Sea Nymph (Galway Bay Marine) Ltd

The Effects of Seaweed Extract Against Nematodes

Information is available for the effects of seaweed extract against a number of nematodes; the majority of the research conducted has used alkaline extracts of *Ascophyllum nodosum* against *Meloidogyne incognita*, *M. javanica*, *M. chitwoodii*, *M. nassi* (root knot nematodes), *Globodera rostochiensis* and *G. pallida* (potato cyst nematodes (PCN)). Not all the nematodes are affected equally by seaweed extract, *M. incognita*, *M. javanica* and the PCN were affected more than *M. chitwoodii* and *M. nassi.* Other nematodes may also be affected by seaweed extracts.

The major problem area for soil-borne parasitic nematodes is the top 15 cm of soil, therefore, to affect the nematodes the seaweed extract must either be applied and incorporated into at least the top 15 cm of soil, or must stimulate root growth sufficiently so that the plant quickly grows through that most susceptible layer of soil.

For the PCN the eggs are contained in the tanned, hardened female body (or cyst) and located within the soil profile. When potato roots are in close proximity the exudates are detected by the cyst, which stimulates the eggs to hatch. The resulting juvenile nematodes are referred to as juvenile stage 2, or J2's for short. These will emerge through one of two openings in the cyst and "swim" towards the potato root tips.

Once at the root tip, if they have 50% or more of their lipid energy reserves left, they are able to penetrate the root where they migrate up into the body of the root. At that point they will reach maturation, passing through juvenile stage 3 and 4 before differentiating into either males, or females. The males exit the root and will fertilize the females. The females form feeding sites with their dorsal end emerging from the roots – once fertilized the eggs form in the part of the female that is outside of the roots and as the plant and egg sack mature the female will eventually die leaving behind the eggs contained within her body – her body will harden to form a new cyst.

The major damage caused by these nematodes is the cellular destruction caused by the migration of the J2's from the root tips to where the females form their feeding sites and the males exit the roots as well as the drain on nutrition from the plants by the feeding females.

A similar life cycle occurs for the root-knot nematodes, however, the eggs are contained within a gelatinous mass that develops within the roots of plants and that are only released after root death; the major damage is caused from the migration of the J2's within the roots, the misshapen roots that result from such invasion and the drain on nutrients by the feeding females.

The application of an alkaline extract of *Ascophyllum nodosum*, such as *"SEA NYMPH"* Seaweed Extract can affect each stage of the nematodes life cycle.

When applied to cysts of the PCN fewer J2's emerge from those cysts, this may be due to the stimulation of growth of naturally occurring fungi found on and in the cysts that results in their hyphae simply blocking the two openings in the cyst thereby not allowing the emerged J2's to "swim" out of the cyst.

The seaweed extract can also lead to the disorientation of the J2's of both the *Meloidogyne* and *Globodera* species. The mechanism for this disorientation is not clear, but results in fewer J2's being able to locate the root tips of the potential host plants. Even for those J2's that do find the root tips, if they have spent too long doing that and have "swum" around for a while, if they have burned up over 50% of their lipid reserves they will be unable to penetrate the roots and enter.

The net result is less J2's invading / infecting the roots of susceptible plants and so less damage being caused to those plants.

Once in the roots the seaweed extract continues to affect them. Those that can enter the roots still cause damage but their maturation is slowed down, by only a day or so going through the juvenile stages J2-J4 but by up to 10-11 days or more to form either mature males or females. Those nematodes that successfully form females tend not to establish such good feeding sites - this ultimately results in less eggs being produced per cyst or egg sack.

The reasons why the application of seaweed extract to the soil around the roots of plants and to the plant roots themselves causes the above mentioned effects is unclear, however, it is known that *"SEA NYMPH"* Seaweed Extract can elicit a Localized and Systemic Acquired Resistance (LAR and SAR) effect in plants and it may be related to that. It may also be due to a combination of the weakening of the J2's treated with the seaweed extract when in the soil profile, plus the direct L/SAR effects of the seaweed extract on the plants.

The effect of applications of *"SEA NYMPH"* Seaweed Extract on the plant itself should not be overlooked, the direct L/SAR effect has been mentioned above; however, it is also known to increase root growth and depth, particularly early root growth. If the roots can grow through the critical top 15 cm of soil faster, it will result in a greater tolerance of the plants to any nematode infestation.

It should be borne in mind that *"SEA NYMPH"* Seaweed Extract is not a nematicide, its' effects are probably manifested through the stimulation of antagonists to the nematodes in the soil and maybe the physical blocking of the sensory apparatus of the nematodes. It will also have direct effects on the plant, stimulating the plants natural defense systems against nematode attack as well as stimulating early plant growth, particularly root growth.

How should *"SEA NYMPH"* Seaweed Extract be used to help ensure optimum impact against parasitic nematodes?

It is critical that the seaweed extract be maintained in the top 15 cm of soil throughout the most susceptible growing period of the crop. If at all possible, applications of *"SEA NYMPH"* Seaweed Extract should commence before the crop is planted and certainly before emergence.

For maximal results against the nematodes the levels of *"SEA NYMPH"* Seaweed Extract needed in the soil profile are quite high – between 1-2% by volume - however, this would be uneconomical to achieve except if drip irrigation or some form of fertigation is used, then a zone immediately around the roots could be maintained with a level of seaweed extract permanently in it. However, there is a balance to be struck between the desired effects against the nematodes, the economics of application of high levels of seaweed extract and any potential negative effects of those high concentrations on crop growth.

In reality, applications of 2-3 litres / ha of *"SEA NYMPH"* Seaweed Extract (LSC) per hectare per week should be made, possibly either higher rates or more frequent timing could be considered if practical and possible. These should be applied pre-sowing and certainly pre-emergence and continued either throughout the crop productive period or certainly through the most critical time for nematode infestation of the crop.

The end results will be more healthy and productive crops (than otherwise would have been possible) that yield greater amounts of acceptable quality produce.

The use of *"SEA NYMPH"* Seaweed Extract as part of an integrated parasitic nematode crop management program is highly recommended. Seaweed extract on its own will rarely lead to acceptable levels of control for any nematode problem, but it can help reduce the negative impact of any infestation on crop growth and productivity thereby helping to maintain or retain some profitability from infected crops.

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