GROWTH AND YIELD BENEFIT OF REPLANTING INTO "TRANSPORTED NON REPLANT PROBLEM SOIL"

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For the purpose of this study "Virgin Soil," or a better term "Non Replant Problem Soil" (NRPS), is soil that had received occasional tillage for weed control but no irrigation and had not supported any crop for 15 or more years and did not harbor soil pests or chemical residues that might limit growth of subsequent perennial crops. "Replant Problem Soil" (RPS), by contrast is soil that can be collected from anywhere near the roots of established trees or vines. In this test the RPS site was a four acre field located directly adjacent to the NRPS site where nemaguard peach rootstock had been grown for 15 years.

Planting occurred within six months after a fall removal of nemaguard peach rootstock. Backhoeing treatments consisted of digging a hole with a tractor-mounted backhoe to 6 ft depth, caving in the four side walls and replacing the spoil pile back to the top of the planting site. All references to ½ yd soil refer to planting sites where a Vermeer tree spade had dug a hole 50 inches in circumference at the ground surface which tapered as a cone down to a point 36 inches in depth. Holes were dug and then either ½ yd NRPS or RPS was transported to each hole where either a NRPS or RPS cropping history existed. Nursery-grown, 0.95 cm.-diameter almond trees on nemaguard peach were planted to each site with six trees per replicate laid out in a randomized complete block design. Trees were fertilized and irrigated uniformly and pruned according to their vigor for the next three years.

One year after planting the trunk diameters of trees started in complete NRPS or ½ yard NRPS were statistically similar (P=0.01) in size at 3.62 and 3.54 cm, respectively. Trees planted to backhoed RPS sites that had received 1 lb. treatment methyl bromide were significantly smaller, measuring 2.98 cm. in diameter. Trees replanted into the RPS field history without backhoeing, with backhoeing, or into sites that had received ½ yard RPS surrounded by NRPS grew diameters that were 2.41 cm., 2.27cm. and 2.35 cm., respectively.

To the observer, replanted trees grew extremely well for three to four months when replanted into ½ yd. NRPS. As their roots extended into the surrounding RPS their above-ground growth visibly slowed. In their second year these trees gradually adjusted to the surrounding RPS condition and resumed their faster growth rate and greener coloration. Four of five replicates were growing well by the beginning of the third year but all trees in one of the replicates were still showing chlorotic leaves and poor growth throughout the second and third year. The poor growth associated with roots present in RPS followed by an apparent recovery from the problem leads the senior author to refer to this phenomena as the rejection component of the replant problem.

Trees replanted into methyl bromide treated sites did not grow fast for the first four months. Growth accelerated after that producing longer bud internodes and taller trees that were never quite as green as those started out in NRPS.

Growth of trees started out in RPS was always less, leaves were more chlorotic, and roots produced fewer feeder roots than those listed above until they reached into a zone of NRPS where feeder root development was stimulated.

At the end of the second year trunk diameters of trees grown completely surrounded by NRPS was 8.34 cm. This value was significantly (P=0.05) greater than the growth from trees in methyl bromide treated soil or those started out in ½ yard NRPS soil, which was similar at 7.56 cm and 7.48 cm, respectively. Trees started out in non fumigated RPS were similar in growth and significantly poorer than the groupings above. The treatment of ½ yard RPS surrounded by NRPS, RPS untreated, and RPS backhoed produced tree diameters of 6.54 cm., 6.47 cm, and 6.31 cm., respectively. During the third year almond yields were collected. These results are displayed in Table 1. These data indicate that methyl bromide treatments to backhoed sites did not completely rid the soil of the replant problem. Best plant growth and yield was obtained when trees were planted into virgin soil (NRPS).

Starting trees out in ½ yard NRPS in a manner that permits no RPS to mix into the ½ yard produces trees at least equivalent in growth to those treated with methyl bromide four times out of five. We have no explanation as to why the one complete replicate of ½ yard NRPS failed to perform equivalent to the other four, but we believe it was something in the soil rather than an error in our methods. The one poor replicate involved an edge row of the four acre trial. For these reasons we do not expect to repeat our success with ½ yard NRPS in all other locations. There appears to be a biological phenomena involving organisms other than known pathogens which is at work in RPS and the result is a six to 12 month rejection of new root development. This problem disappears as quickly as it appears.

The use of ½ yard NRPS is adequate to overcome much of RPS or at least give three to four months of exceptional root growth enabling a stronger response as roots encounter the RPS condition and then grow past it or in some manner develop a compatibility with it. Our conical shaped ½ yard of soil may not be the best design for this problem. We estimate that 1 or 2 yards NRPS would provide even better growth but there must be economy inserted into the technique. The authors are unclear about the practicality of transporting NRPS though it does have application where there are fewer than 100 plants per acre. Using the current farm gate price of $5.00 per kg of fruit the ½ yd NRPS treatment would have provided $10.00 per tree in the third year whereas the RPS untreated treatment produced $4.80 per tree. The cost of transporting ½ yd soil in this experiment was approximately $7.00 per tree site.

Regardless of the practical implications of these findings the authors are more interested in the academic question of what is RPS and NRPS and why does the replant problem frequently disappear six months after replanting but remain a problem as much as four years to confront a new replant? Note also that tree roots started out in RPS and entering into NRPS within six months did not stimulate a sudden increase in plant growth.

Table 1. Mean weight and fruit numbers per tree in the third year after planting Mission Almond/Nemaguard Peach into six preplant scenarios.

Treatment	Kg Fruit/Tree	Number Fruits/Tree
NRPS	2.09 a	172. a
½ yd NRPS into RPS	1.96 a	184. a
RPS treated with MB	1.85 a	169. a
½ yd RPS into NRPS	0.58 b	50. b
RPS backhoed only	0.66 b	62. b
RPS untreated	0.84 b	79. b
	(*P*=0.01)	(*P*=0.05)

Means followed by a different letter are significantly different based on an analysis of variance and separation of differences by a Duncan's Multiple Range Test.

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