FOSETYL-AL SPRAYS ON PHYLLOXERA DAMAGED GRAPEVINES

P.D. KING, D.R. LAUREN, J.S. MEEKINGS, K.C. PHILLIP,
M.P. AGNEW

Ruakura Soil and Plant Research Station, Hamilton

SUMMARY

The effect of the systemic fungicide fosetyl-Al on phylloxera (*Daktulosphaira vitifoliae*) root damage and vine growth was investigated in a glasshouse trial. Vines received five sprays of the fungicide (4 g ai/litre) at monthly intervals commencing in November. Levels of the active ingredient and major metabolite were assessed by residue analysis of the leaves and roots. Residues of the active metabolite phosphonic acid were recovered from the vine root system. Numbers of undamaged root tips and phylloxera galls on the roots of vines sprayed with fosetyl-Al did not differ from those of infested unsprayed vines. The levels of root galling and decay, and shoot and root weights of infested vines, were not affected by the fungicide. The results indicate the compound does not reduce the effects of phylloxera root damage.

INTRODUCTION

Phylloxera root feeding causes galling on both the fine feeding roots and larger roots of own-rooted *Vitis vinifera* vines. The entry of soil micro-organisms or secondary pathogens through the lesions caused by phylloxera feeding and the subsequent decay of the root from the action of these micro-organisms is responsible for root death and vine decline. This has been discussed by Davidson and Nougaret (1921), Coombe (1963), Stevenson (1963) and Boubals (1966). A technique which can prevent or reduce this secondary consequence of phylloxera feeding, i.e., the rotting of infested roots, may offer growers a worthwhile short-term management strategy while interplanting or replanting using vines grafted on phylloxera resistant rootstocks.

The systemic fungicide fosetyl-Al can be translocated both upwards and downwards in the plant, and so is able to reach the roots and act on pathogens (Bompeix 1982). The fungicide has given promising results in South African trials for the control of *Phytophthora* sp. in avocado pears when applied either as foliar spray or by a tree injection technique (Turner pers comm).

In view of the systemic properties of the fungicide, a trial was undertaken to investigate the possible action of the material on other soil micro-organisms involved in root decay following phylloxera feeding damage to the roots.

This paper reports the results of fosetyl-Al sprays on the level of phylloxera root galling, on root rotting and on vine vigour in terms of shoot and root growth.

MATERIALS AND METHODS

Potted vines of the *V. vinifera* cultivar Muller-Thurgau were placed in a glasshouse in November 1983 and watered or fertilised as required. The following treatments were established:

- 1) No phylloxera, no fungicide;
- 2) No phylloxera, fungicide sprays;
- 3) Phylloxera infested, no fungicide;
- 4) Phylloxera infested, fungicide sprays.

There were 20 replicates of Treatment 1, 58 of Treatment 2 and 30 of Treatments 3 and 4. Vines of Treatments 1 and 2 were kept in one glasshouse and of 3 and 4 in an adjacent house. The location of vines was randomised within a house every 2 weeks and between houses at monthly intervals.

Proc. 38th N.Z. Weed and Pest Control Conf.

Foliar sprays of fosetyl-Al (Aliette 80% WP) were applied at 4 g ai/litre through a hand-held pressure sprayer on 18/11/83, 16/12/83, 13/1/84, 22/3/84 and 16/4/84. Shoots, leaves and roots were taken for residue analysis from vines of Treatment 2 at the times shown in Table 1, commencing with the first spray in November 1983, bagged separately for each vine and deep frozen at -20°C .

Phylloxera were introduced to each pot of Treatments 3 and 4 on 7/12/83 and 17/1/84. By late February 1984, each vine of Treatments 3 and 4 was heavily infested with phylloxera, but as there was no visible effect on vine health, it was decided to continue the trial for a second year. Vines were pruned to two buds, repotted in 2 litre pots and maintained in a similar manner to that in 1983/84. Examination of the root system of all vines in November 1984 showed that all vines of Treatments 3 and 4 were heavily infested with phylloxera. Commencing in November 1984, a further five foliar sprays of fosetyl-Al were applied over the 1984/85 growing season at the same intervals as in 1983/84.

In February 1985, a 63 cm² area of the peripheral root system of all vines was examined under a binocular microscope and the number of live root tips and live nodosities (phylloxera galled root tips) in the area was counted. At the end of April 1985, 20 replicates of Treatment 1 and 30 replicates of Treatments 2, 3 and 4 were removed from the pots and the root and shoot growth cut from the vine trunk. All shoot growth for individual vines was oven dried and shoot weight recorded. Roots were washed free of potting medium and the level of phylloxera root galling and root rotting assessed for each vine using a visual rating scale. For phylloxera galling the categories ranged from 0 - no galling present to 5 - most roots severely galled. For root damage, the categories ranged from 0 - no apparent root decay to 8 - extensive root death and decay. After assessing the level of root damage, roots were oven dried and root weights of individual vines recorded.

To provide further data on fosetyl-Al residues on and in the vines, a further 27 Muller-Thurgau vines which were potted up in spring 1984, were sprayed with 4 g ai/litre fosetyl-Al fungicide in February 1985 and again 4 weeks later. Shoot and root samples were taken from three vines for subsequent residue analysis at 0, 3, 7, 14, 21, 28, 35, 42 and 49 days after the first spray. Analysis of the levels of fungicide active ingredient and the metabolite in the shoots and roots of all samples retained for residue analysis was carried out using a method developed by Rhone-Poulenc Agrochimie (Unsworth pers comm).

TABLE 1: Residues of fosetyl-Al and the phosphonic acid metabolite on and in leaves and in roots of grapevines sprayed with fosetyl-Al fungicide.

Sample Day	Leaf residues (mg/kg)		Root residues of metabolite (mg/kg)	
	Fosetyl-Al	Metabolite	1984	1985
0	998	94	0	0
3	622	38	0	0.9
7	446	94	0	0
14	188	22	0	0
21	56	13	0	0.4
28	60	18	0.8	0.4
35	674	51	7.3	0.3
42	-*	-	-	1.3
49	-	-	-	2.6

*Samples not taken

RESULTS AND DISCUSSION

Fungicide residues

Levels of fosetyl-Al and the phosphite metabolite on and in the leaves and in the roots of vines sprayed with the fungicide are shown in Table 1. Only the metabolite is translocated to the roots. There was a steady decline in residue levels in the leaves up to 28 days after the first spray, followed by an increase after the second spray. In the samples taken in 1984, no metabolite was recovered in the roots up to day 28. The level reached 7 mg/kg a week after the second spray. In the study carried out in 1985, low levels (< 1 mg/kg) were recovered from the roots up to day 35 and the metabolite level peaked at 2.6 mg/kg 3 weeks after the second spray (Table 1). These levels can be compared to those in a field trial on grapes in France where seven foliar sprays of fosetyl-Al were applied over an 11 week period at 2 kg ai/ha, residue levels of the metabolite averaged 6 mg/kg in the roots at the end of the period (Rhône-Poulenc Agrochimie, unpublished data).

Root damage and vine growth

The numbers of live root tips and live nodosity galls with active phylloxera for each treatment after three fungicide sprays in the 1984/85 season are shown in Table 2. Phylloxera infestation had a significant ($P < 0.01$) effect on reducing the numbers of live roots when comparing Treatments 1 and 2 with 3 and 4. There were no significant differences between Treatments 3 and 4 showing that fosetyl-Al foliar sprays did not influence the level of root galling. As the number of live root tips in the fungicide sprayed treatment did not differ from the unsprayed, it appears the fosetyl-Al did not prevent galled root tips from decaying after phylloxera infestation.

TABLE 2: Numbers of live root tips and live phylloxera nodosities per 63 cm² of the peripheral root system in February 1985.

Treatment	Live root tips		Live nodosities	
	$\bar{x}/\text{vine} \pm \text{S.E.}$	Range	$\bar{x}/\text{vine} \pm \text{S.E.}$	Range
1	189 $\pm$ 15	73-295	0	-
2	206 $\pm$ 13	58-377	0	-
3	21 $\pm$ 4	0-89	10.8 $\pm$ 2.3	0-68
4	23 $\pm$ 4	0-139	11.3 $\pm$ 1.1	0-47

The levels of phylloxera galling, root damage and root and shoot growth for each treatment at the final assessment is shown in Table 3. In the uninfested Treatments 1 and 2, the low damage score was a measure of natural senescence of the fine feeding roots. There was no significant difference in shoot and root weights between these treatments showing that vine growth in the absence of phylloxera was not affected by the fungicide.

TABLE 3: Mean levels of phylloxera root galling, root damage and vine shoot and root dry weight of grapevines sprayed with fosetyl-Al fungicide or unsprayed.

Treatment	Gall score	Damage score	Shoot weight (g)	Root weight (g)
1	0	1	55.1 $\pm$ 10.8	48.7 $\pm$ 7.5
2	0	1	52.8 $\pm$ 9.4	46.2 $\pm$ 6.3
3	3.1 $\pm$ 0.8	3.8 $\pm$ 1.3	21.4 $\pm$ 4.7	19.1 $\pm$ 5.3
4	3.0 $\pm$ 0.7	3.9 $\pm$ 1.3	20.2 $\pm$ 4.6	19.1 $\pm$ 4.9

Roots of Treatments 3 and 4 vines had variable levels of root damage or decay (range 2-7 for both treatments), following phylloxera galling. On most vines there was major loss of the fine feeding roots along with considerable decay of tuberosity galls on thicker roots (3-10 mm) of both the current season's growth and roots older than one year. Phylloxera colonies were primarily confined to the tuberosities due to very low

numbers of live root tips. The fungicide had no effect on the level of phylloxera galling or on reducing subsequent root decay from the action of soil micro-organisms (Table 3). Shoot and root growth of infested vines were not affected by fosetyl-Al sprays reflecting the similar levels of damage to the vine roots.

CONCLUSIONS

The metabolite of fosetyl-Al can be translocated to the roots of grapevines which receive foliar sprays of the fungicide. Metabolite levels in the roots appear to accumulate with more than one spray necessary to cause a build-up in the roots. Relative to residue levels on the sprayed leaves and shoots, only low levels of the metabolite reach the roots. The fungicide has no effect on the level of phylloxera root galling or subsequent root decay of vines. Foliar sprays of fosetyl-Al are unable to improve the growth of phylloxera infested vines.

REFERENCES

- Bompeix, B., 1982. Fosetyl-Al, a new concept in fighting plant disease. *Phytoma* 342.
- Boubals, D., 1966. Etude de la distribution et des causes de la resistance in phylloxera radicole chez les citacees. *Ann. Amelior, Plantes* 16 (2): 145-184.
- Coombe, B.G., 1963. Phylloxera and its relation to South Australia viticulture. Dept. of Agriculture, Sth. Australia, Technical Bulletin No. 31.
- Davidson, W.M. and Nougaret, R.L., 1921. The grape phylloxera in California. U.S. Dept of Agriculture Bulletin No. 903.
- Stevenson, A.B., 1963. Abundance and distribution of the grape phylloxera *Phylloxera vitifoliae* in the Niagara Peninsula, Ontario. *Canada. J. Plant Sci.* 43: 38-43.