# Notes brèves

## EFFECT OF GRANULAR NEMATICIDES ON NEMATODE POPULATION AND SUGARCANE YIELD

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Nematodes cause a major problem in sugarcane cultivation in Pakistan, where up to twenty genera and 40 species have been recorded from different varieties of sugarcane (Maqbool, Zain & Shama, 1975; Maqbool, 1984). Reports on the control of nematode associated with sugarcane showed a 200-300 % increase in number, length and weight of canes by pre-plant application of nematicides (Chu & Tsai, 1957; Bates, 1957) DBCP (Roman, 1965) EDB, DBCP and DD (Dick, 1969). This experiment describes the effects of application of two non fumigant nematicides on nematode dynamics, growth and yield of sugarcane in Pakistan.

### Materials and methods

A heavily infested field of two year ratoon sugarcane cv. BL4, was selected at Thatta Sind. The soil was sandy loam, 60 % sand, 22 % silt and 18 % clay. The field was divided into 9 × 6 m plots with 12 rows in each plot, containing 15 sugarcane setts 45 cm apart in each row.

Two nematicides Temik 10G (aldicarb; 2-methyl-2 (methylthio) Propionaldehyde 0-(methylcarbamayl) oxime and Furadan 3G (carbofuran; 2, 3-dihydro-2, 2-dimentyl benzofuran-7-YLN-methyl carbamate) were applied 1 kg a.i. and 2 kg a.i./ha on top of cane cutting and covered immediately with 15 cm of soil. Plots not treated served as control. Plots were fertilized and irrigated following normal practices. Experiment was laid on a complete randomized block design with 3 replicates of each treatment. Ten soil samples/plot and root samples from 5 sett roots were collected at 0 time and at monthly interval from May, 1985 until harvest in October 1985. Population of nematodes in soil was determined using Oostenbrink (1960) and in roots by Coolen and D'Herde (1972) method; weight of cane, length and diameter of canes were recorded at harvest and analysed using multiple range test.

Table 1

Effect of nematicides on yield of sugarcane

| *Treatments* | *Dose kg a.i./ha* | *Yield/ha in metric tons* | *Length of cane in meter* | | *Diameter of cane in meter* | |
|---|---|---|---|---|---|---|
| | | | *Maximum* | *Minimum* | *Maximum* | *Minimum* |
| Temik (Aldicarb) | 2 | 127.7 *a* (+ 48.3) | 1.8 *a* (+ 20) | 1.5 *a* (+ 25) | 0.12 *a* (+ 50) | 0.09 *a* (+ 50) |
| Furadan (Carbofuran) | 2 | 123.3 *a* (+ 43.3) | 1.7 *b* (+ 13.3) | 1.4 *b* (+ 16.7) | 0.12 *a* (+ 50) | 0.08 *b* (+ 33.3) |
| Furadan (Carbofuran) | 1 | 117.6 *a* (+ 36.5) | 1.6 *c* (+ 6.7) | 1.3 *c* (+ 8.3) | 0.11 *b* (+ 38) | 0.07 *c* (+ 16.7) |
| Temik (Aldicarb) | 1 | 121.9 *a* (+ 41.5) | 1.6 *c* (+ 6.7) | 1.4 *b* (+ 16.7) | 0.10 *c* (+ 25) | 0.08 *b* (+ 33.3) |
| Control | — | 86.1 *b* | 1.5 *d* | 1.2 *d* | 0.08 *d* | 0.06 *d* |

Means not followed by the same alphabets are significantly different at least at $p < 0.05$ as determined by New Duncan multiple range test.

+ indicates percent increase over control.

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## Results and discussion

Population density of ectoparasitic nematodes averaged 1 400/100 g of soil were represented by *Helicotylenchus digonicus* 35 %; *H. indicus* 12 %; *Hoplolaimus indicus* 10 %; *Paratrichodorus mirzae* 10 %; *Tylenchorhynchus annulatus* 20 %; *Xiphinema* sp. 8 % and others 5 %, and *Pratylenchus zeae,* the only endoparasite recovered from sett roots averaged 120/g of roots.

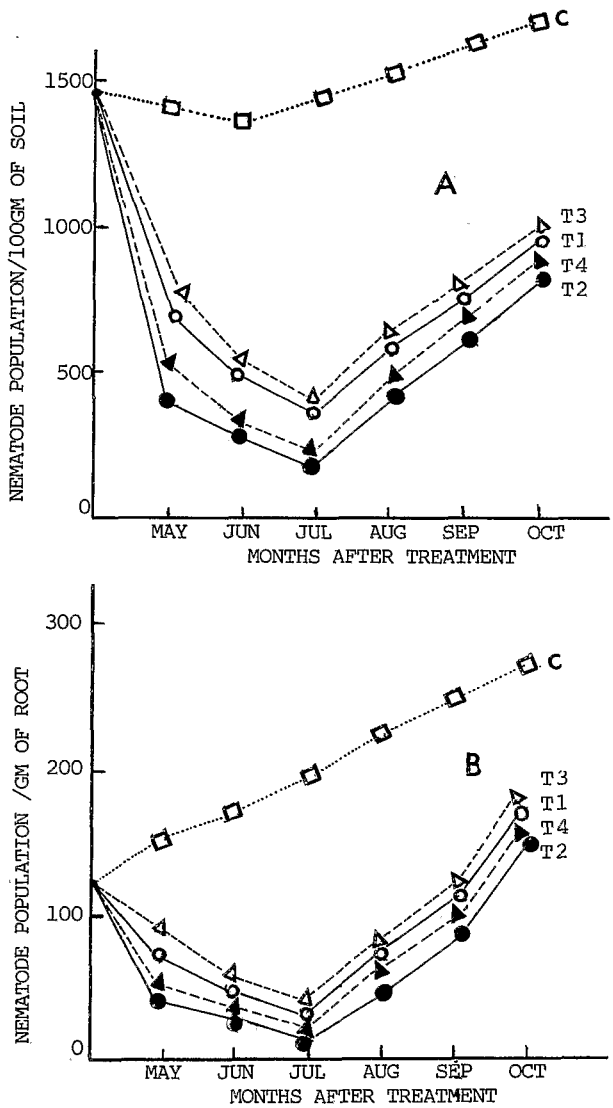


Fig. 1. Changes in ecto and endoparasitic nematodes after nematicide application (each plot represents the average of three replicates).
(A : Ectoparasites; B : *Pratylenchus zeae;* □ : Control (untreated); △ : Furadan 3G : 1 kg a.i./ha; ▲ : Furadan 3G : 2 kg a.i./ha; ○ : Temik 10 G : 1 kg a.i./ha; ● : Temik 10 G : 2 kg a.i./ha).

In untreated plots *Pratylenchus zeae* showed a gradual increase in numbers and remained relatively at a high level till harvesting. As suggested previously by Cadet and Spaull (1985) whereas the component genera of ectoparasites after initial decrease also increased. Both the nematicides showed a gradual decline in nematode densities of the ectoparasites in soil and the endoparasite in roots. Nematicides used 2 kg a.i./ha were more effective than when applied at 1 kg a.i./ha (Fig. 1). Reduction in nematode number from 77 to 90 % of ectoparasites and 80 to 90 % in *Pratylenchus zeae* was observed during the first three months of nematicide treatment followed by a gradual increase in nematode numbers reaching maximum average of 935/100 g of soil and an average of 180/g of roots in *Pratylenchus zeae.* The high percentage of ectoparasites in soil and invasion of sett roots in untreated plots by *Pratylenchus zeae* showed adverse effect on root development. Yield data in multiple range test (Tab. 1) revealed that best response of aldicarb and carbofuran was reported in the plots treated with 2 kg a.i./ha of these nematicides. Effect of granular nematicides on nematode control and increase in yield has been reported earlier (Birchfield, 1969 : aldicarb) and (Cadet & Merny, 1978 : carbofuran). Our results give an indication of the over all benefits to be gained by the use of nematicides.

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# CELLULAR RESPONSES OF THREE SUSCEPTIBLE CULTIVARS OF POTATO TO INVASION BY THE JUVENILES OF *GLOBODERA PALLIDA*

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A general distinction between the cellular responses of the roots of resistant and susceptible cultivars of potato to invasion by potato cyst nematodes is reported as hypersensitivity. This condition is expressed by localised lignification and necrosis around the nematode and the developing syncytium, in resistant cultivars. Eventually the lignification walls off the syncytium, thereby preventing its continued expansion (Hoopes, Anderson & Mai, 1978; Rice, 1983, Rice, Leadbeater & Stone, 1985).

Susceptible cultivars allow the incorporation of cells into the syncytium and their further proliferation to proceed unchecked; simple mechanical damage without lignification is the only evidence of the passage of the nematode through the root tissues.

Evans, Greet and Inge (1983) reported that potato cultivars with no resistance to *Globodera pallida* Stone exhibited different degrees of tolerance to this nematode. The same authors described experiments which related these differences in tolerance to the interaction between the nematode and the wilt fungus *Verticillium dahliae* (Kleb.). Three cultivars of potato, Maris Anchor, Maris Peer and Pentland Javelin, gave very different responses to invasion by *G. pallida.*

Sixty tuber pieces bearing single sprouts of the three potato cultivars were incubated on 2 % water agar (containing 0.005 % streptomycin sulphate) at 20° in the dark. After ten days, 10 µ of 2 % carboxymethylcellulose containing 20 newly hatched juveniles of *G. pallida* were placed on roots growing on the surface of the agar; additions were made at the root tip or at 2.5 cm, 4.5 cm, 6.5 cm or 8.5 cm from the root tip. The plants were then returned to the incubator and 1.0 cm segments around the inoculation points harvested eight days later. The segments were fixed immediately in F.A.A. and processed through a tertiary butyl alcohol series to wax (Southey, 1970); 10 µm sections were stained in either Sudan Black B or Safranin O and Fast Green.

Fig. 1 A-C shows the structure of the root of each cultivar at 2.5 cm from the tip. Pentland Javelin (Fig. 1A) has large diameter roots, a well developed cortex of up to eleven layers of thick walled cells, a thickened epidermis, no distinct hypodermis and a well developed pentarch xylem. Maris Peer (Fig. 1B) has thinner roots, a less developed pentarch xylem, up to eight layers of thinner walled cortical cells and possesses a well developed hypodermis thickened on its radial and outer tangential walls. Maris Anchor (Fig. 1C) has very thin roots, a tetrarch xylem, a cortex with up to only five layers of large thin walled cells of which the outer layer forms a distinct hypodermis.

Pentland Javelin exhibited the expected susceptible response to invasion by nematodes (Fig. 2A) with little tissue damage and hypersensitivity shown only by those cells adjacent to the nematode and with no lignification around the developing syncytium. However, Maris Peer (Fig. 2B) and Maris Anchor (Fig. 2C) both exhibited a marked hypersensitivity in several layers of cells around the nematode, which in Maris Anchor spread rapidly through the surrounding tissue often resulting in its collapse. Lignification around the syncytium also occurred but was not pronounced; evidently the

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