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Influence of Vydate and Benlate on Root-knot and Plant Growth of Tomato in Greenhouse

M. WAJID KHAN[1]

ABSTRACT

Vydate and Benlate applied to soil in pots in a greenhouse considerably reduced the development of root-knot nematode, *Meloidogyne incognita* on tomato. Root-knot index was the highest in plants without treatment. When Benlate was applied root-knot index was 2 and with Vydate or a mixture of both it was 1. Galls in non-treated plants were well-developed with numerous mature females. Only a few females were recovered from chemically treated plants. Growth performances of the plants were good. At the dosage applied, none of the two chemicals exhibited phytoxicity alone or in mixture.

INTRODUCTION

In order to grow disease-free crops, plants must be protected from all groups of plant pathogens. Methyl bromide and chloropicrin have demonstrated their effectiveness as nematicides, soil fungicides and herbicides (7,8,9,11,12). Other soil fumigants like DD, EDB and DBCP have also been attempted for multiple pest control. Mixtures of DBCP and PCNB applied in the seed row at the time of planting cotton were somewhat successful for the control of nematodes (6).

Non-volatile organic phosphate and carbamate nematicides have also been used in multiple pest control. Mixture of Aldicarb and PCNB is reported to control *Belonolaimus caudatus* and *Fusarium oxysporum* f. *vasinfectum* and weeds in cotton (6). Mixture containing any of the nematicides like Aldicarb, Dasanit, Cynem, the herbicide Pebulate and the fungicide PCNB controlled *Meloidogyne incognita*, *Rhizoctonia solani*, *Fusarium* sp. and weeds like Mexican clover and crab grass (5).

Systemic fungicides and nematicides offer new hope for effective control of certain categories of plant pathogens. Their different combinations may also be tried against mono- or multi-pathogenic situations to explore the possibility of their efficacy against target and non-target organisms. Accordingly, an attempt has been made to study the efficacy of Vydate (nematicide) and Benlate (fungicide) separately, and in mixture on the development of root-knot on tomato and also the growth of the plants in greenhouses.

MATERIALS AND METHODS

Seedlings of tomato, *Lycopersicon esculentum*, Mill. var. Super Marmande, were raised in sterilized soil contained in a tray. Pure culture of *Meloidagyne incognita* (Kofoid and White, 1919) Chitwood 1949 was reared on tomato plants grown in sterilized pots by inoculating the seedlings with single egg-mass. From single egg-mass

[1]*Department of Plant Protection, Faculty of Agriculture, University of Al-Fateh, Tripoli, S.P.L.A.J.*

culture, more plants were subsequently inoculated to suffice the inoculum requirement for the experiment. Freshly hatched second-stage larvae were used for inoculation.

The chemicals used were Benlate and Vydate L. The concentration of Benlate was kept at 200 ppm and that of Vydate L at 400 ppm on the active ingradient basis. In the treatments where their mixture was used, half quantity of each was taken.

Two-week old seedlings were transplanted in five replicate pots. Chemicals (100 ml) were applied in pots, except the checks, at the time of transplantation. Treatment pots receiving root-knot nematode were inoculated with 5,000 second-stage larvae per pot at the time of treatment (Table 2). Checks with and without nematode were maintained.

To determine the growth performance of plants, the height of the plants was measured 20 and 30 days after the start of the experiment. Experiment was terminated after 45 days. The root and shoot length were measured, and fresh and dry weight of root and shoots were determined. The data was analysed for significance. Samples of roots from each treatment that had received nematode were stained in lactophenol-cotton blue to examine the presence of females and egg-masses. Root-knot index was rated as follows: 0 = no galls; 1 = 1–10 galls; 2 = 11–20 galls; 3 = 21–50 galls; 4 = 51–100 galls; 5 = 101 or more galls per root system.

RESULTS AND DISCUSSION

M. incognita significantly reduced the growth of the plants as exhibited by their height at each interval. The dry and fresh weight of the roots and shoots of plants was poorest in comparison to other treatments. So was the case with the length of root and shoot at the treatment of the experiment. The height of the plants receiving *M. incognita* and Benlate, after 20 days, was not significantly different from plants inoculated with root-knot nematode, but was significantly less than those treated with the nematode and Vydate, or nematode and mixture of both chemicals. After 30 and 45 days plants improved their length and attained the same height as in other treatments, except the treatment with nematode only (T_2). The root-length was less than check (T_1) and T_4 but significantly more than nematode inoculated plants (T_2). Root system was more luxuriant and intensive with many finer roots (Table 1).

The rate of growth of plants treated with Vydate and *M. incognita* was better than all other treatments. Initially at 20 days interval there was no significant difference,

Table 1 Effect of Vydate and Benlate on root-knot development, plant length and root length of tomato.

Treatments	Shoot length (cm) After 20 days	Shoot length (cm) After 30 days	Shoot length (cm) After 45 days	Root length after 45 days (cm)	Root index
Check (T_1)	16.2a	23.0a	44.6a	25.0a	—
Meloidogyne incognita (T_2)	12.3b	19.2b	31.8b	17.8b	5
M. incognita + Benlate (T_3)	12.7b	22.5a	46.6a	22.6c	2
M. incognita + Vydate (T_4)	16.5a	24.4a	48.0a	28.2d	1
M. incognita + Benlate + Vydate (T_5)	15.2a	21.0a	41.9a	21.8c	1

The results are mean of five replicates. Figures followed by the same letter are not significantly different according to the Duncan's Multiple Range Test ($P = 0.05$).

Table 2 Effect of Vydate and Benlate × treatments on the fresh and dry weight of root and shoot of tomato.

Treatments	Root growth		Shoot growth	
	Fresh weight (g)	Dry weight (mg)	Fresh weight (g)	Dry weight (mg)
Check (T_1)	3.40a	344a	30.10a	3.42a
Meloidogyne incognita (T_2)	1.25b	147b	21.19b	1.54b
M. incognita + Benlate (T_3)	2.65c	319a	32.00a	3.22a
M. incognita + Vydate (T_4)	2.80c	343a	35.42a	3.72a
M. incognita + Benlate + Vydate (T_5)	2.30c	306a	29.00a	3.18a

The results are mean of five replicates. Figures followed by the same letter are not significantly different, according to the Duncan's Multiple Range Test (P = 0.05).

however, with other treatments except plants receiving *M. incognita* only. At 30 and 45 days, its height was best in all treatments but not significantly different from T_1, T_3 and T_5. Its root length was highest and significantly different from all other treatments (Table 1).

When both chemicals were applied in a mixture, the growth performance of the plants was also good. At 20 days, its height was better than plants with *M. incognita* plus Benlate or *M. incognita* only. At later stages, in comparison to other treatments, its growth performance did not improve but it was significantly higher at each interval than those inoculated with *M. incognita* alone. Its root length was less than other treatments but more than nematode inoculated plants (Table 1).

The fresh and dry weight of the plants treated with Vydate or Benlate, or mixture of the two, did not differ significantly in between. But, it was significantly higher than plants treated with *M. incognita*. Fresh weight of roots of plants treated with chemicals and nematodes was less than check and more than nematode inoculated plants (T_2). The fresh weight of shoots of all treatments with chemicals did not differ significantly from the check but it was significantly higher than nematode inoculated plants. A similar trend was exhibited by the fresh and dry weight of the shoot (Table 2).

The root-knot rating was highest in the treatment receiving no chemical (Table 1). Galls were well developed and had numerous mature females with several protruding egg-masses. Vydate suppressed the development of galls. Even at this low dosage, only a few galls of small size were formed. Very few females were present at the time of termination. In plants treated with Benlate, development of galls was also poor. Its rating was more than Vydate, however. But when mixture of both was used, the rating was same as in Vydate alone. The galls were poorly developed and few females matured in them (Table 1).

Treatment of plants with Benlate appeared to have accelerated the growth and overall growth of the plants at the end. The extensive and luxuriant finer roots increased the absorbing capacity of the plants. Benlate, although not a nematicide, appears to have positive effect on suppressing the root-knot development. It is known to reduce the larval entry of *Heterodera tabacum* (= *Globodera tabacum*) in tomato, tobacco and eggplant roots (10). Benlate was first reported to suppress the nematode by Miller (10). He claimed that roots apparently penetrated by Benlate acted as repellant and became unattractive to the *H. tabacum* larvae.

Both chemicals reduced the invasion of roots of tomato by the larvae of *M. incognita*. Probably both, being systemic, entered the roots and protected against the invasion. Only a few larvae could enter. The Vydate being an effective nematicide, even at this low dosage allowed only a few larvae to develop and mature and few galls developed. Benlate was less effective than Vydate in suppressing the development of larvae into adult females and galls but its role in their suppression needs further investigations. In mixture their performance was almost the same.

Vydate, a well established systemic nematicide, can be exploited after further experimentation for use at lower dosage particularly in greenhouse cultivation of tomatoes. Benlate with its proven ability as successful fungicide may also serve as repellant against root-knot nematode. The mixture of both can be effective against several root infecting pathogens.

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تأثير مبيد فيديت و البنليت على نيماتودا تعقد الجذور ونمو نباتات الطماطم فى الصوبات الزجاجية

د. محمد واجد خان

المستخلص

ان اضافة مبيد فيديت و البنليت الى التربة داخل الصوبات الزجاجية فانها تضعف ظهور نيماتودا تعقد الجذور *Meloidogyne incognita* على الطماطم .

ان معدل الاصابة فى نباتات الطماطم بنيماتودا تعقد الجذور كان مرتفع جدا فى النباتات غير المعاملة بالمبيدات .

عند اضافة بنليت كان معدل الاصابة بنيماتودا تعقد الجذور (٢)، وعند اضافة مبيد فيديت او خليط من الاثنان كانت معدل الاصابة (١) .

وكانت العقد أو الانتفاخات فى النباتات الغير معاملة (المقارنة) نموات واضحة وكذلك ظهور اناث بالغين . ولوحظ أن بعض الاناث أو عدد بسيط منها لم يتأثر بالمعاملات الكيميائية ، بالنسبة لظاهرة نمو النبات كانت جيدة .

والجرعات المضافة من كلا المبيدين لم تظهر أى تأثير على نمو النباتات سواء خليط من المبيد أو المبيد بمفرده .

وكذلك عند خلط المبيد لم يظهر عدم تجانس أو عدم تأثير .