EFFECT OF A NEEM PREPARATION ON REPRODUCTION OF
THE NEMATODE *GLOBODERA ROSTOCHIENSIS* AND
GROWTH OF POTATO

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Abstract: An experiment was conducted under glasshouse conditions to test
the effects of neem-based product in the form of drenches and potato tuber
applications on the growth of potato and population density of the potato cyst
nematode *Globodera rostochiensis*. The soil applications of the biopreparation
improved the plant growth and yield of potato, being greatest with 1% Neem Azal.
The biggest increase in the yield occurred in the Oxamyl application (15.8%). The
biopreparation in concentrations from 0.2% to 1% increased the yield of potatoes
from 0.3% to 9.7% compared to the untreated inoculated control. The soil
application was relatively more effective in increasing of the yield (0.3%-9.7%)
than the potato tuber treatments (0.3%-2.3%). The nematode reproduction was
reduced 83.3% with Oxamyl and from 59.8% to 71.0% with Neem Azal
treatments.

Key words: potato cyst nematodes control, biopreparates.

Introduction

The potato cyst nematode *Globodera rostochiensis* (Woll.) is the major pest of
the potato cultivars in Bulgaria, causing up to 80% loss of yield (Trifonova, 1995;
2000). Soil treatment with nematicides has been an established practice for the
control of cyst-forming nematodes of the genus *Globodera*, though it is very
expensive for the farming community. These have led to an increasing need for
alternative control tactics that are safe, economically attractive and which can be
used in Integrated Pest Management Programmes (IPM).

Several plants, belonging to different botanic families, contain components
possessing nematicidal or nematostatic properties (Grainge and Ahmed, 1988).
Investigations on extracts from various plants, neem (*Azadirachta indica*) and
neem products have revealed that some of them are effective against insects and
nematodes (Sharma, 2000; Kumar and Khanna, 2006) and commercial

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formulations of them are already available. Neem-based formulations are known to have nematicidal potential, particularly against plant parasitic nematodes (Mojumber, 1995, Kumar and Khanna, 2006). According to Akhtar and Mahmood (1993), Khurma and Singh (1997) and Upadhya et al. (2003), the seed and leaf extracts of neem (Azadirachta indica A. Juss.) caused 100% juvenile mortality of the root-knot nematodes and of some free-living plant parasitic nematodes on the potato.

Investigations were undertaken to evaluate the efficacy of the new commercial neem-based formulation Neem Azal T/S applied as soil drenches and potato tuber treatments on plant status and population density of the potato cyst nematode Globodera rostochiensis on potatoes.

Material and Methods

The population of Globodera rostochiensis was obtained from soil samples collected from heavily infested potato fields in Smolyan region. Cysts of the nematode were produced on susceptible potato cultivars, Solanum tuberosum cv. Focal in a glasshouse at 20-22°C. They were extracted from the soil by wet-sieve technique (Southey, 1986).

The experiment included four treatments: 1) Neem Azal T/S preparation (in three concentrations), 2) Oxamyl, 3) Potato cyst nematodes alone as a positive control, and 4) Potato plants alone as negative control. The trial was conducted in a glasshouse at 20-22°C and at the 13 h day length. The 12 cm diameter pots were filled with 600 g of autoclaved soil. Seed tubers of cv. Nadejda were used in all the tests. Each plant was inoculated with 50 viable nematode cysts put in muslin bags around the root. Control pots with potato plants alone received only 100 ml of distilled water. Each treatment had six replications.

Neem Azal T/S was used in concentrations of 0.2%, 0.5% and 1.0% and stored in cool, dry conditions (0°C).

Soil application was performed by adding 50 ml of preparation to soil around the tuber, ten days after the planting. Oxamyl (Vidate G) at the rate of 1.5 mg/g was applied to the soil through irrigation carried out before seedling planting.

Potato tuber treatments were applied to potato tubers by immersing the tubers in the solution of the neem preparation for 1/2 hour and in 1% Oxamyl (Vidate EK) for 5 min. After the treatments, potato tubers were directly planted in soil. The experiments were terminated after 14 weeks or after the completion of the nematode life cycle. Observations on plant status - shoot length, shoot weight, root length; weight and yield of potatoes were recorded at the end of the experiment. The final nematode density was determined after 14 weeks by the wet-sieve decantation technique (Southey, 1986). The effect of the treatments on reproduction of nematodes was determined by calculating a reproductive index.
(R = Pf/Pi - final/initial population densities). The yield of potatoes was assessed according to the weight of the potato tubers in the pots.

The data were subjected to factorial analysis of variance and treatments were compared using Duncan’s multiple range test (Steel and Torrie, 1980).

**Results and Discussion**

The soil application of the neem product significantly improved plant growth and increased the yield of potatoes from 0.3% to 9.7% compared with the untreated-inoculated plants (Figure 1). The plants were higher and the weight of the shoot and root of the treated plants was significantly larger compared to infested untreated plants (N). The best results were obtained in the case of 1% Neem Azal (44 cm length of shoot, 2.7 g weight and 9.5 cm root length). The greatest increase in the yield occurred with Oxamyl (15.8%), followed by 1% Neem Azal (9.7%) and 0.5% Neem Azal (6.6%) compared with inoculated untreated plants (N).

![Figure 1. Effect of soil treatment with Neem Azal on plant growth of potatoes inoculated with *Globodera rostochiensis*.](image)

Legend: n-1 = 0.2% Neem Azal; n-2 = 0.5% Neem Azal; n-3 = 1% Neem Azal; n. = nematode; ox. = Oxamyl; c. = control.*-Significant differences from the nematode (n) at P \leq 0.05.

The potato tuber treatments were relatively less effective in enhancing the plant growth and yield of potatoes compared with the soil application of Neem Azal (Figure 2). The greatest enhancement in the yield was obtained with Oxamyl (8.9%), followed by 1% Neem Azal (2.2%) and 0.5% Neem Azal (2.3%) compared with inoculated untreated plants.
All neem-based concentrations greatly suppressed the population density of the nematode (from 54.2% to 71.0%). The suppression was greater in the higher concentration of the preparation. The lowest nematode population was observed when treated with Oxamyl (30.1 mean number of cysts per pot). Plants treated with 1% Neem Azal had the lowest mean number of cysts - 52.2 compared to the nematode treatment (180.0 mean number of cysts/pot). Potato treatments showed similar degrees of cysts suppression. This indicated that, although all neem concentrations reduced the infestation by *G. rostochiensis* significantly, the degree of their efficacy varied significantly (*P* ≤ 0.05).

Figure 2. Effect of potato tuber treatment with Neem Azal on plant growth of potatoes inoculated with *Globodera rostochiensis*.

The highest reproduction rate of the nematode was registered in the infected-untreated plants (Figure 3). The soil application of the Neem Azal product significantly suppressed cyst formation. The greatest reproduction index occurred in the nematode application (R = 3.6), followed by Neem Azal application (R = 1.0 - 1.6) and by Oxamyl treatment (R = 0.6). Potato tuber treatments decreased cyst formation by 54.2% to 63.7%.

These results agree with findings of Hafeez et al. (2000), and Kumar and Khanna (2006), who tested Neem Azal against *Meloidogyne incognita* on tomato. Akhtar and Alam (1990) observed that in their experiment reduction in nematode population of free living plant-parasitic nematodes on potato was due to treatments...
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with oil-seed cakes and leaves of neem. Neem is the extract obtained from the seeds of the tropical tree *Azadirachta indica* A. Juss. originating in India. It is known that efficacy of neem (*Azadirachta indica* A. Juss., *Meliaceae*) products is due to limonoids (solalin) and azadirachtin A present in all parts of the plant.

The product neem Azal T/S is registered in Bulgaria for control to acari, thrips and whiteflies.

![Figure 3. Reproduction index (R) of *Globodera rostochiensis* under soil and potato treatment with Neem Azal.](image)

Legend: n. = nematode; ox. = Oxamyl; Columns with the same letters are not significantly different ($P \leq 0.05$) according to Duncan’s Multiple Range Test ($F = 125.93$; Sd = 0.150; LSD$_{0.05} = 0.327$).

Our experiment revealed that the tested concentrations of Neem Azal improved plant status and reduced nematode density of *G. rostochiensis* on potato. Because of that it can be used as an alternative to the chemical method of the control. However, further evaluation under field conditions is necessary to assess the feasibility of using this product as a component of an integrated nematode management strategy.

**Conclusion**

The results obtained from the research of the used biopreparation Neem Azal for the control of *Globodera rostochiensis* on potatoes allowed us to make the following conclusions:

Neem Azal in concentrations of 0.2%, 0.5% and 1% improved plant growth and increased the yield of potatoes from 0.3% to 9.7% compared to the untreated inoculated plants.
The potato tuber treatments were relatively less effective in enhancing the plant growth compared with the soil application of the biopreparation. The greatest increase in the yield occurred in the Oxamyl application (15.8%), followed by 1% Neem Azal (9.7%), 0.5% Neem Azal (6.6%) and 0.2% Neem Azal (0.3%).

The nematode reproduction was reduced by 83.3% with Oxamyl and from 59.8% to 71.0% with Neem Azal treatments.

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References

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**UTICAJ PREPARATA BILJKE NIM NA REPRODUKCIJU NEMATODE GLOBODERA ROSTOCHIENSIS I RAST KROMPIRA**

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**R e z i m e**

Ogled je sproveden u uslovima gajenja u stakleniku kako bi se ispitali uticaji proizvoda zasnovanih na biljci nim pri kvašenju i tretmanu krompirovih krtola na rast krompira i gustinu populacije krompirove cistolike nematode *Globodera rastrochiensis*. Primena biopreparata preko zemljišta je poboljšala rast biljke i prinos krompira, a najbolji rezultati su postignuti primenom 1% Neem Azal preparata. Najveće povećanje prinosa je postignuto prilikom primene preparata Oxamyl (15,8%). Biopreparat u koncentracijama od 0,2% do 1% je povećao prinos krompira od 0,3% do 9,7% u poređenju sa netretiranoj (tretiranom kontrolnom grupom. Primena preko zemljišta je bila relativno efikasnija u povećanju prinosa (0,3% - 9,7%) nego kod tretmana krompirovih krtola (0,3% - 2,3%). Reprodukcija nematode je smanjena za 83,3% korišćenjem preparata Oxamyl i od 59,8% do 71,0% pri tretmanu uz pomoć preparata Neem Azal.

**Ključne reči:** kontrola krompirovih cistolikih nematoda, biopreparati.

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