

I. Deciduous Orchard Diseases

d. Chemical control

1. Orchard replant

Host: Apple (*Malus sylvestris* 'Granny Smith', 'Golden Delicious')

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APPLE REPLANT STUDIES IN COLORADO, 1988 RESULTS: Old apple trees (20+ yrs age) were removed late summer prior to replant year and all replant acreage ripped to 45 cm depth. Randomly assigned tree sites were either blasted or backhoed 1 X 1 X 1 m, the soil replaced back into the original tree hole, and soil treatments injected to 45 cm depth in November. Granny Smith and non-spur Golden Delicious trees (both on M-26) were planted in April 1986 and 1988, respectively. After they were watered in, irrigation creases were cut in to the new trees and a 2-3 wk irrigation schedule was followed for both studies. Standard insecticide/ miticide materials were used to control insect and mite pests, and standard fertilization practices were used after the first year of growth. The 1986 study was a randomized complete block design (15 treatments X 5 reps with two trees within each rep) but also containing an incomplete factorial design (2 site prep factors X 3 or 4 soil treatment factors X 5 reps with two trees averaged for each rep); the nine other treatments were assigned to the rip + blast site preparation. The 1988 study was a randomized complete block design (8 trts X 10 reps) with two control treatments (rip only and rip + backhoe only); all other treatments were both ripped and backhoed as described above. Trunks of all trees were marked approx. 15 cm above the graft union for trunk circumference measurements at their first measurement after planting in April. All trees were measured at or just after leaf fall each succeeding autumn, and the trunk circumferences converted to trunk cross-sectional area for analysis. Factor means (combined treatments, 1986 study) were tested by contrasts associated with ANOVA analysis. Treatment means were separated by Duncan's Multiple Range Test only where the ANOVA demonstrated significant differences between treatments ($p < 0.05$).

Suboptimal soil temperatures at the time of fumigation (12.5° C and 3-40 C at 40-45 cm depth for the 1986 and 1987 studies, respectively) may have decreased effectiveness of soil fumigation treatments since optimal temperatures for such are $> 15^{\circ}$ C. Pre-plant soil loosening (by blasting or backhoeing) provided the greatest growth response for any single factor within both studies. That may be due to the fine-silt soil texture at the location; however it is not uncommon to find large, fist-sized gravel embedded within the silt soil matrix. The pronounced growth response to the plastic mulch treatment in the 1988 study may be attributable to either increased soil temperatures or enhanced soil moisture (or both) during early tree growth. Enhanced soil moisture is more likely because of the extremely arid climate (18-20 cm annual precipitation) at the location. Any severe water stress prior to establishment of a new root system during that period would greatly reduce tree growth. Only the fertilizer and Vorlex treatments in the 1988 study reduced tree growth to any extent, and the reduction was not significant ($p < 0.05$).

Table 1. Effects of pre-plant site preparation and soil treatment on early growth of apple trees at the Orchard Mesa Research Center (Colorado).

Study

Site Prep. ^a	Treatment/Rate per Tree ^b	Cross-Sectional Trunk Area (cm ²) ^c			
		Initial	Year 1	Year 2	Year 3
1986 Study					
R	Ck	0.5	0.9	2.8	5.7
	N (50 g/m ²)	0.5	1.1	3.0	6.0
	B (0.45 kg)	0.5	1.0	2.8	6.0
	T (0.45 kg)	0.5	1.0	2.7	6.0
R + BL	Ck	0.6	1.4	4.6	9.3
	B (0.45 kg)	0.6	1.2	3.6	7.6
	B (0.68 kg)	0.5	1.8	5.5	11.4
	T (0.45 kg)	0.5	1.4	4.1	8.0
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R	Ck + B + T	0.5	1.0 b	2.8 b	5.9 b
R + BL	Ck + B + T	0.6	1.4 a	4.1 a	8.3 a
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1988 Study					
R	Ck	1.3	1.6 e		
BK	Ck	1.1	2.0 bc		
	P	1.2	2.4 a		
	F (2.3 g/l soil) .	1.0	1.6 de		
	V (237 ml) . . .	1.3	1.9 bcd		
	B (0.68 kg) . . .	1.2	2.1 ab		
	F + V (as above) .	1.1	1.7 cde		
	F + B (as above) .	1.2	1.9 bcd		

^a Site preparation: R = ripped, 45 cm depth; BK = backhoed, 1 X 1 X 1 m; BL = blasted.

^bTreatment/Rates: Given as amounts per tree unless noted otherwise.
 Ck = control (not treated);
 B = Brom-O-Gas 98, injected 45 cm deep by hand probe.
 T = Terr-O-Gas 67, injected 45 cm deep by hand probe.
 N = Nematicur 15G, applied to surface prior to planting April 1986.
 P = Plastic mulch (clear), applied 1 mo prior to and replaced after planting.
 F = Fertilizer, 11-52-0, mixed with soil at backhoeing Nov. 1987.
 V = Vorlex, mixed with soil at backhoeing Nov. 1987.

^cMeans followed by the same letter within each column for each study are not significantly different (p=0.05).