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Management of the Plant-Parasitic Nematodes with Approved Nematicides by CIBRC: Safe and Effective Solutions

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Plant-parasitic nematodes (PPNs) are among the most destructive soil-borne pathogens, causing significant yield losses in a wide range of agricultural crops. As rapid and effective nematode suppression is crucial for maintaining crop productivity, the Central Insecticides Board and Registration Committee (CIBRC) has approved several biological and chemical nematicides for field use. Chemical nematicides such as carbofuran, dazomet, fluensulfone and fluopyram provide fast population reduction under high nematode populations, while biological agents including *Pseudomonas fluorescens*, *Trichoderma* spp., *Paecilomyces lilacinus* and *Verticillium chlamydosporium* contribute to sustainable management through enhanced soil microbial activity, reduced toxicity and improved plant resilience.

Keywords: CIBRC, Plant-Parasitic Nematodes, Crop losses and Nematicides

Introduction

Plant-parasitic nematodes (PPNs) are microscopic roundworms that parasitize plants, primarily attacking roots and interfering with the uptake of water and nutrients. More than **4,100 species** of plant-parasitic nematodes have been identified and this number continues to rise as cropping systems evolve and new species emerge as pests. These nematodes are significant threats to global agriculture and as they are damaging vegetable, fruit and cereal-based production systems. The global distribution of PPNs varies widely depending on climate, host availability and cropping practices. Some nematodes are **cosmopolitan,** such as many **species of nematodes,** which occur across tropical, subtropical and temperate regions.
The most important 10 plant parasitic nematodes are the root-knot nematodes (*Meloidogyne* spp.), Cyst nematodes (*Heterodera* and *Globodera* spp.), Reniform nematodes (*Rotylenchus reniforms*), Lesion nematode (*Pratylenchus* spp.), Burrowing nematode (*Radopholus similis*), *Ditylenchus* spp., Pine wilt nematode (*Bursaphelenchus xylophilus*), *Xiphinema index*, *Nacobbus aberrans* and *Aphelenchoides besseyi* (Jones *et al*., 2013)

Crop losses and Economic impacts

Plant-parasitic nematodes are causing approx $80–118 billion **annual global crop loss. I**n tropical and subtropical regions, yield reductions are more severe, averaging **14.6%** compared to **8.8%** in developed countries. PPNs cause extensive economic losses in various crops annually. Specifically, the total loss across 30 crops is estimated at Rs. 102,039.79 million with fruits suffering the highest damage at 25.5%, vegetables at 19.6% and spices at 29.5%. Field crops such as cereals, pulses, oilseeds and fibers show overall losses of about 18.23% with pulses experiencing the highest percentage loss of 23%. Among individual crops, rice incurs the greatest damage with nematodes like *Meloidogyne graminicola* causing

losses of Rs. 23,272.32 million, representing the largest single impact among all crops and nematode species considered (Kumar *et al*., 2020).

Notably, root-knot nematodes (*Meloidogyne* spp.) are responsible for approximately Rs. 77,373.87 million of the total losses accounting for about 75.83% of the overall damage, making them the most economically significant group of plant-parasitic nematodes. Other notable impacts include damage to citrus, banana, tomato, brinjal and okra with losses varying from Rs. 2,480.86 million to Rs. 9,828.22 million depending on the crop. The widespread distribution and high damage potential of these nematodes underscore their critical role in crop yield reductions and economic losses in agriculture (Kumar *et al*., 2020).

Symptoms

Plant-parasitic nematodes cause damage to roots by leading to stunted growth, formation of galls and development of lesions, which reduce the roots ability to absorb water and nutrients, ultimately decreasing plant growth and crop yields. Some nematodes create wounds on roots that can be invaded by fungi. In addition to roots, certain nematodes attack above-ground plant parts, producing symptoms such as distorted leaves, cracked stems or galls replacing seeds in grasses.

Table- Recommended nematicides by Central Insecticides Board and Registration Committee (CIBRC)

Carbofuran 3% CG		
Sr. No.	**Crop**	**Nematode**
1	Wheat	Cereal Cyst Nematode (2000 a.i./hac.)
		Ear- Cockle (3000 a.i./hac.)
2	Barley	Cereal Cyst Nematode (1000 a.i./hac.)
3	Rice	(1500 a.i./hac.)
4	Soybean	Root- Knot nematode (1500 a.i./hac.)
5	Jute	(1000 a.i./hac.)
6	Citrus	(360 a.i./hac.)
7	Banana	1.5gm per sucker
8	Brinjal	RKN, Reniform nematode (1000 a.i./hac.)
Dazomet (Soil fumigant)		
9	Tobacco nursery	RKN, Stunt and Reniform nematode
10	Tomato nursery	RKN
Fluensulfone 2% GR		
11	Tomato	*Meloidogyne* spp.
12	Cucumber	*Meloidogyne* spp.
13	Okra	*Meloidogyne* spp.
14	Pomegranate	*Meloidogyne* spp.
Fluopyram 34.48 % SC		
15	Tomato	RKN
16	Cucumber	RKN
Biological Nematicides		
***Pseudomonas fluorescens* 1.0% WP (Seed+ Nursery+ Soil application)**		
17	Tomato, Brinjal, Carrot, Okra	RKN
***Trichoderma harzianum* 1.0–1.5% WP**		
18	Tomato, Brinjal, Carrot, Okra	*M. incognita*
	Gerbera, Carnation, Tuberose	*Meloidogyne* spp.
	Acid lime	*Tylenchulus semipenetrans*
	Papaya	RKN+ *Reniform* Nematode
***Trichoderma viride* 1.5% WP**		
19	Tomato, Brinjal, Carrot, Okra	*M. incognita*

***Verticillium chlamydosporium* 1.0% WP (Egg- parasitic fungus)**		
20	Tomato, Brinjal, Carrot, Okra	*M. incognita*
***Paecilomyces lilacinus* 1.15–1.50%**		
21	Brinjal, tomato	RKN

(GOI, MA&FW and DPPQ&S) *(a.i.- Active ingredient, hac.- Hectare)

Conclusion

Effective management of plant-parasitic nematodes is essential to safeguard crop productivity and economic returns in Indian agriculture. The biological and chemical nematicides recommended by the Central Insecticides Board and Registration Committee (CIBRC) provide reliable, science-backed options for nematode suppression. Chemical nematicides such as carbofuran, dazomet, fluopyram and fluensulfone ensure rapid population reduction, particularly where high infestations threaten severe yield loss. Complementarily, approved biological agents including *Pseudomonas fluorescens*, *Trichoderma* spp., *Paecilomyces lilacinus* and *Verticillium chlamydosporium* offer eco-friendly suppression while improving soil health and promoting long-term sustainability. The use of these CIBRC-approved products as part of an integrated nematode management strategy enhances crop protection while minimizing environmental and residue-related concerns.

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