REDUCTION OF PRIMARY INFECTION OF TOMATO EARLY BLIGHT BY FALL FUMIGATION OF SOIL WITH VORLEX[1]

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Abstract

Field plots infested with Alternaria porri f. sp. solani were treated with Vorlex at rates of 25, 50, and 75 gal/acre after a severely infected tomato crop was ploughed under in the fall of 1971. The following spring the percentage of tomato transplants showing symptoms of primary infection was reduced in those plots by 58%, 74%, and 78%, respectively, as compared with untreated control plots.

Résumé

Après l'enfouissement dans le sol par labourage d'une récolte de plants de tomates sévèrement infectés de l'Alternaria porri f. sp. solani au cours de l'automne 1971, les champs furent traités au Vorlex au taux de 25, 50, et 75 gallons l'acre. Le printemps suivant, le pourcentage des plants de tomates repiqués dans ces champs, ayant des symptômes d'infection primaire, baissa à 58%, 74%, et 78%, respectivement, par rapport aux champs non traités au Vorlex.

Introduction

Propagules of Alternaria porri (Ellis) Cif. f. sp. solani (Ell. & Mart.) Neerg., the causal fungus of early blight of tomato (Lycopersicon esculentum Mill.), potato (Solanum tuberosum L.), and related crops, can overwinter in soil. with diseased plant debris (1, 6). Crop rotation has been suggested (6, 7) to avoid this pathogen but soil fumigation has not been employed as a control measure primarily because of its high cost and the possibility of soil pollution or ill effects on the crop. However, volatile soil fumigants, such as chloropicrin (3) and Vorlex (5), have been used without permanent harmful effects on tomatoes, peas, and many other vegetable crops (2, 3, 5). The long-term residual effects of Vorlex are not clearly known but lettuce (Lactuca sativa L.) seedlinqs can tolerate 1 ppm methyl isothiccyanate, the active ingredient of Vorlex, in outdoor soils (4). Objectionable levels of Vorlex in field soil are usually determined by odor and by the failure of lettuce seeds to germinate (personal communication, Morton Chemical Co., Woodstock, Ill., U.S.A.).

The main objective of the present work was to determine the effects of a fall application of Vorlex to field soil heavily infested with debris of early blight affected tomato plants in reducing the amount of primary infection of a tomato crop the following spring.

Materials and methods

Vorlex (methylisothiocyanate 20%, and 1, 3-dichloropropane and related chlorinated hydrocarbons 80%, Morton Chemical Co.) was applied to soil with a tractor driven soil fumigator (Pfizer Co., Ltd., Sarnia, Ontario) according to the manufacturer's instructions, after a tomato crop heavily infected by A. porri f. sp. solani was ploughed under in the fall of 1971. The rates cf application were 0, 25, 50, and 75 gallons of the formulation per acre in plots of 7 X 126 ft dimension with four replications. Each plot was surrounded by a 7-ft-wide zone treated with Vorlex at 75 gal/acre to avoid contamination of plots by diseased plant tissues. In early June 1972, 10 seedlings cf each of three tomato cultivars (Fireball VR, Jet Star, and Geneva John Baer) were transplanted in a row in each plot (28 ft/cultivar). Each plant was carefully observed for initial symptoms of early blight until the end of June. During that time the appearance of disease symptoms on lower leaves, especially those in contact with soil, was indicative of primary infection (1, 7).

Results and discussion

The lower leaves of all tomato plants in the nontreated plots showed typical leaf spots of early blight by the end of June 1972 (Table 1). The absence of leaf spots on the middle and top leaves indicated that secondary infections had not started during the period of observation. At that time in

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Table 1. Effect of fall application* of Vorlex to infested field soil on the incidence of primary infection of early blight on three tomato cultivars the following spring

Vorlex conc. (gal/acre)	Average number of infected plants**			% infected plants of all cultivars	% reduction of primary infection
	Fireball VR	Jet Star	John Baer		
0	10	10	10	100.0	0.0
25	5.2(±0.7)	3.5(±0.9)	3.8(±0.9)	41.7	58.3
50	2.0(±0.7)	3.0(±0.7)	2.8(±0.8)	25.8	74.2
75	3.5 (i0.6)	1.5(f0.9)	1.5(±0.6)	21.7	78.3

* Soil treated October 1971; tomato seedlings transplanted to field June 3, and disease assessed June 15-30, 1972.

** Average of 4 replications of 10 plants; figures in parentheses indicate standard error.

the Vorlex-treated plots, the overall percentages of infected plants were 41.7, 25.8, and 21.7, respectively, for the 25, 50, and 75 gal/acre treatments. In the treated plots Fireball VR showed slightly greater numbers of infected plants than John Baer or Jet Star, indicating that Fireball VR wculd be more efficient in detecting the primary inoculum in soil than the other two cultivars. The variability in the numbers of infected plants in each treatment was reasonably low as indicated by the range of standard error values (0.6 to 0.9).

The results clearly show that the primary infection of tomato plants by A. porri f. sp. solani can be considerably reduced by soil fumigation with Vorlex; a reduction of 74% occurred when the treatment was at the rate of 50 gal/acre. Little added advantage was obtained by using 75 gal/acre. It was significant to note later in the season that even at this high initial dosage of Vorlex in soil, the growth and yield of tomato plants remained unaffected. Results also suggest that a reduction in the number of infected plants early in the season should lower the amount of inoculum (conidia) for secondary infections (6, 7).

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Literature cited

1. Basu, P.K. 1971. Existence of chlamydospores of Alternaria porri f. sp. solani as overwintering propagules in soil. Phytopathology 61: 1347-1350.

2. Ebbels, D.L. 1967. Effect of soil fumigants on Fusarium wilt and nodulation of peas (Pisum sativum L.). Ann. Appl. Biol. 60: 391-398.

3. Howard, F.L., and F.K. Crandall. 1939. Response of field grown tomatoes to soil fumigation with chloropicrin. Proc. Amer. Soc. Hort. Sci. 37:939-941.

4. Lloyd, G.A. 1962. The elimination of methyl isothiocyanate from soil after treatment with metham-sodium. J. Sci. Food Agr. 13:309-315.

5. McKeen, C.D., and R.M. Sayre. 1964. Control of Verticillium dahliae and Meloidogyne incognita in greenhouse tomatoes by soil fumigation. Can. J. Plant Sci. 44:466-470.

6. Rands, R.D. 1917. Early blight of potato and related plants. Wis. Agr. Exp. Sta. Res. Bull. 42:1-48.

7. Walker, J.C. 1952. Disease of vegetable crops. McGraw-Hill Book Co. 529 p.