PHC68949: The Only Bionematicide That Protects the Plant from Inside Out

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Plant Health Care, Inc. (PHC) is a global company dedicated for more than two decades to the development and commercialization of peptide elicitor technologies which enable plants to express their full productive potential.

Peptides are the new frontier that the market is starting to recognize, and which are the essence of the technologies PHC has successfully developed and scaled to commercial business in the biologicals market space.

The newest technology, based on the peptide PHC68949, is in process of being registered in Brazil and the US as a biological solution to protect plants from yield and quality losses associated with damage from soil dwelling plant parasitic nematodes. The proposed label and use instructions encompass a wide range of crops including vegetables, row crops, fruit trees, vines, and specialty crops. PHC68949 will provide growers with highly flexible nematode control because it can be applied as foliar spray, or as a seed treatment via both on-farm and industrial seed treatment. As a peptide-based technology, PHC68949 breaks down rapidly within the environment, has no adverse effects on non-target organisms, and has a zero-day preharvest interval with no restrictions on maximum residue limits in harvested seed or crops.

Nematodes are microscopic parasitic worms that live in soil and feed on plant roots, affecting crop yields. The annual crop losses caused by nematodes were estimated, in 2015, at 12.3% of worldwide production and worth about US$157 billion.

Upon application to the plant or seed, PHC68949 initiates a complex set of metabolic responses in the treated plants, activating gene expression linked to an innate plant defense and growth response common in all agricultural crops. This activation leads to reduced nematode root feeding and changes in the root exudates within the rhizosphere that inhibits nematode egg hatching, increasing crop development, stand establishment and vigor, which ultimately results in improved yield and harvest quality.

As with all harpin-derived peptides, PHC68949 is not 'cidal: It does not have any direct activity on nematodes or other pathogens or pests. Rather, its application to plants elicits a complex natural defense mechanism, similar to a broad-spectrum immune response in animals.

PHC68949 is a third generation harpin peptide that has been specifically screened and optimized by Plant Health Care to elicit a systemic acquired resistance mode of action which results in commercially acceptable resistance to nematode damage in a wide range of annual and perennial crops.

Laboratory, growth chamber, and field trial results confirmed that PHC68949 is an innovative technology that is highly compatible with a wide range of agricultural products including chemicals, biologicals, and nutrients. As such, PHC68949 can be used alone or in combination with other registered products to protect crops and improve yields.

Results from field trials to assess PHC68949 efficacy, crop tolerance, and yield response on almond, grape, pepper, tomato, walnut, and soybeans as representative crops, demonstrate that foliar or seed treatment applications of PHC68949 provides statistically significant control of damage that is equivalent to, and often better than current commercial standards for the following nematode pests:

- Pin nematodes (*Paratylenchus* sp.)
- Root knot nematodes (*Meloidogyne* sp.)
- Root lesion nematodes (*Pratylenchus vulnus*; *Pratylenchus brachyurus*)
- Southern root-knot nematode (*Meloidogyne incognita*)
- Stubby root nematode (*Paratrichodorus* sp.)

PHC68949 has no phytotoxicity. It is safe on all crops tested when applied as a seed treatment at maximum rates such as 120 ug/seed and via foliar application at rates of 1–2 oz/acre (70–140 g/ha). Furthermore, applications of PHC68949 on a wide range of crops presents commercially acceptable nematode control, improved crop yield and harvest quality providing growers with a positive economic return on investment equivalent to or better than the commercial positive control.

It is well recognized that a common problem with non-conventional biological pesticides is the inherent inconsistency of product efficacy associated with performance variability across different agronomic and environmental conditions. In this sense, PHC68949 is a unique biological pesticide as product efficacy and value has been confirmed as highly consistent, and in many

Pictures 1 and 2: *Field trial visits in Brazil, showing symptoms of P.brachyurus in soybeans – root lesions, at Agro Carregal (upper) and chlorotic spots, at Juliagro (lower), February 2023, Brazil.*

> *"Based on soybean data and initial evaluations in coffee, we could see promising results from PHC68949 for three nematode species: Root-lesion nematode (Pratylenchus brachyurus), Root-knot nematode (Meloidogyne incognita) and Spiral nematode (Helicotylenchus sp.). The plant's elicitor response over time seemed to be effective, with the plant responding in productivity and I would even say that we underestimated the product because we compared it with another biological one as a standard treatment and I would suggest comparing it with chemical nematicides and other market-leading biological strains."*

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cases, similar to results observed from applications of synthetic chemical pesticides without use restrictions commonly associated with Pre-Harvest Intervals, Crop Residues, and Maximum Residue Limits (MRLs) which often limit export markets.

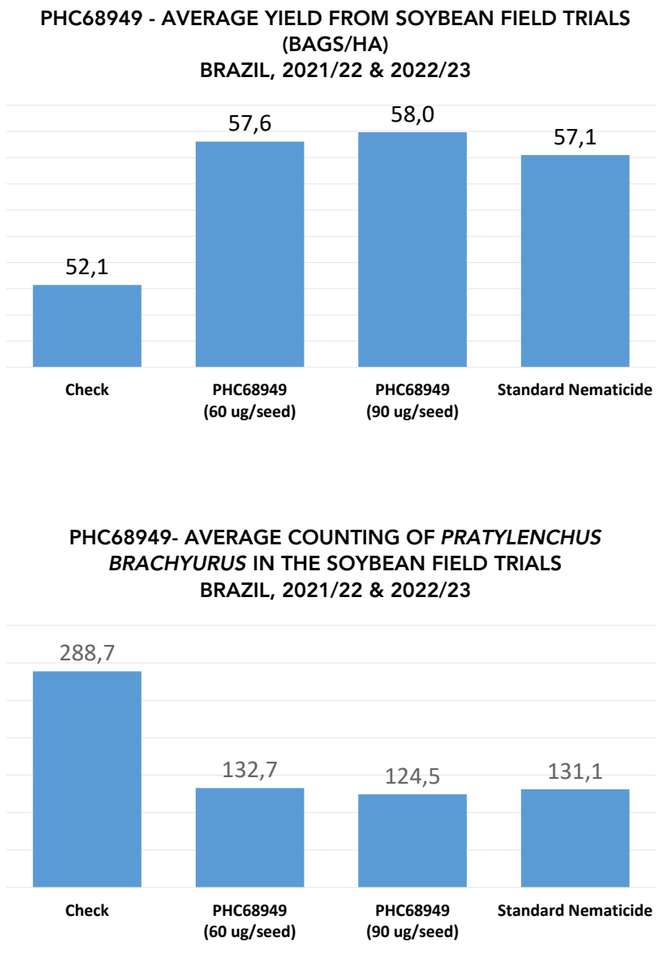
PHC68949 is also unique as it provides growers with a new mode of action to control plant parasitic nematodes either alone or in combination with current agricultural practices as part of an Integrated Pest Management (IPM) program. PHC has developed PHC68949 in cooperation with world-leading nematologists who have repeatedly and conclusively stated that growers appreciate new low risk products as alternatives to conventional pesticides.

PHC68949 has demonstrated product efficacy equivalent to registered nematicides, which represents a breakthrough for biological products. Plant Health Care will continue to invest in field trials to further characterize, understand and confirm product efficacy relative to registered commercial standards. PHC believes that growers will appreciate the opportunity to add PHC68949 to their toolkit to control nematode pests. PHC68949 is expected to be initially launched in Brazil for the control of soybean lesion nematodes, followed by expansion into other crops and geographies globally in coming years. Pictures 3 and 4 show a summary of the results achieved using PHC68949 in seed treatment in soybeans in Brazil in the last two seasons (2021/22 and 2022/23).

It is well known that the world's diverse agricultural production systems and markets suffer economic loss associated with infestation of many different species of root-feeding nematodes that attack a wide range of plants, including many common vegetables, fruit trees, and ornamentals. Nematodes represent a unique challenge to commercial agriculture as they are difficult to control and scout, as they demonstrate temporal and spatial variability.

In summary, PHC68949 represents a unique and highly efficacious product that is safe on crops, free of environmental and crop residue issues, and controls a wide range of nematode pests through a unique mode of action that disrupts the life cycle of this ubiquitous pest.

Count on PHC to continue to invest in and develop innovative crop protection technologies to deliver sustainable solutions that add value to growing agricultural markets. For further updates, please follow PHC's website and social media platforms to receive upcoming news.



Pictures 3 and 4: *PHC68949 field trial results from soybeans seed treatment. Season 2021/22 and 2022/23, Brazil.*