ORCHARD PREPLANT LAND PREPARATION NEW AND REPLANT

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BACKHOES HAVE BEEN used to remove trees from orchards for many years. In sandy soils, increased tree growth has resulted where large holes were dug for replanting as compared to trees planted conventionally.

Examinations of soils with a backhoe have often revealed such severe manmade soil compaction caused by land-grading operations that trees did not grow, or grew poorly, in fill areas. Compaction normally extends to about a 15-inch depth. Land-grading to facilitate border check irrigation often compounds surface compaction by burying organic matter, compacted layers, and stratified textures. Natural stratifications that restrict water movement also occur. These present the same difficulties whether in coarse loamy sands or finer textured soils.

In September 1967, part of a fourth-leaf almond orchard was removed because of poor and dying trees. Backhoe excavations diagnosed a series of four grading operations since the 1930s, and in some areas the original surface soil was as much as 11 feet below the surface.

Comparison

Experiment 1 was established to compare a preplant slip-plow and a backhoe treatment. The slip-plow operated at depths of 44 to 48 inches. One pass was made down the tree row and one eight feet away on either side. Backhoe holes were two feet by six feet long, to a depth of approximately 15 inches below visual evidence of total fill depth. Control trees were interplanted between trees that had received the preplant backhoe treatment. Trees were planted in February 1968. Six replications were used per treatment, with 19 to 23 trees per replication.

After two and four growing seasons the trunks were measured, using circumferences one foot above ground level as a standard (graph 1). Backhoed trees were two and one-half times larger than control trees (significant at the .1% level). Slip-plowed trees were two times larger than control trees (significant at the 1% level).

Examination of the root systems after the first two years revealed that few roots escaped the backhoe or slip-plow modified soil. Additional soil modifications were made on half the trees by digging six-foot-deep trenches as close as possible on either side.

Control trees

Original control trees that were backhoed after the first two years were larger when four years old than control trees (significant at the 5% level). Additional backhoeing alongside originally backhoed trees also improved growth, but backhoeing alongside slip-plowed trees did not.

Results of this experiment led to a series of tests to establish proper hole size, conditions where backhoeing is economical, use of soil fumigants in backhoe sites, and best rates.

In experiment 2 (almonds), the chemical application method varied with soil manipulation. We also decided to look at holes of different sizes. Single bucket-width backhoe holes (two by six by six feet deep) had the sides caved in and the chemicals applied before backfilling. Square holes (six by six by six feet deep) had chemicals applied to the bottom before backfilling. A three-inch barrel auger was used to apply chemicals where soil manipulation was simple subsoiling.

Methyl bromide (MC-2) was used with and without plastic tarpaulins. In the carbon disulfide (CS_2) applications one quart of material was poured across loose soil after the sides were caved in or in the bottom of square holes before backfilling. This placed the chemical two to three feet below field level.

Single treatments

Single tree treatments were used with five replications per treatment. Materials and treatments used were: (1) subsoiling 20″ deep (control); (2) subsoiling plus 1 qt CS_2; (3) subsoiling plus 1 lb MC-2; (4) subsoiling plus 1 lb MC-2 tarped; (5) subsoiling plus 2 lbs MC-2; (6) single bucket backhoe, 2′ × 6′ × 6′ (caved); (7) above, plus 1 qt CS_2; (8) above, plus 1 lb MC-2; (9) above, plus 1 lb MC-2 tarped; (10) above, plus 2 lbs MC-2; (11) square backhoe hole 6′ × 6′ × 6′; (12) above, plus 1 qt CS_2; (13) above, plus 1 lb MC-2; (14) above, plus 1 lb MC-2 tarped; (15) above, plus 2 lbs MC-2.

Trunk circumferences of backhoed trees have been consistently larger than subsoiled trees, and the larger backhoe holes produced larger trees than did the smaller holes, but not significantly so.

Trees in chemically treated sites were larger than those in untreated sites. Significant levels were at 5% and 1% and varied somewhat from year to year. There was no statistical difference between chemical treatments, but methyl bromide produced larger trees than carbon disulfide. Graph 2 presents results from one-pound applications of methyl bromide.

In experiment 3 (peach), an orchard soil with no physical problem was chosen for soil manipulation practices in combination with three different chemical treatments. The chemicals were one quart Telone or Telone C, or one pound methyl bromide. Single tree treatments were used with six replications.

Trunk circumference

Trunk circumferences at the end of each growing season are shown in graph 3. No benefit resulted from soil manipulation beyond subsoiling. All chemical treatments were significantly better than the control. Figure 3 data are the mean of each material, regardless of soil treatment.

In experiment 4 (peach), a rate trial was established on a Tujunga loamy sand underlain with coarse sand at five feet. Part of a four-year-old peach planting was removed because of poor growth or death of trees. Experience in the area indicated preplant backhoeing was of value. All holes were six by six feet to a depth of five feet.

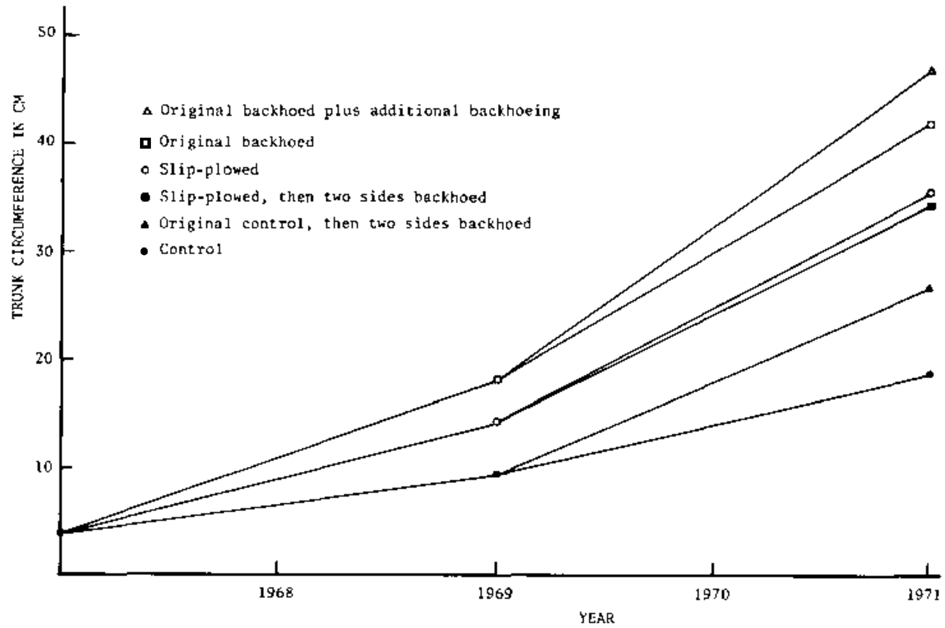
Interplanted control

In one corner of the field, a small-scale trial (4A) was established with interplanted control trees that were neither backhoed nor fumigated. In December 1972, after one growing season, trunk circumference was 3.6 cm in the control group, 4.5 cm in the trees that had been tarped and treated with 1 lb MC-2, 4.9 cm in the backhoed-only trees, and 7.3 cm ($P > .05$) in the backhoed plus 1 lb. MC-2 trees. After the second growing season in December 1973, the trunk circumferences were 5.0, 9.5, 11.4 and 15.2, respectively, for the same groups of trees. As these trees started their third leaf, bacterial canker was severe. Only the backhoed plus fumigated trees were growing well or even alive, so this portion was terminated.

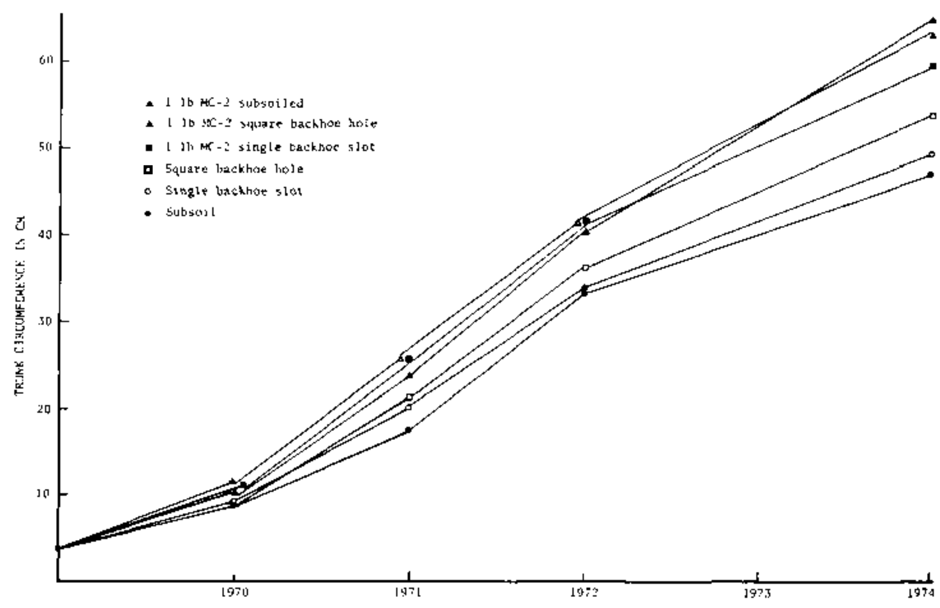
The main experiment (4B) was a fumigation rate and polyethylene cover trial, so all tree sites were backhoed and fumigated. Five replications of 11 treatments were used, with three trees per replication.

Trunk circumferences were taken at the end of the first three growing seasons.

GRAPH 1. SIZE OF ALMOND TREES—BACKHOED COMPARED WITH SLIP-PLOWED



GRAPH 2. SIZE OF PEACH TREES—IN DIFFERENT SIZE BACKHOE SLOTS, AND WITH AND WITHOUT MC-2 FUMIGATION.



GRAPH 3. SIZE OF PEACH TREES—FUMIGATED WITH MC-2, TELONE C, TELONE, AND UNFUMIGATED.

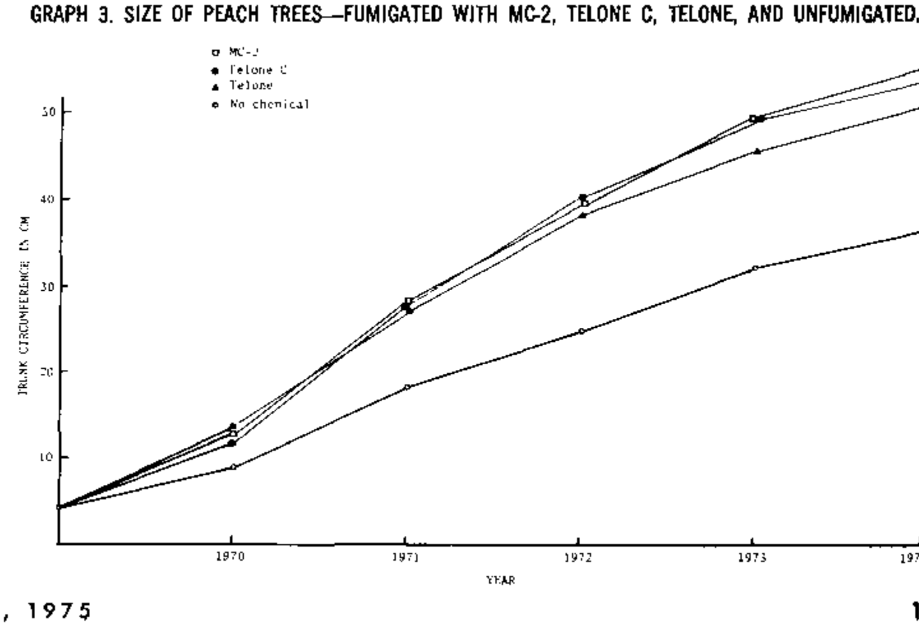


TABLE 1. EFFECT OF BACKHOEING AND FUMIGATION ON GROWTH OF PEACH TREES

Treatment	December 1974 Trunk circumference at end of third leaf
	(cm)
2 lbs MC-2 from cylinder plus tarp	28.1 a
1 qt Telone C	28.0 a
2 qts Telone	27.6 a b
2 lbs MC-2 from cylinder	27.0 a b
1 lb MC-2 from cylinder plus tarp	26.8 a b
1 lb MC-2 from chilled can plus tarp	25.9 a b
1 qt Telone	25.9 a b
1 lb MC-2 from chilled can	25.7 a b
1 lb MC-2 from cylinder	24.6 a b
1.5 lbs methyl bromide-chloropicrin (MC-33) plus tarp	24.6 a b
1.5 lbs MC-33	23.4 b
LSD .05 = 3.7	

TABLE 2. EFFECT OF BACKHOEING AND FUMIGATION ON GROWTH OF CLINGSTONE PEACH TREES

Material	Trunk circumference at end of third leaf
	(cm)
1 pt Telone	36.0 a
3 pts Telone	35.9 a
2 pts Telone C	35.7 a
1 pt Telone C	35.5 a
2 pts Telone	35.3 a
1 lb MC-2	34.5 a b
1 lb methyl bromide-chloropicrin (MC-33), but at bottom of hole	34.0 a b
2 lbs MC-2	32.7 a b
1.5 lbs MC-33	31.8 a b
2.25 lbs MC-33	31.7 a b
0.75 lb MC-33	30.5 b
LSD .05 = 3.9	

There were no statistical differences among chemicals at the end of the first growing season. Control trees in the small-scale trial (4A) cannot be used for statistical purposes in the main experiment. However, it was probably correctly concluded by comparing untreated and treated trees that all those in sites that received chemical treatments were in the range of four times as large in trunk cross-sectional area. Table 1 shows treatments and growth responses after three growing seasons. In each case tarped treatments produced larger trees, but not significantly so.

In experiment 5, a rate trial was established on a Hanford sandy loam where two previous plantings of clingstone peaches had been grown. After trees were removed in September 1971, all tree sites were backhoed and fumigated, because experience on this property had shown that preplant fumigation was necessary. Table 2 gives materials and tree trunk circumferences at the end of the three growing seasons. Trees in sites treated with methyl bromide-chloropicrin (MC-33) at 0.75 pounds were significantly smaller than Telone and Telone C treatments. There was no other statistical difference.

Injection

One pint of Telone or one pound of methyl bromide was adequate. Telone, at one pint per hole, is just about four times the concentration used by growers in a 50-gallon-per-acre injection treatment.

Experiment 6 (peaches) was a Telone rate trial on Hanford sandy loam. This material had consistently performed well and was easy to apply. All tree sites were backhoed in early October 1972, and Telone was used at 4, 8, 12, and 16 ounces per tree site. Four ounces of Telone in a hole approximately 5½ by 5½ feet square is comparable to 50 gallons per acre. Single tree treatments were used with nine replications. Five unfumigated trees alongside this experiment were paired with grower-treated (50 gallons per acre Telone) trees for comparative purposes. After two years the unfumigated trees were smaller at the 5% significant level. The various fumigant rates produced no mathematical or statistical differences in trunk size at the end of the first or second growing season. Trunk circumferences in each treatment were as follows: 4 oz Telone, 25.7 cm; 8 oz Telone, 25.0 cm; 12 oz Telone, 25.2 cm; 16 oz Telone, 25.0 cm; Grower 50 gal/acre, 24.7 cm; Grower check 19.3 cm.

Cold soils

Experiment 7 (almonds) was a rate trial to test adverse conditions of cold, saturated soil. The soil was a Tujunga loamy sand with a history of poor crops. All tree sites for fumigant comparisons were backhoed to the now standard six by six by six feet deep.

Four materials — methyl bromide, methyl bromide with 33% chloropicrin, Telone, and Telone C—were used at four rates each. Fumazone 86 (DBCP), 1 ounce mixed in 50 gallons of water and sprayed on the soil as it was backfilled, was another approach to preplant treatment. Control trees were backhoed, but not fumigated.

Soil moisture was at field capacity, and rain showers occurred during soil treatments. Application date was December 7; ambient air temperature 45°F; soil temperatures at one, two, and three feet below the soil surface were 43°, 44°, and 46°F, respectively. Two days after treatment the morning low was 25°F, and for several mornings minimums were in the low 20s.

No response was measured from any of the chemical treatments at the end of either the first or second growing season.

Conclusions

Backhoeing is advantageous in sandy soils, fill areas where compaction is severe, or where soil is underlain with water-infiltration-restricting zones within rooting depth. No advantage has been shown by backhoeing where soil profile problems do not exist, other than root removal for replants in existing orchards. Many fields do have areas with physical problems, so it is advisable to carefully map proposed orchard sites to determine optimum type of land preparation.

Properly applied, preplant treatments with nematicides or general fumigants are the best means of obtaining uniformly vigorous almond and peach trees, whether on Nemaguard or Lovell rootstock. There has been no statistical difference between the use of Telone, Telone C, or methyl bromide. Use of polyethylene tarps appeared to be advantageous only if weed control is desired where methyl bromide is used.

In areas within a field where previous crops did not grow well, each tree site should be backhoed and fumigated. Fumigation can be in individual tree sites or by conventional machine application after the holes are backfilled. To be effective, fumigation must be completed before the soil becomes wet and cold from autumn and winter weather.

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