TECHNICAL NOTE

Assessing the Control Potential of Aldicarb against Grapevine Phylloxera

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Aldicarb 15 G soil treatments in vineyards were evaluated for their phylloxera control potential. A post-harvest application was made on single vines and phylloxera populations on roots were quantified using a washing and sieving technique. Natural population fluctuations on control vines were also determined. Data were subjected to a rank sum statistical test to determine the significance of the findings. Results indicated that aldicarb had a definite suppressing effect on all stages of grapevine phylloxera.

The vine phylloxera, *Daktulosphaira vitifolii* (Fitch), remains an important grapevine pest in South Africa. The reason for this is that none of the rootstocks used are immune to attack and some have a low degree of resistance (Loubser, De Klerk & Ferreira, 1987). The problem is aggravated by the use of ungrafted vines in certain regions.

Chemical control of phylloxera has been attempted for many years. One of the initially promising products was hexachlorobutadiene (De Klerk, 1979). Possible phytotoxicity of this chemical as well as its persistence in soil for up to four years (De Klerk, 1979), which may lead to contamination of soil water, has prevented its registration as a control chemical. Several other chemicals have been evaluated for their control potential against the aerial (Williams, 1979) and root forms (Rammer, 1980) of this insect. A lack of growth and yield in response to treatment was often seen as a lack of control of the insect. Boubals & De Redon (1976), however, demonstrated in a pot trial that aldicarb and carbofuran were able to prevent root galling of grapevines under severe conditions of infestation.

The registration of aldicarb for nematode control on grapevines in South Africa has given rise to new hopes for phylloxera control. Results by Loubser & De Klerk (1985) indicated that improvements in growth and yield were achieved after treatment with aldicarb, even though a significant decrease in nematode populations could be detected for 60 days only. Complete eradication of the pest population, or the suppression of population numbers for extended periods, therefore seems not to be a prerequisite for effective control. Whether this would apply to phylloxera infestations was unknown.

A field trial was conducted to determine phylloxera populations on grapevine roots and their suppression by aldicarb. Because of the uneven distribution of insect populations on vine roots and their normal seasonal fluctuation, experimental evaluation and statistical analysis had to be considered carefully. For this purpose populations on both treated and untreated vines were determined and a two-sample rank sum test was employed for comparing the data.

MATERIALS AND METHODS

Treatment and sampling: A Chenel X 143B vineyard at Bonnievale was selected using poor growth and severe phylloxera infestation as criteria. Roots (max. 2.0 mm diameter) were collected separately from twelve vines after harvest. They were taken from four holes (15 cm square x 30 cm deep) within 30 cm of the trunk of each experimental vine. A 1 m^2 basin was made around each vine and aldicarb 15 G was then applied at 5 g/m^2 around six of them. Thereafter irrigation was applied to all experimental vines. An unrestricted random design was employed for the allocation of treatments. Thirty days later root sampling was repeated on all vines by digging holes at positions that differed from the previous sampling spots.

Root samples were kept separately in plastic bags in a cooler bag and analysed for phylloxera infestation within 24 hours. The mass of each root sample was determined, whereafter phylloxera populations were washed from the roots. This was done by placing the roots on a 200 mm diameter sieve (2 mm apertures) on top of a 10ℓ capacity bucket and spraying them with a jet of water. Washing was restricted to 20 seconds for each sample using a 6 mm diameter nozzle at a pressure of 150 kPa.

After the roots were washed, the water in the bucket was poured through a 150 μ sieve and the trappings washed into a 500 ml beaker. After sedimentation for 10 minutes, excess water was syphoned off and the volume was standardised to 200 ml. Five milliliter aliquots of the suspension were poured into 90 mm diameter petri dishes, marked with grids for easy counting. Adult females, nymphs and eggs were counted separately for each replicate of treated and non-treated vine. Phylloxera counts

were made in control plots in order to determine natural population fluctuations. Populations were expressed as the number of individuals found on 30 g of roots.

Statistical analysis: Data from treated vines could not be compared with control vines without taking normal population fluctuations into account. To accommodate this as well as the variation between replicates, the following statistical approach was followed:

The Mann-Whitney U test (Siegel, 1956) was used. The lowest post-treatment count was assigned the lowest rank. If ties were encountered when ranking, the observation with the highest pre-treatment count was assigned the lowest rank of the tied values, indicating superior control. Observations in which both post- and pre-treatment counts were tied, were treated in the usual way for tied values. One-tailed significance levels were calculated using the table of Hodges & Lehmann (1964).

RESULTS AND DISCUSSION

Results obtained with the washing and sieving method were satisfactory, indicating that populations and different life phases can be quantified using this technique. The figures obtained clearly indicated that all stages of the phylloxera population were reduced by a single application of aldicarb (Table 1). The extraction technique and treatments gave results comparable to those of Buchanan & Godden (1989). However, by taking normal population fluctuations into account as was done in this trial, the effect of aldicarb was not as prominent as reported by these authors. According to the numbers recorded on treated vines only, aldicarb almost eradicated the phylloxera infestation (Table 1). However, reductions obtained on untreated vines indicated that the population showed a natural decrease during the evaluation period.

The statistical approach which was followed enabled us to compare highly fluctuating population numbers on "normal" and treated vines. Note that the raw data must be judged as such, as they have not been summarised in terms of a fully specified but possibly ill-founded model; the statistical test serves only to provide assurance that the evidence being presented cannot reasonably be attributed to experimental error.

CONCLUSIONS

The washing and sieving technique proved successful in the extraction of all phylloxera life phases from root samples. According to our statistical analysis aldicarb 15 G suppressed the numbers of all phases significantly over a period of 30 days. Whether this would be sufficient to ensure improved root development and growth was not determined. Further field experiments will have to be carried out to verify this before registration of the chemical for phylloxera control can be considered.

TABLE 1
Phylloxera population numbers on grapevine roots: Initially and 30 days after treatment with aldicarb 15 G.

	Treated vines						Control vines					
Eggs:												
Numbers before treatment	4	55	11	37	15	15	37	9	12	12	12	6
Numbers after 30 days	0	0	0	0	0	0	2	2	0	2	11	26
Rank order number	7	1	6	2	3,5	3,5	8	10	5	9	11	12
	Total score: 23						Total score: 55					
Nymphs:												
Numbers before treatment	75	74	112	58	126	21	60	85	53	44	33	4
Numbers after 30 days	0	4	0	0	0	0	32	45	13	18	6	6
Rank order number	3	6	2	4	1	5	11	12	9	10	7	8
	Total score: 21						Total score: 57					
Adults:												
Numbers before treatment	4	9	14	4	6	9	10	5	2	0	7	2
Numbers after 30 days	0	0	0	0	0	0	0	0	0	0	2	4
Rank order number	7,5	3,5	1	7,5	5	3,5	2	6	9	10	11	12
	Total score: 28						Total score: 50					

Significance level of the difference in total scores: Eggs P = 0,004
Nymphs P = 0,001
Adults P = 0,047

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