

EFFECT OF THREE NEMATICIDAL SOIL TREATMENTS ON THE GROWTH OF TOBACCO PLANTS

by

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Soil applications of either 1,3 dichloropropene 1,2 dichloropropane (D-D) or granular Phenamiphos in field experiments to control the root-knot nematode *Meloidogyne incognita* (Kofoid *et* White) Chitwood have always induced remarkable yield increases, as compared with untreated or plots treated with other chemicals, on different row or vegetable crops in Southern Italy (Lamberti, 1973). Beneficial effects were also noticed when these chemicals were applied in lightly infested soils of when no evidence of plant parasitic nematodes were found on the roots of control plants (Lamberti, unpublished).

The stimulating action of D-D on plant growth has been shown by others who attributed it to increased nitrogen made available by the microbial activity taking place after chemical application (Cooke and Draycott, 1971). Little is known on the effect of Phenamiphos on growth of tobacco plants. These investigations were initiated to study the influence of this chemical on plant growth compared with the effects of D-D and steam sterilization.

Materials and methods

Sandy loam soil was collected in a field infested with *M. incognita* and divided into four equal parts. One part was steam sterilized for eight hours at 90°C two weeks before transplanting. A second part was treated with an equivalent dose rate of 300 l/ha

of D-D in plastic bags one month before planting, a third part was mixed with an equivalent rate of 500 kg/ha of granular Phenamiphos (10% a.i) two days before planting. A fourth part was left as a control. Four series each of 50 1/2 l plastic containers with five holes in the bottom were prepared with the different treated soils. One tobacco seedling, « Xanthi Yakà », in the three leaf stage, was transplanted in each container and randomized on a greenhouse bench. Temperatures ranged from 25-26°C during the experimental period (75 days). Ten plants of each series were harvested at fifteen day intervals after transplanting. Roots were examined for galling or nematode infestation and weighed.

A second experiment intended to determine the direct effect of Phenamiphos on the growth of tobacco plants and its interaction with soil nutrients. Forty 1/2 l plastic containers were filled with washed, nematode-free river sand. Phenamiphos at an equivalent rate of 500 kg/ha was incorporated into the soil of 20 containers. Fifty ml of KNOP nutritive solution [Ca (NO₃)₂ 1g + KNO₃ 0.25g + KH₂PO₄ 0.25g + Mg SO₄ 0.25g + FeCl₃ traces/1 l H₂O] was added to each of 10 untreated and 10 Phenamiphos treated pots at transplanting time. The remanent 10 treated and 10 untreated pots served as control. The fresh weight of aerial part of each plant was determined after two months.

All data were statistically analyzed and compared by Duncan's multiple range test.

Results

Experiment 1.

The tobacco plants transplanted into steam sterilized soil had the greatest growth increase and root development in the first month compared to plants in untreated soil (Fig. 1, Tab. I). However, no remarkable differences were evident between plants grown 45 days either in D-D fumigated or steam sterilized soil, whereas the growth of the tobacco plants in soil to which Phenamiphos had been incorporated continued to be slow (Table I). At the end of the second month plants in D-D treated soil were still actively growing; those in steam sterilized soil had stopped their growth and appeared yel-

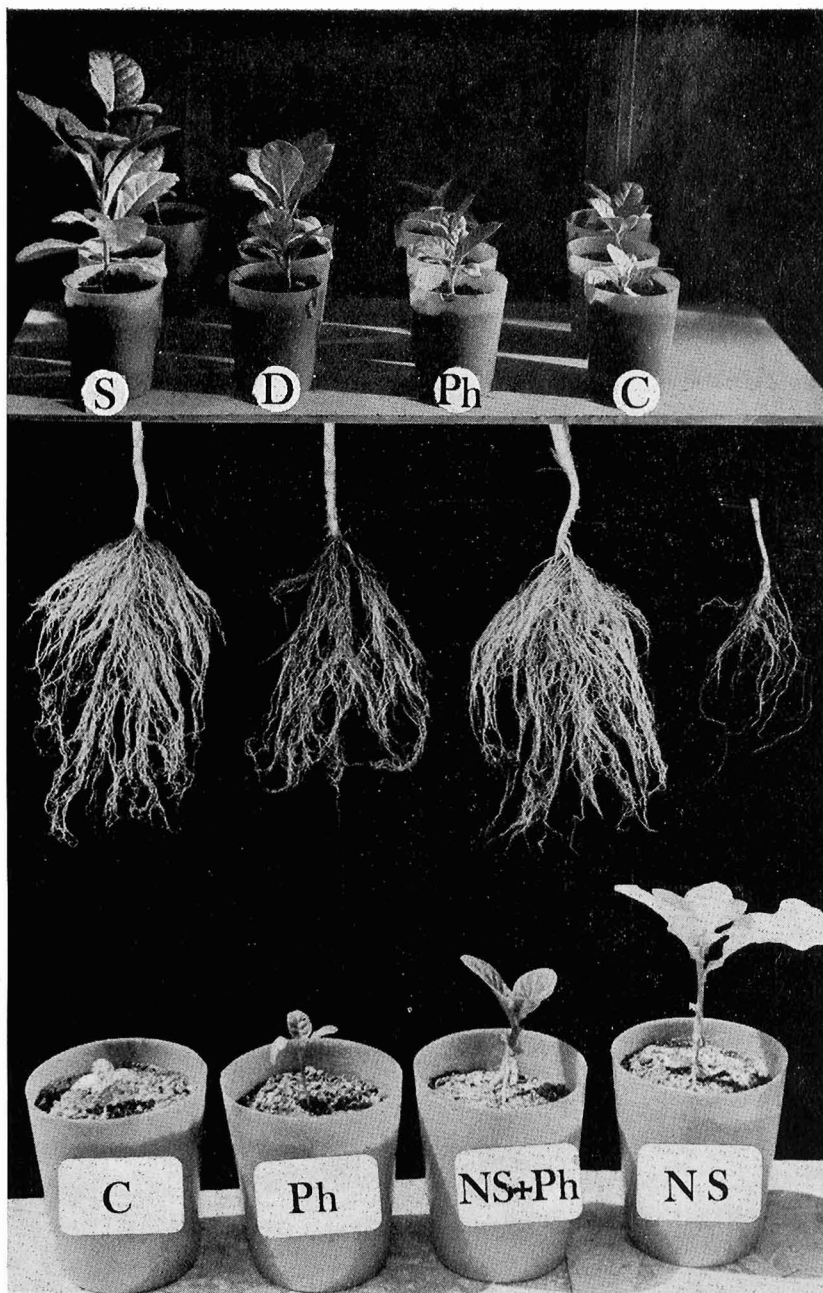


Fig. 1 - (top) Growth of tobacco cv «Xanthi Yakà» plants in (S) steamed soil, (D) D-D treated, (Ph) Phenamiphos treated and (C) Control 30 days after transplanting;

(middle) Root systems of tobacco cv «Xanthi Yakà» plants grown in (S) steamed soil, (D) D-D treated, (Ph) Phenamiphos treated and (C) Control 60 days after transplanting;

(bottom) Tobacco cv «Xanthi Yakà» plants grown in river sand with (NS) Knop nutritive solution, (NS-Ph) Knop nutritive solution plus Phenamiphos, (Ph) Phenamiphos alone and (C) Control 60 days after transplanting.

Table I - Effect of three soil treatments on the growth of tobacco « Xanthi Yakà » plants.

| | Treatments | Time after transplanting | | | | | | | | | | | | | | |
|-------------------------|-------------|--------------------------|---|----|---------|---|---|---------|---|---|---------|---|---|---------|---|---|
| | | 15 days | | | 30 days | | | 45 days | | | 60 days | | | 75 days | | |
| Height cm | Steam | 14.4 | a | A | 19.4 | a | A | 26.7 | a | A | 25.7 | a | A | 25.0 | b | B |
| | D-D | 10.3 | b | B | 12.3 | b | B | 21.5 | b | B | 26.5 | a | A | 33.6 | a | A |
| | Phenamiphos | 8.4 | c | BC | 9.3 | c | C | 12.7 | c | C | 26.7 | a | A | 35.5 | a | A |
| | Untreated | 7.4 | c | C | 7.5 | d | C | 11.1 | c | C | 8.7 | b | B | 15.1 | c | C |
| Weight of top g | Steam | 14.8 | a | A | 17.7 | a | A | 22.1 | a | A | 18.8 | b | B | 18.1 | c | C |
| | D-D | 13.7 | b | B | 15.1 | b | B | 23.1 | a | A | 23.2 | a | A | 25.1 | b | B |
| | Phenamiphos | 13.7 | b | B | 13.7 | c | C | 15.9 | b | B | 22.4 | a | A | 29.9 | a | A |
| | Untreated | 13.1 | c | C | 13.1 | d | C | 14.7 | b | B | 13.5 | c | C | 16.3 | c | C |
| Weight of roots g | Steam | | | | | | | 14.0 | a | A | 11.0 | a | A | 11.1 | a | A |
| | D-D | | | | | | | 12.4 | a | A | 10.7 | a | A | 10.6 | a | A |
| | Phenamiphos | | | | | | | 8.1 | b | B | 9.7 | a | A | 11.6 | a | A |
| | Untreated | | | | | | | 7.2 | b | B | 5.6 | b | B | 8.7 | b | A |

N.B.: Data flanked on the columns by the same letters are not statistically different; capital letters for P = 0.01, small letters for P = 0.05.

Table II - Effect of Phenamiphos on the growth of tobacco « Xanthi Yakà » plants.

| Treatments | Height cm | | | Weight of top g | | |
|----------------------------------|-----------|---|---|-----------------|---|---|
| Nutritive solution alone | 8.0 | a | A | 1.9 | a | A |
| Nutritive solution + Phenamiphos | 7.0 | a | A | 1.3 | b | B |
| Phenamiphos alone | 3.2 | b | B | 0.3 | c | C |
| Control | 1.7 | c | C | 0.2 | c | C |

N.B.: Data flanked on the columns by the same letters are not statistically different; capital letters for P = 0.01, small letters for P = 0.05.

lowish. After 45 days, the inhibited growth of plants in Phenamiphos treated soil had ceased and these plants began to grow vigorously. When the experiment was discontinued, two and a half month after transplanting these seedlings, appeared healthy and still in full growth (Table I). Plants growing in soil fumigated with D-D were also growing vigorously. Those transplanted in steam sterilized soil did not differ greatly from plants grown in untreated soil (Table I).

At the end of the experiment the root system of the plants grown in the untreated soil weighed about the same as those of plants grown in the treated soils because of the large galls that had developed on the lateral roots (Table I). No galls or presence of nematodes were ever observed on the roots of the plants in any of the treated soil.

Experiment 2.

The effect of Phenamiphos seemed to be beneficial to tobacco plants only when no nutritive solution was added into the pots (Tab. II, Fig. 1). The addition of the two (chemical and nutritive solution) in the same container resulted in a repression of the growth.

Discussion

The results of these experiments indicate that tobacco plants in steam sterilized soil grow rapidly at first reaching their full size within six weeks and beginning after that the natural process of senescence.

A less favourable environment is initially found by the plants transplanted in soil treated with either D-D or Phenamiphos, due likely, to the presence of phytotoxic residues. However, when this phytotoxic effect is over, the plants undergo a very active growth which was still in progress when the experiment was discontinued.

Plant growth in river sand was poor during the experimental period. However, this second experiment has shown that the phytotoxic effect of Phenamiphos might be effected by certain ions present in the soil.

S U M M A R Y

« Xanthi Yakà » tobacco plants transplanted in steam sterilized soil in pots kept in glasshouse developed, in the first six weeks, much faster than plants grown in soil treated with either 300 l/ha of D-D or 500 kg/ha of Phenamiphos. However, plant growing in steam soil approached rapidly senescence after this intensive period of growth whereas those growing in D-D and Phenamiphos treated soil were still actively growing 75 days after transplanting, when the experiment was discontinued. Interaction of Phenamiphos with ions present in the soil seems to result in phytotoxic effects.

R I A S S U N T O

Effetto di tre trattamenti nematocidi al terreno sulla crescita di piante di Tabacco.

Piante di Tabacco « Xanthi Yakà » trapiantate in terreno sterilizzato col calore si sono sviluppate, in vaso in serra, nelle prime sei settimane, molto più rapidamente di piante allevate in terreno trattato con 300 l/ha di D-D o 500 kg/ha di Fenamifos. Tuttavia, le prime, dopo l'intenso periodo di crescita iniziale hanno raggiunto rapidamente la senescenza, mentre le altre erano ancora in attiva crescita 75 giorni dopo il trapianto, al termine dell'esperimento. L'interazione del Fenamifos con ioni presenti nel terreno sembra essere la causa di un effetto fitotossico.

R E S U M É

Effet de trois traitements nématocides du sol sur la croissance de plantes de tabac.

Des plants de tabac « Xanthi Yakà » repiqués en pots contenant du sol stérilisé à la chaleur croissent, en conditions contrôlées, au cours des premières six semaines, bien plus rapidement que les plantes élevées en sol traité au D-D, 300 l/ha, ou au Phenamiphos, 500 kg/ha. Les premières, toutefois, après l'intense période de croissance, sont vite atteintes de la sénescence, tandis que les plantes élevées en sol traité au D-D ou au Phenamiphos croissent encore activement 75 jours après la transplantation à l'issue de l'épreuve. L'interaction du Phenamiphos et des ions présents dans le sol paraît être à l'origine d'effets phytotoxiques.

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