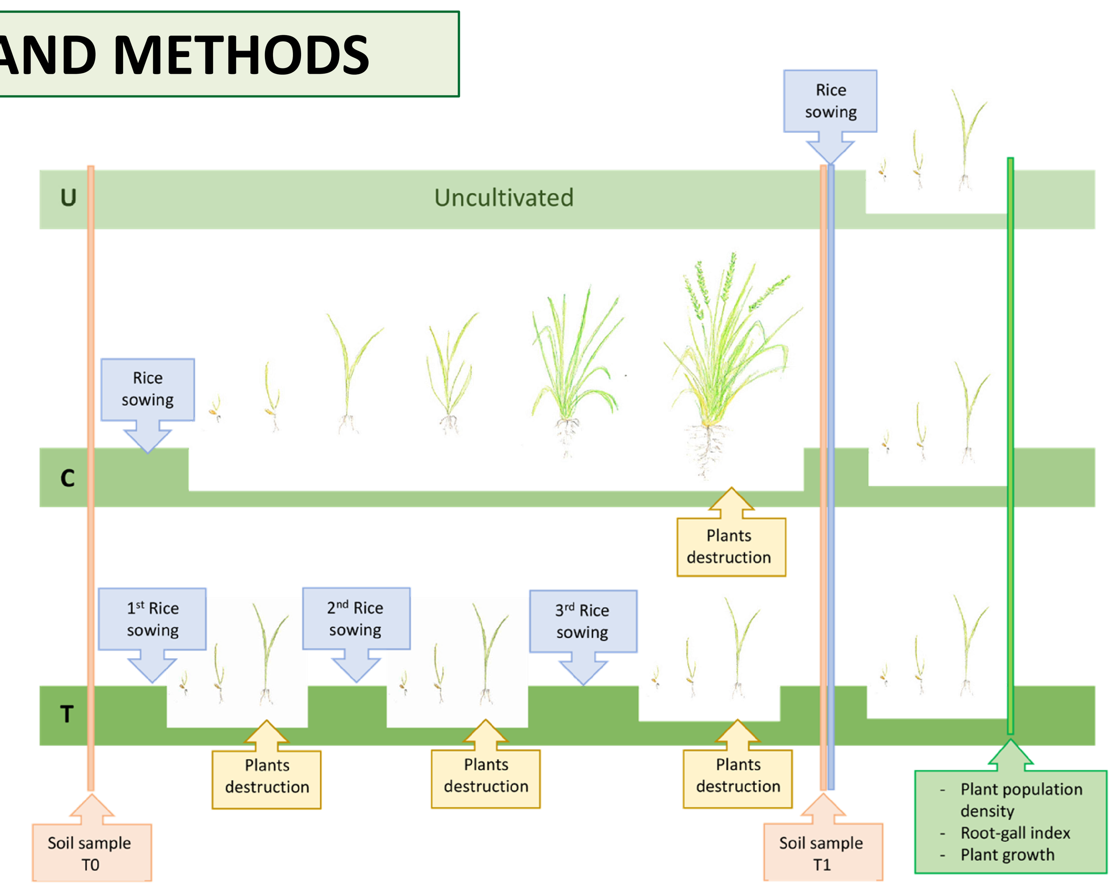
EXPERIMENTAL AREA

Rice-cultivated area at the Cascina Scalina farm, located in Garlasco (Pavia, Lombardy region, Italy)

MATERIAL AND METHODS

In 2019, field trials using rice plants as trap crops were performed.
Five plots for three different management approaches were staked out:

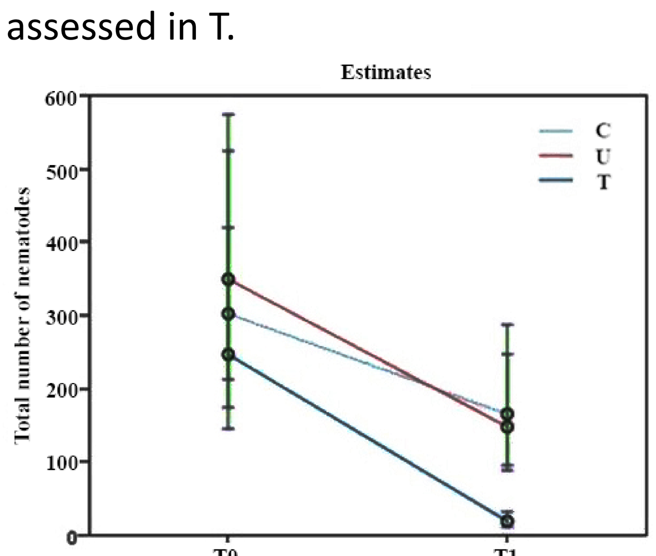
(i) **Uncultivated** (U)
(ii) **Control (C):** rice was sown and left to grow until the end of the three cycles in treated plots.
(iii) **Treated (T):** three separate cycles of rice production where plants were sown and destroyed each time at the second leaf stage.



RESULTS

1) Evaluation of Nematode Density in the Soil

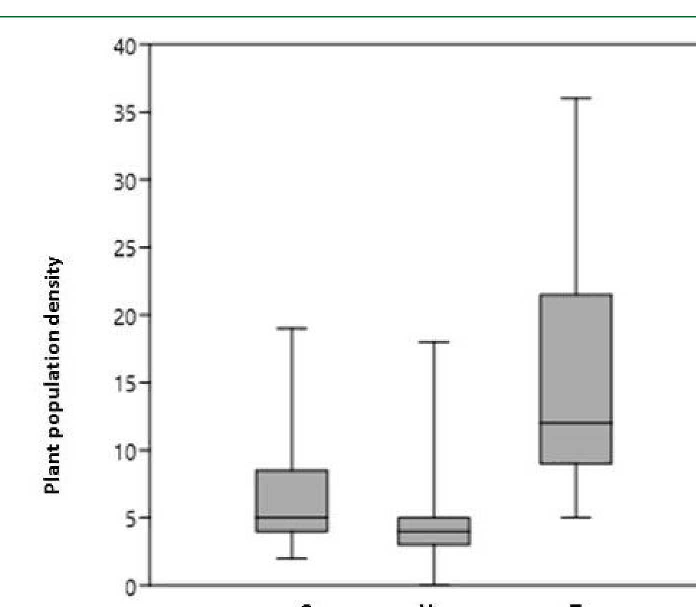
The management and the time had a significant effect on the total number of nematodes ($F = 13.641$, df = 2, 81, $p < 0.0001$ and $F = 38.563$, df = 1, 81, $p < 0.0001$, respectively).
In T0 no differences were found among managements (U, C, and T), confirming the similar distribution of nematodes in the experiment area. In T1, the number of nematodes were again similar in C and U, while a significant reduction was assessed in T.



Time	Pairwise comparisons	P
T0	C vs U	0.698
T0	C vs T	0.603
T0	U vs T	0.350
T1	C vs U	0.769
T1	**C vs T**	**0.002**
T1	**U vs T**	**0.001**

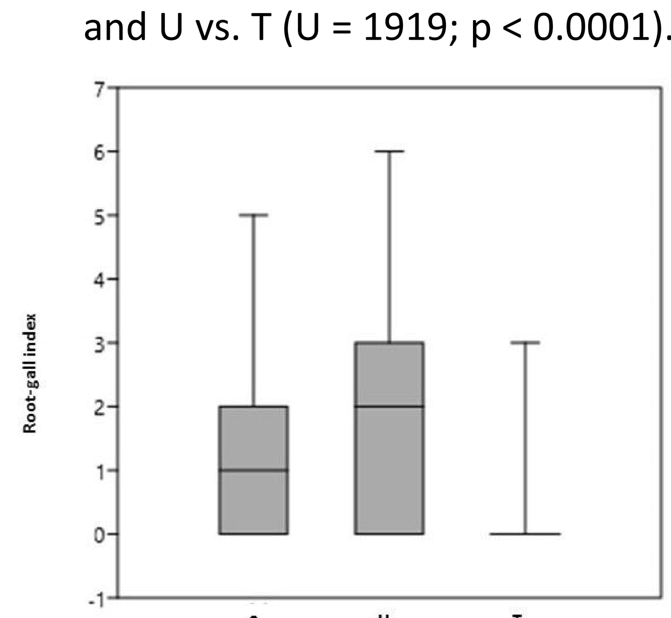
2) Evaluation of the Plant Population Density

The management had a significant effect on the plant population density per unit area ($F = 21.509$, df = 2, 72, $p < 0.0001$). Plant density was higher in treated plots (T) in comparison to both plant density in the U ($p < 0.0001$) and those in the C plots ($p < 0.001$). No significant difference was found when comparing the plant density between C and U plants ($p = 0.114$).

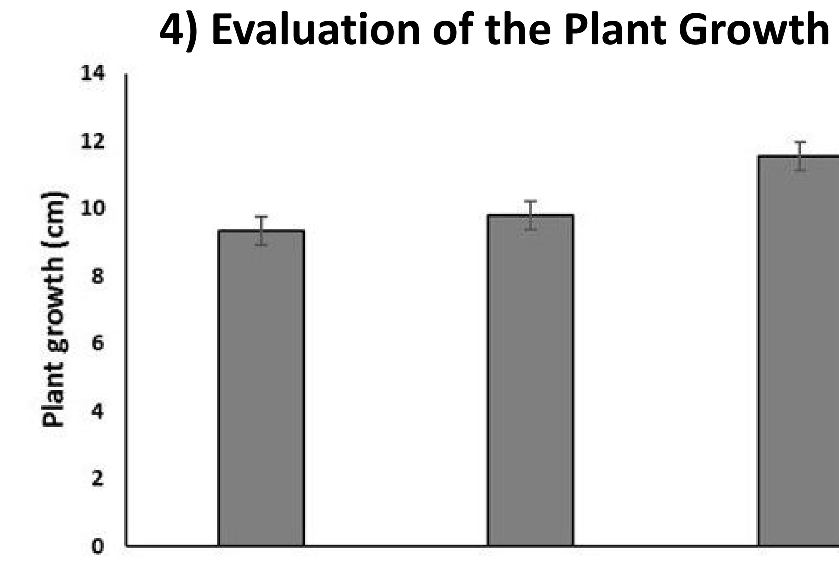


3) Evaluation of the Root-Gall Index

There was a significant difference in the root-gall index among management ($H = 63.81$, df=301, $p < 0.0001$). In particular, C vs. U ($U = 4284$; $p = 0.03$), C vs. T ($U = 2766$; $p<0.0001$), and U vs. T ($U = 1919$; $p < 0.0001$).



4) Evaluation of the Plant Growth



The management had a significant effect on the plant growth ($F = 37.107$, df = 2, 300, $p < 0.0001$). Plants were higher in T than both plants in U ($p < 0.0001$) and C ($p<0.0001$). No significant difference was found when comparing plant growth between C and U ($p = 0.105$).

DISCUSSION AND CONCLUSIONS

A decrease in the number of *M. graminicola* specimens was recorded only in the treated plots (T). Uncultivated (U) and Control (C) managements gave similar results and are perhaps related to the several weeds (e.g., *Echinocloa* spp. and *Cyperus* spp.) present in the uncultivated plots; therefore, the nematode can survive and reproduce in these alternative hosts. Rice plants grown after the three trap crop cycles showed a significantly lower infestation index in treated plots than in both control and uncultivated ones, notwithstanding the low root-gall index in all plots due to the second leaf stage of the plants. Also, the rice plants grown in the treated plots were taller by about 12% than both plants in the control and uncultivated plots at this stage of plant development. Moreover, in the treated plots, the plant population density increased by 25% and 34% compared to the control and uncultivated ones, respectively.
In conclusion, these results showed the efficacy of trap cropping as a phytosanitary measure to control *M. graminicola* in most rice-growing areas.

More information in:
Sacchi, S.; Torrini, G.; Marianelli, L.; Mazza, G.; Fumagalli, A.; Cavagna, B.; Ciampitti, M.; Roversi, P.F. Control of *Meloidogyne graminicola* a Root-Knot Nematode Using Rice Plants as Trap Crops: Preliminary Results. Agriculture 2021, 11, 37. https://doi.org/10.3390/agriculture11010037