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CULTURAL PRACTICES FOR THE CONTROL OF *XIPHINEMA INDEX* IN CYPRUS

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Summary. Experimental work for controlling the natural vector of the Grape Fan-leaf Virus disease, *Xiphinema index* Thorne *et* Allen indicated that, under local conditions, fallow alone or fallow rotated with barley can decrease populations to non-detectable levels, between 40 to 52 months after up-rooting grapevine plantations.

Commercial grapevine growing in Cyprus dates back to the 12th century. The present area under production is approximately 22.000 ha most of which is in the hilly areas of the island, with an annual value of $US 32m (Anon, 1991). In recent years the grape industry in Cyprus has faced serious economic problems due mainly to overproduction. The Cyprus Government therefore has introduced a "Vine Replanting Scheme" with the aim of reducing the area under grapevines while, at the same time, upgrading the quality of the wine produced by replacing the old, traditional cultivars with new ones more suited to high quality wine making.

Grapevine fanleaf virus (GFLV) and its natural vector *Xiphinema index* Thorne *et* Allen are widespread in the grapevine production areas of Cyprus (Philis, 1993) and they must be controlled, if not eliminated, in land that is to be planted with the new cultivars. Raski and Hewitt (1960) demonstrated in the laboratory that *X. index* lost its ability to transmit GFLV if maintained for nine months without any host plants. Under field conditions, however, the survival of roots in the soil after the removal of the grapevine crop maintains a reservoir of virus for a much longer period as well as providing a food source for *X. index* Raski *et al.*, 1965). Experiments were therefore initiated to establish the efficiency of fallow and fallow-barley cropping systems in Cyprus as a means of controlling GFLV and *X. index* before replanting with new cultivars.

Materials and methods

Experiments were undertaken at two sites. That at Statos was situated in the western, hilly part of the island at an altitude of 1050 m and in a clay loam (30% clay; 30% silt; 40% sand) and that at Achelia was in the western coastal area in a sandy clay loam (30% clay; 15% silt; 55% sand). At both sites the grapevines were more than 30 years old when uprooted with a special digger in late summer, 1988. One month later the land was ploughed to a depth of 40-50 cm and at each site six plots were marked out, each between 60-80 m^2. At Statos, the whole experimental field was continuously fallowed while at Achelia half of the plots were continuously fallowed and half rotated every other year with barley cv. Athenais. At both sites the experimental fields were ploughed to a depth of 30 cm each summer. Starting in January, 1989, soil samples were taken in January, April, July and October of each of the five years of the experiment. The samples were obtained with a 9 cm diameter soil auger to depths of 20, 40 and 60 cm at Achelia but only at 20 and 40 cm at Statos because of the increasing amount of stones with depth. At Statos and Achelia, a total of twenty four and thirty six samples were taken at random in each sampling season, respectively. Nematodes were extracted from 200 g aliquots by decanting and sieving with a final separation by the Baeramm funnel technique using a 110 µ nylon filter (Brown and Boag, 1988). Numbers of nematodes were transformed to $\sqrt{x+0.5}$ for statistical analysis.

Results and discussion

At Achelia, where the initial nematode population was relatively high, 48 and 52 months were needed for the rotation and fallow cultural practices, respectively, to reduce the namtode population to non-detectable levels. At Sta-

TABLE I *Population decline of* Xiphinema index *caused by cultural practices after vine up-rooting (Nematodes/200g soil).*

Cultural practices	Soil depth cm	1989 Mean*	1989 Overall** mean	1990	1990 Overall mean	1991 Mean	1991 Overall mean	1992 Mean	1992 Overall mean	1993 Jan.	1993 Apr.	S.E. of overall mean
ACKELIA												
Continuous fallow	20	25.6 a		10.4 a		2.0 ab		1.4 a		0.0	0.0	
	40	14.5 b	15.5 a	6.9 a	7.7 b	3.0 a	2.1 c	0.8 b	0.9 c	0.2	0.0	0.9
	60	6.5 c		5.9 a		1.3 b		0.4 b		0.0	0.0	
S.E. of mean		1.2		0.9		0.3		0.5				
Rotation***	20	20.3 a		8.2 a		2.1 a		0.8 a		0.0	0.0	
	40	11.6 a	12.7 a	3.7 a	4.9 b	2.4 a	2.0 bc	0.1 a	0.4 c	0.0	0.0	0.3
	60	6.3 a		2.9 a		1.6 a		0.2 a		0.0	0.0	
S.E. of mean		3.4		0.5		0.		0.2				
STATOS												
Continuous fallow	20	3.0 a		0.5 a		0.1 a		0.1 a		0.0	0.0	
			3.0 a		0.5 b		0.2 b		0.0 b			
	40	3.0 a		0.6 a		0.3		0.0 a		0.0	0.0	
S.E. of mean		0.2		0.2		0.03						

Mean of four sampling seasons (Jan., Apr., July, October). Data flanked on the column by the same letters are not statistically different (P=0.05); ** Comparing overall means horizontally; *** Starting with "Fallow" in 1989.

tos, where the initial population was substantially lower than at Achelia, fallow "eliminated" the nematode in 40 months from the time of up-rooting the old vineyard (Table I). These findings are to a great extent, in accord with those of Raski *et al.* (1965) who found that, under Californian conditions, *Xiphinema index* survived for 4.5 years in the soil under winter grain and summer fallow after vine up-rooting. The shorter time for the population to reach zero levels at Statos is believed to be due, mainly, to the very stony soil at that site and the extremely dry conditions, especially during summer, which occur in such a soil type.

Significant reductions in nematode population occurred at both sites from the second year of experimentation while in 1991, the third year of experimentation, populations were drastically reduced as compared to 1989 densities, reaching zero levels in April, 1992 at Statos and in April, 1993 at Ackelia (Table I). At Ackelia, the nematode population decreased with increasing soil depth, this being particularly apparent in the first and second years of the experiment when nematode populations were still relatively high. There was no significant difference between fallow and fallow-barley cropping sequences in reducing population densities of *X. index*. It is concluded that in Cyprus, old plantations of grapevines should be left fallow for at least four years after grabbing out, with a deep cultivation each summer, to ensure that new plantings of grapevines will remain free from infection with grapevine fanleaf virus.

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