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Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

Centro di ricerca
Cerealicoltura e Colture Industriali

Agroecology and plant protection tools

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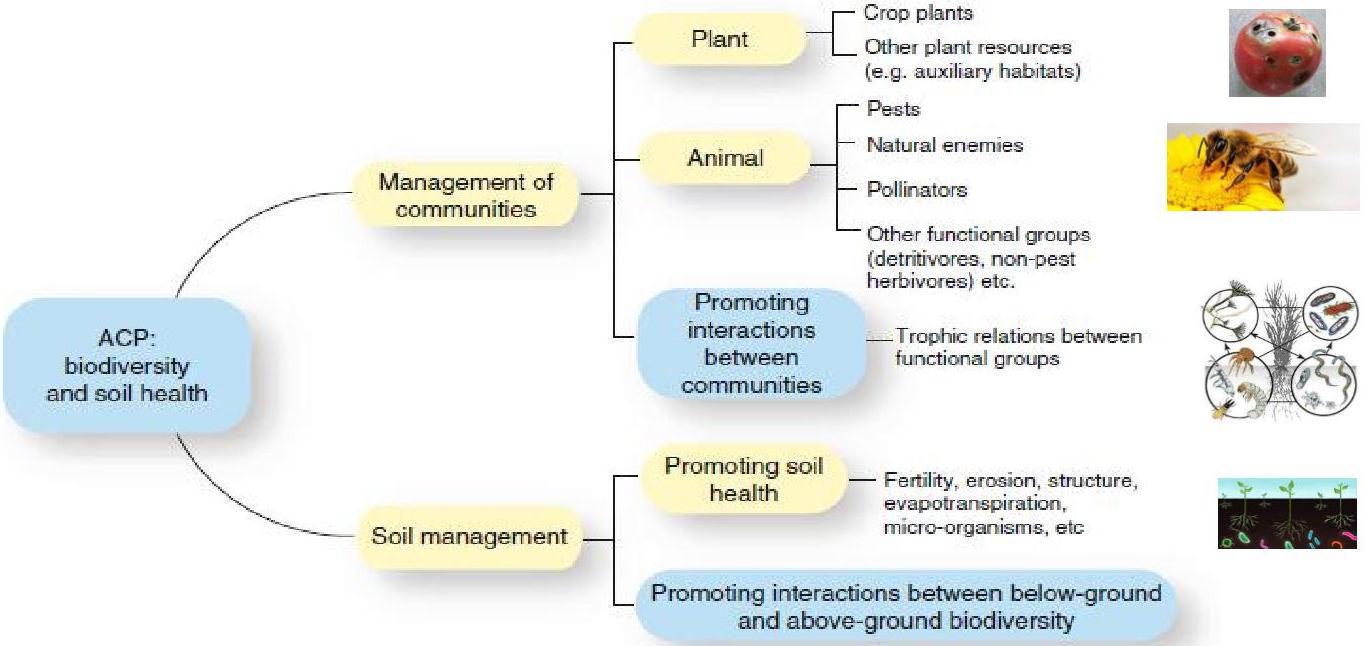
“For every complex problem, there is always a simple solution. Which is wrong.”
— George Bernard Shaw

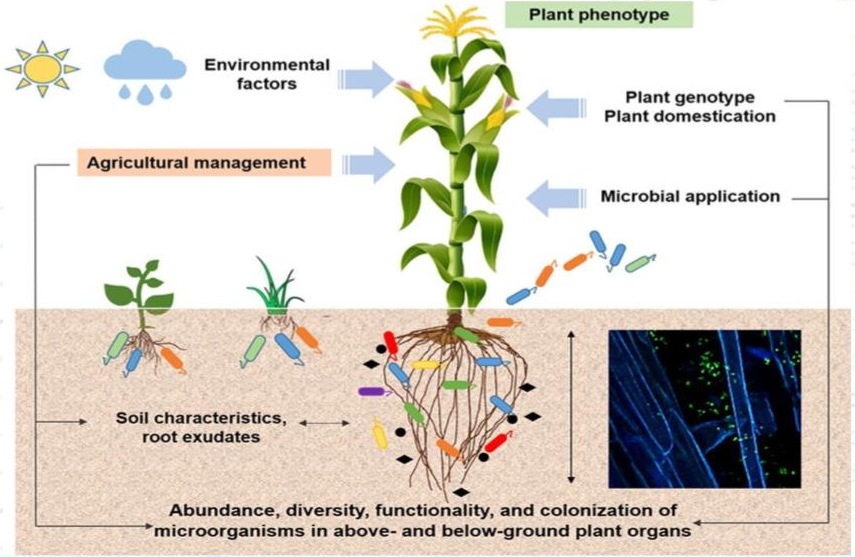
In the last decade, the challenges of the agricultural world have changed under the combined influence of ecological and sociological factors: climate change, loss of biodiversity, scarcity of land, urbanization, shifts in public opinion, and demographic pressure. These changes are interacting variables that increasingly shape legislation in Europe and around the world, and all this is driving a significant transformation in the way agriculture is practiced.

Since 2000 the application of **agro-ecological** principles are increasingly at the core of innovation and production processes.

From integrated pest management to agroecology in crop protection



Agroecology is based on the study of purely ecological phenomena within the agroecosystem, which is considered in its entirety, recognizing the close interconnection of each element with the others and with the surrounding environment.



Finally, from the perspective of production and research, agriculture is regarded as a necessary 'disturbance' of the natural ecosystem, which can be managed by applying the principles of ecology.

From IPM to ACP (Agroecological Crop Protection)

In the agro-ecosystem, the same ecological processes occur as in any natural plant community, including competition, succession, nutrient cycling, and predator–prey interactions. The objective is to analyze these dynamics to effectively manage the agro-ecosystem and sustain productive functions, while minimizing dependence on external inputs that generate adverse environmental and social impacts. This issue is particularly critical in tobacco cultivation, where agrochemical availability is limited.

Agroecological protection must simultaneously reduce impact and disturbance while also, whenever possible, striving to restore the natural biological balance of the agroecosystem—since it is this balance that ultimately governs sustainability

IPM is a set of practical techniques, while ACP refers to the scientific framework of agroecology (Gliessman 1997). It draws on biology and ecology, applying this knowledge to farming practices by considering, at different scales, aspects such as functional biodiversity and how agroecosystems work. In practice, agroecology turns this knowledge into a clear, step-by-step approach.

From integrated pest management to agroecology in crop protection

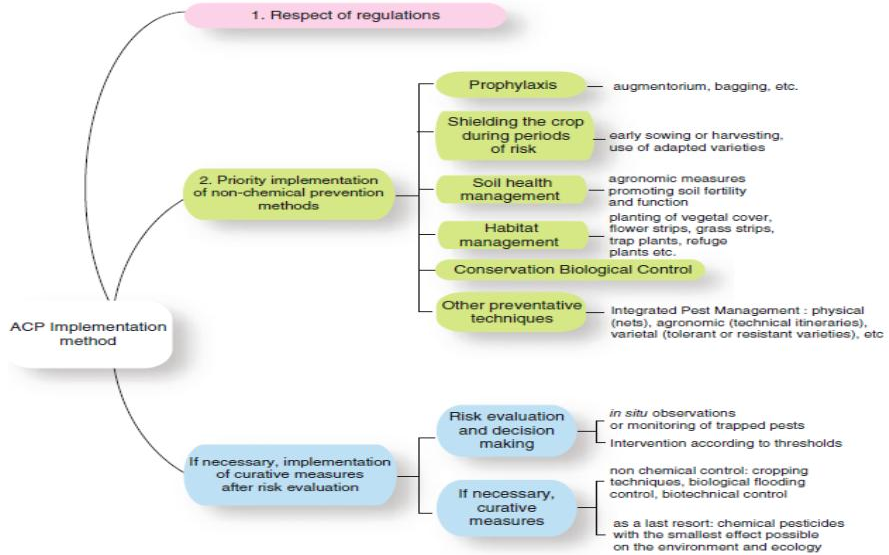


Fig. 1.8 Implementing Agroecological Crop Protection in the plot

Innovations are acceptable only when they are perfectly integrable with each other, contributing to the improvement of all the performance requirements of this type of cultivation.

It should be noted that substitution evaluation of single innovations has been applied in the past to fertilizers or pesticides, with the idea that complexity could be managed through the notion of a single solution for each specific problem.


Tobacco

Evaluation of innovations to be applied in agroecological pest management

Use of organic matter, BCAs, new dual-purpose products and copper reduction

Nitrogen and containment of *P. tabacina*

Use of smart technology

Incorporation of formulations based on BCAs

The introduction of BCAs formulations for the control of soil-borne diseases is no longer just a method to control soilborne pathogens but must be used routinely to maintain soil and plant health alongside organic fertilization.

It should be noted that the results presented are not directly transferable to other host-pathogen pairs.

Organic matter + BCAs against P. parasitica

Organic matter + BCAs against P. parasitica

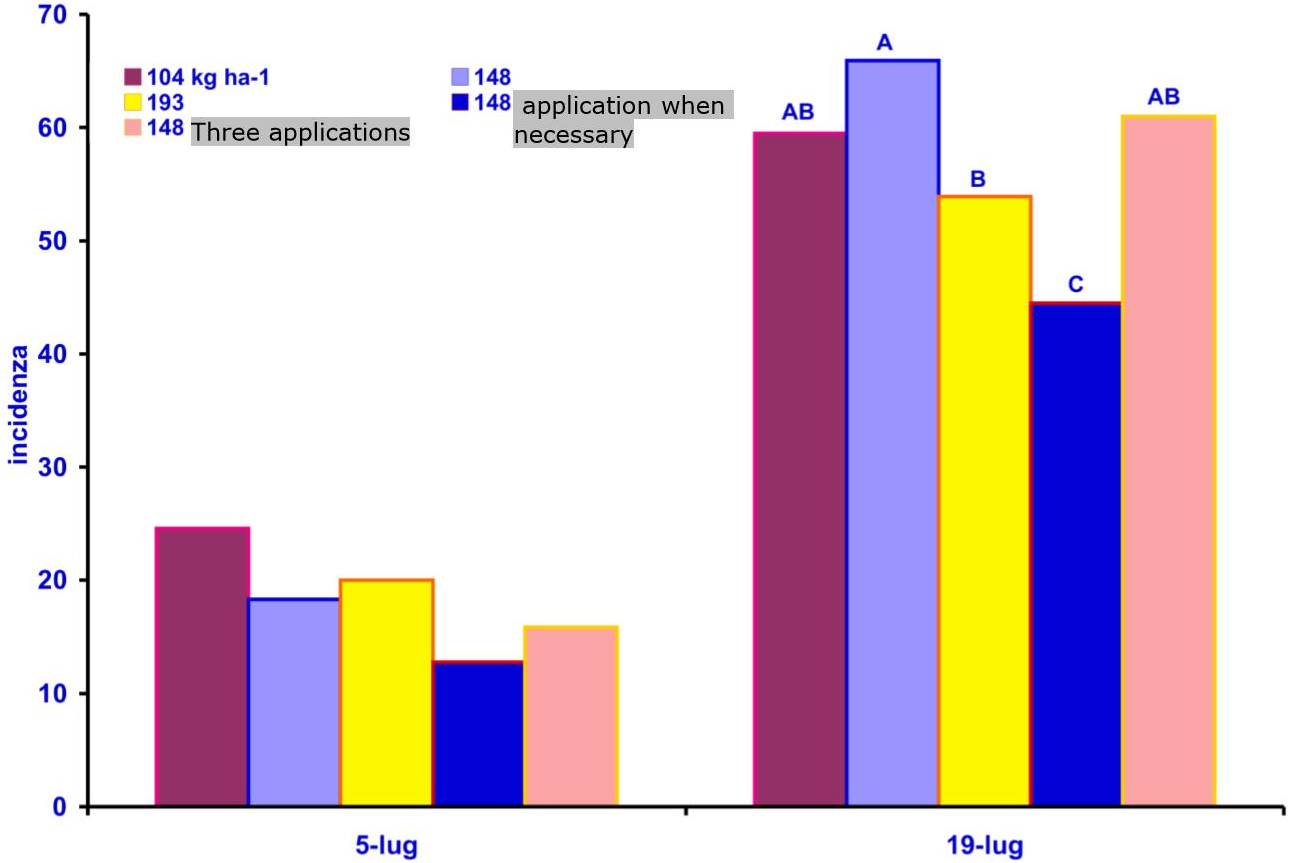
Disease incidence

Mineral fertilization	43.1 a	67,5 a
Organic fertilization	21.0 b	27.5 b
Fungicides	16.2 c	26.2 b
BCAs	19.2 bc	30.5 b
Fungicides + Mineral fertilization	29.3 b	30.5 b
Fungicides + Organic fertilization	10.2 d	14.5 c
BCAs + Mineral	24.2 b	26.1 b
BCAs + Organic fertilization	2.4 d	3.8 c

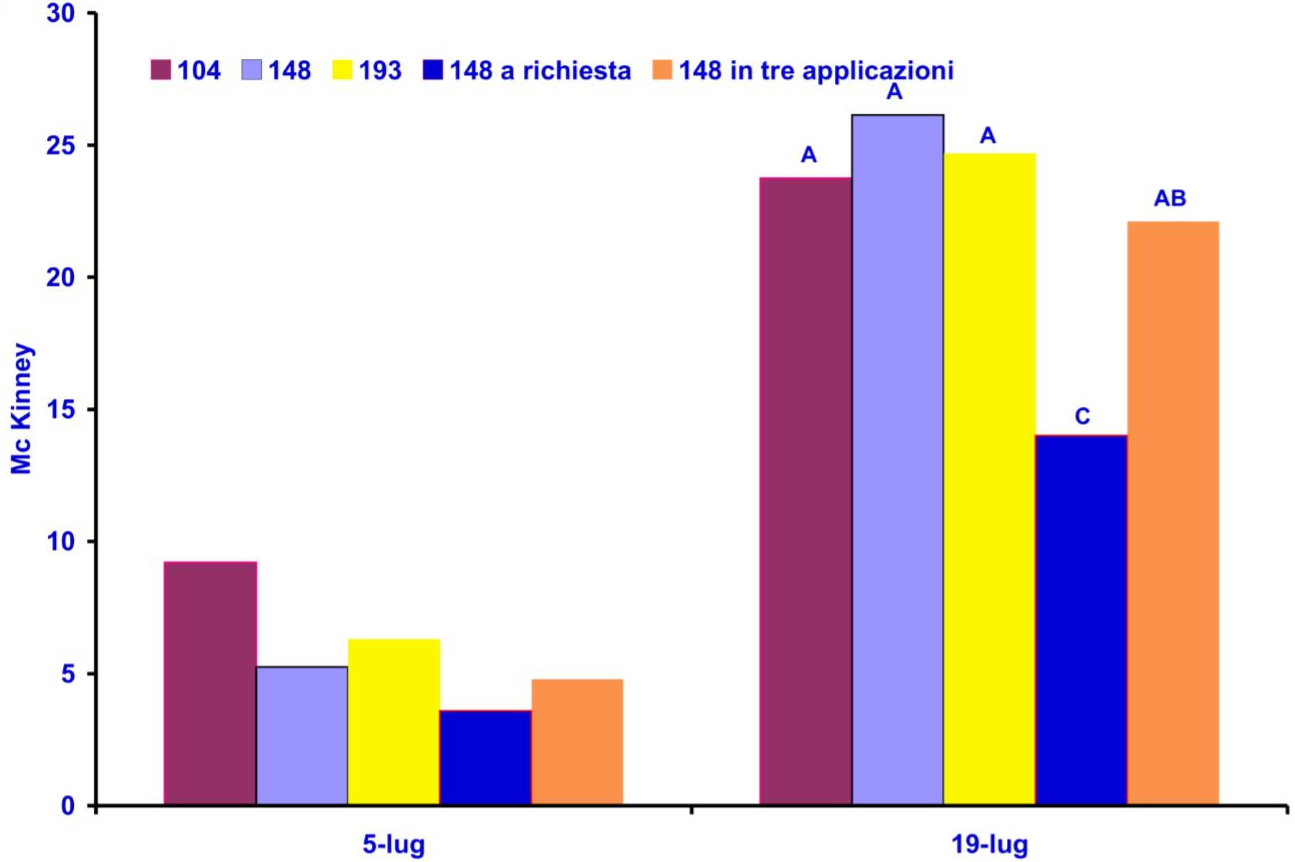
BCAs = consortium of *Trichoderma* and *Clonostachys*

Susceptibility to *P. tabacina* as a function of nitrogen fertilization

Susceptibility to *P. tabacina* and nitrogen fertilization

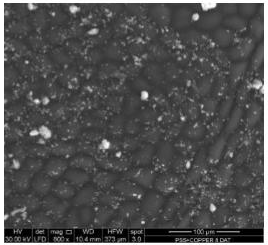


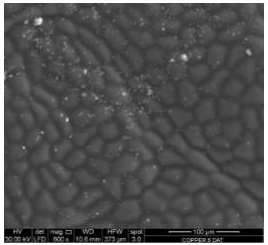
Susceptibility to *P. tabacina* and nitrogen fertilization



P.Syringae control dual-purpose products and copper reduction

Polysaccharide: based on galactomannans extracted from carob (Lerigel® - PSS)
Stable in water
Expansion equal to 25% of its initial volume
Biodegradation time is 4 weeks





dual-purpose products and copper reduction

TESI	Number of leaves	Total weight of leaves plant^{-1}	Mean weight of stems	Mean weight of leaves
Untreated control	18.2	1672.5	731.7	92.1
Cupric fungicides	18.7	1710.1	800.8	91.7
New molecul	21.7	2388.3	1256.7	110.2
Strategy	20.5	2102.2	1059.8	101.2

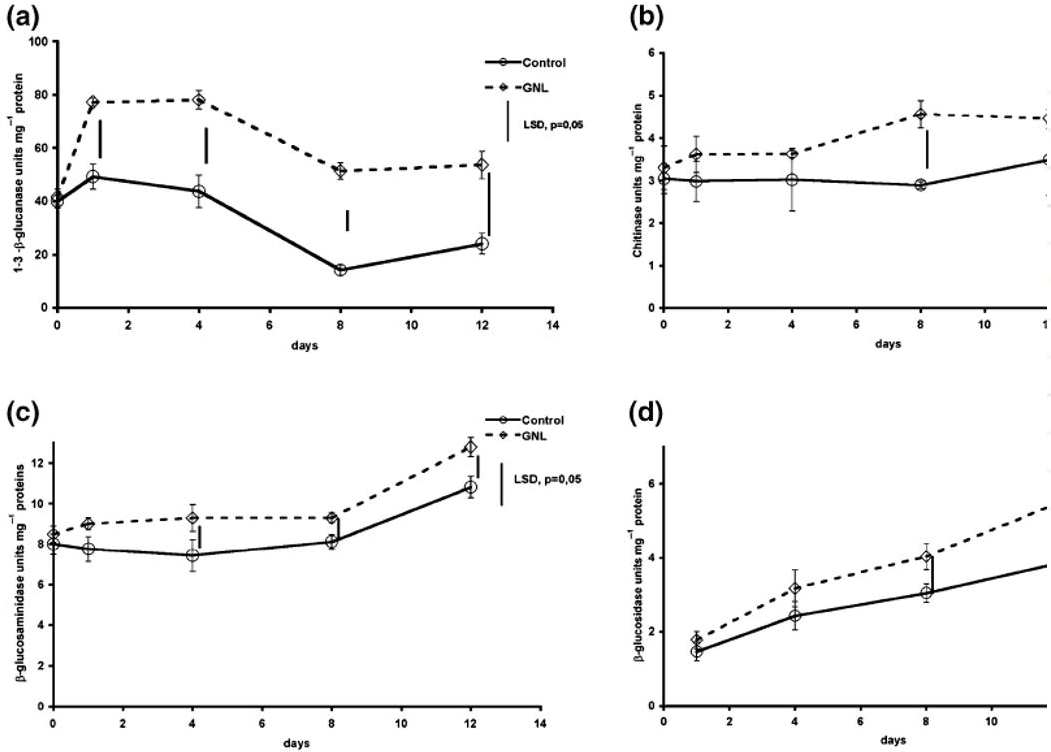


Fig. 1 Enzymatic activities in leaves of tobacco plants treated or not (control) with *Gliocladium roseum* (GNL) conidia suspension at different times after inoculation. (a) 1,3-β-Glucanase, (b) chitinase, (c) 1,4-β-glucosidase, (d) *N*-acetyl-β-D-glucosaminidase

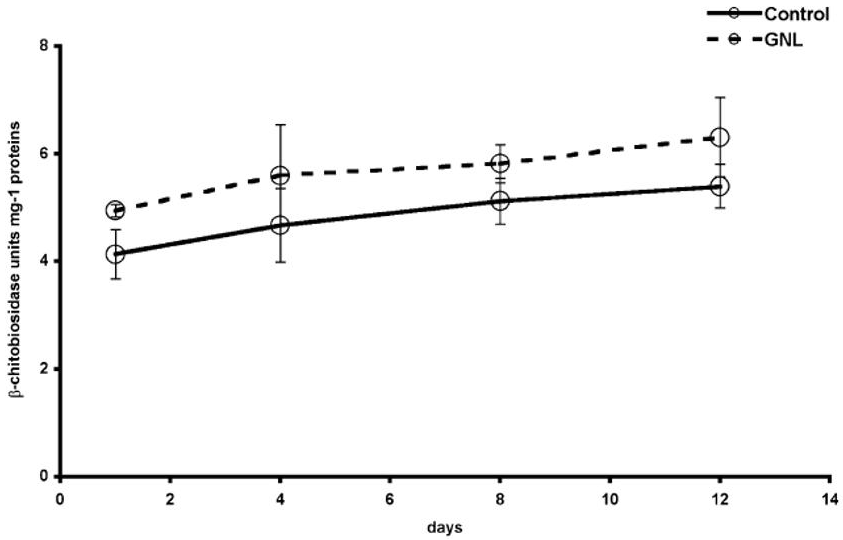


Fig. 2 β-D-*N*-*N*′-Diacetyl-chitobiosidase activity in leaves of tobacco plants treated or not (control) on roots with *Gliocladium roseum* (GNL) conidia suspension at different times after inoculation

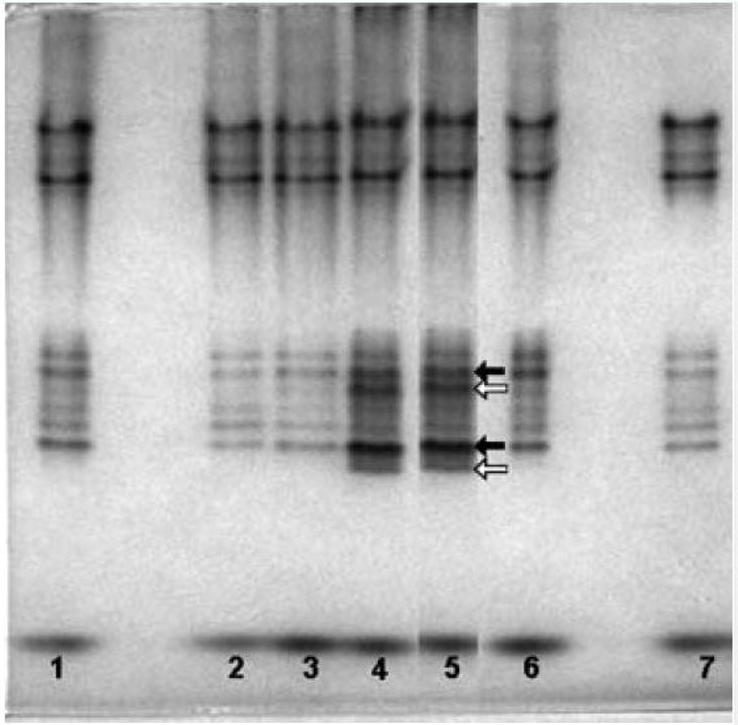
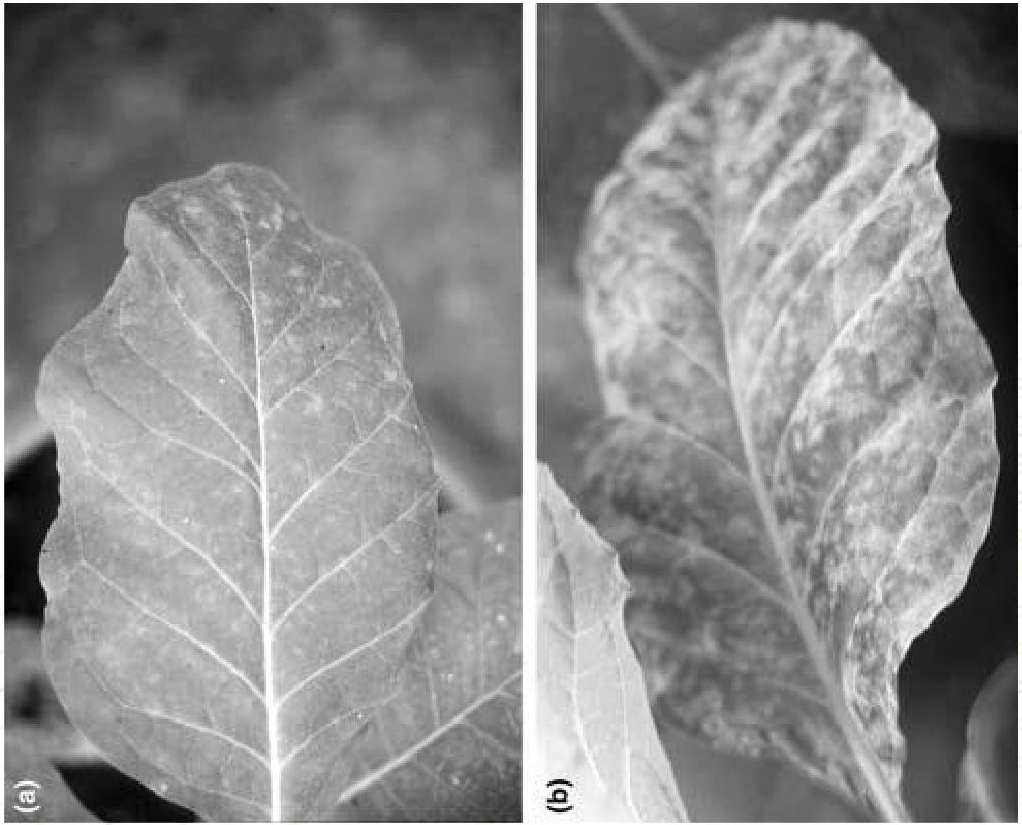


Fig. 3 Isozyme polyacrylamide gel electrophoresis (PAGE) stained for peroxidase activity, of leaf extracts of tobacc treated or not (control) with *Gliocladium roseum* (GNL) cor pension at different times after inoculation. Empty arrows

dual-purpose products and copper reduction



dual-purpose products and copper reduction

Smart technology

Nematool®

Nematool digital tool alert

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0%

100%

Allert VERDE: periodo di sviluppo dei nematodi

Allert ARANCIO: le forme adulte di nematodi si apprestano allá deposizione delle uova

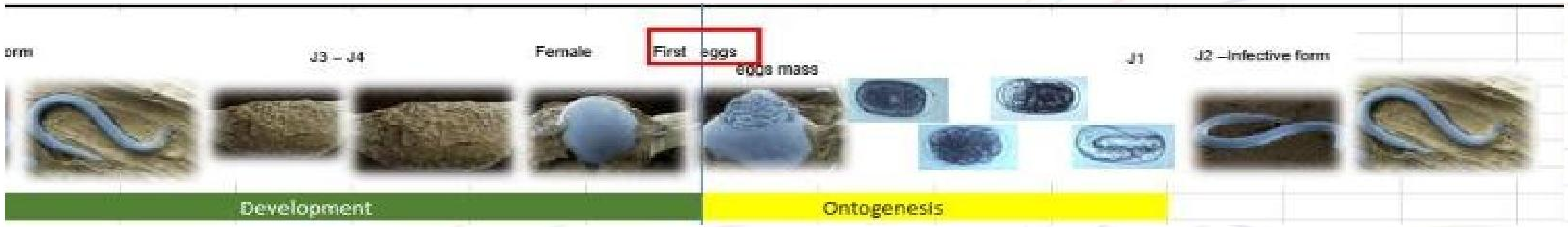
Allert ROSSO: Ovideposizione

Allert BLU: J2 in sviluppo

Nematool Model & Meloidogyne Life Cycle

Alert Nematool

Biological Cycle



Solution

Ovicidal products attack the eggs and other static forms of nematodes

Direct nematicidal action on the mobile forms

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Agroecological management fundamentally relies on making informed choices, integrating them to achieve both environmental and economic sustainability, while assessing the combined impact of innovations

Thank you for your kind attention


AGAIN