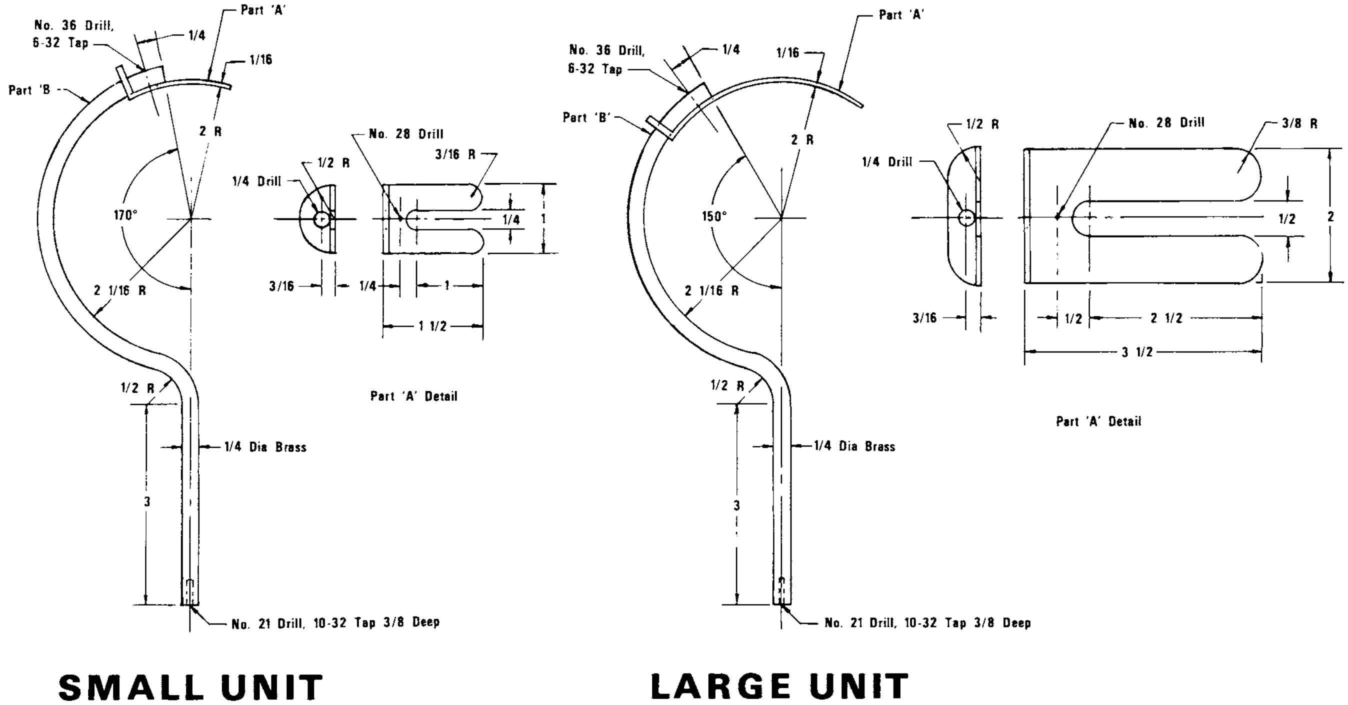

Fig. 2. Details of the two fruit removal units.

screw 1/2 inch from the end. This hole was in line with the 2-1/16 inch radius.

The smaller unit will handle fruit up to 1 inch in diam (stem diam 1/4 inch or less) while the larger unit will handle fruit up to 4 inches in diam. To use, the claw (slot of part "A") is hooked over the fruit as shown in Fig. 1 and while the limb was held a slow, gentle pull is exerted on the gauge. It is important that the angle of pull be at right angle to the abscission layer. After the fruit is removed the maximum removal force is read from the scale.

This low cost instrument has been used for 4 seasons and has provided an easy and rapid method of obtaining the force required to remove peaches from branches. Although it was designed for use on peaches, the instrument could also be used on other fruit with little modification.

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Effects of Aluminum Concentration on Growth and Chemical Composition of Peach Seedlings[1]

H. C. Kirkpatrick, J. M. Thompson, and J. H. Edwards[2]

U.S. Department of Agriculture, Byron, Georgia

Abstract. **Aluminum concentrations of 0, 3, 10, 30, and 100 ppm in nutrient solution reduced proportionately the dry weights of stem, roots, and leaves of seedlings of 'Lovell' peach [*Prunus persica* (L.) Batsch]. Roots grown at 30 and 100 ppm Al were shorter, thicker, and had less branching than roots grown at lower concentrations. The epidermal and endodermal cells were small, with grossly thickened cell walls. Cells of the cortex were shortened in the longitudinal axes. Leaf Al level indicated solution Al better than did the Al levels of roots, stems, or the 2% acetic acid-extractable Al fraction of leaves, stems, or roots. The concentration of Ca, Mg, Mn, and P were reduced as Al concentration increased.**

[1]Received for publication November 23, 1974.

[2]Research Plant Pathologist, Research Geneticist, and Soil Scientist, respectively, Southeastern Fruit and Tree Nut Research Station, Agricultural Research Service, U.S. Department of Agriculture.

Peach production in the Southeast has declined sharply in the last decade as a result of the death of producing peach trees. However, the problem of peach tree death has been recognized for a century (7). Peach trees planted on former orchard sites frequently die 3 to 4 years after planting. According to Prince (14), the average life of a peach orchard in middle Georgia is 8 years.

The syndrome associated with peach tree short life has been attributed to Clitocybe root rot (16), bacterial canker (1, 9, 13), nematodes (11), root toxicity (8, 10, 12), and cultural practices (15). Information on possible soil-related factors is more limited (6).

The influence of Al concn on annual crops is documented extensively (2, 3, 4). The Al concn that is toxic to peach has not been determined, nor is it known that Al concn in Southeastern soils can be related to peach short life. The objectives of this study were to determine the effect of Al concn in sand-nutrient culture on peach seedling growth and chemical composition.

'Lovell' peach seedlings were germinated and grown in sand washed with distilled water. When they were 8-12 cm tall, one peach seedling was transplanted into a 4-liter plastic pot that contained 7-8 cm of crushed gravel and 25 cm of quartz sand, 2-3 mm size. A polyvinyl chloride (PVC) outlet was placed in the crushed gravel to facilitate recycling the nutrient solution. Treatments were replicated 10 times. The experiment was ended after 74 days.

Steinberg nutrient solution (5), as modified by Tiffin and Brown (Frederick E. Hutchinson, personal correspondence), at 2/5 strength was used in these experiments. Seedlings received nutrients minus Al for 2 weeks before Al was added to the solutions as $KAl(SO_4)_2 \cdot 12\,H_2O$ for concn of 0, 3, 10, 30, and 100 ppm. Solutions were adjusted to pH 4.0-4.5 and maintained by daily additions of 0.1 N HCl or 0.1 N NaOH. Twice daily for 15 min, the solutions were pumped to the surface of the pots from 60-liter reservoirs. Fresh

Table 1. Terminal growth and dry wt of roots, stems, and leaves of 'Lovell' peach seedlings grown for 74 days in sand-nutrient culture at various Al concn (pH 4.0-4.5).

Al concn (ppm)	Terminal buds dormant (%)	Terminal growth (cm)	Laterals /tree (avg no.)	Average length laterals (cm)	Dry wt (g/tree)		
					Root	Stem	Leaves
0	0	66.0	14	26	7.9	11.1	13.7
3	40	56.0	8	26	5.6	6.5	8.3
10	70	44.6	2	13	5.3	3.3	4.4
30	100	41.7	2	17	4.8	3.9	4.5
100	100	27.3	0	0	2.7	1.9	2.2
LSD 5%		8.00					

Fig. 1. Terminal and lateral growth characteristics of 'Lovell' peach seedlings in nutrient culture with 0, 3, 10, 30 and 100 ppm aluminum.

nutrient solutions were prepared every 2 weeks, weekly, and finally every 3 days, as the reservoir nutrient supply was depleted by seedling growth.

Terminal growth (main stem) was measured on individual seedlings. To obtain the necessary amount of plant tissue for chemical analysis, all replications were combined. The composite samples of each tissue, roots, stems, and leaves were dried at 80°C in a forced air oven and ground in a Wiley Mill through a 40-mesh screen. Total and 2% acetic-acid-soluble fractions were analyzed by the Cooperative Extension Service of the University of Georgia, Soil Testing and Plant Analysis Laboratory, Athens, Ga.

Terminal growth was significantly reduced at the 3 ppm Al concn (Table 1, Fig. 1). Length and no. of laterals decreased as the Al concn increased. At the end of this experiment (74 days), seedlings grown at 30 and 100 ppm had 100% of terminals dormant, and those grown at 10 ppm had 70% of the terminals dormant. Analysis of variance was not possible on the dry wt of stem, leaves, and roots. The data are included in Table 1 to show how Al concn reduced the dry wt of the plant. No symptoms of Al toxicity were evident in the top growth other than the growth characteristics (Fig. 1). Roots grown in the 100-ppm solution (Fig. 2) were more brittle, angular, stubby, and thickened than those of the check. The main roots of seedlings grown at 3 and 10 ppm Al were thickened, with fewer lateral roots. Little necrosis was noted in the roots, except in those grown at 30 and 100 ppm Al.

The anatomy of roots grown at each Al concn was observed. Root tips, particularly the tips of root hairs emerging through the cortex, showed little disorientation of cells, regardless of the Al concn in which the roots had been grown. The epidermis of roots grown in 30 and 100 ppm Al were generally rugose and collapsed and had a high stain affinity. The rugosity of the epidermis was associated with gross abnormalities at the bases of root hairs. The root hair eruption sites failed to heal properly, thus leading to basal constrictions of the root hairs. In gross observations, the root hairs were noticeably fragile. As the main effect on root cortex, Al caused cortical cells grown at the higher concn to be shortened in the longitudinal axes, so that they appeared as squares instead of rectangles in longitudinal sections. The

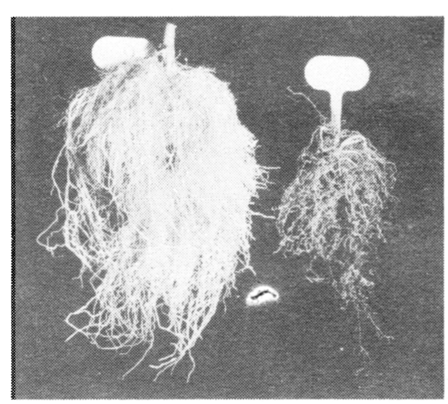

Fig. 2. Root growth of 'Lovell' peach seedlings in nutrient culture without aluminum (left) and with 100 ppm aluminum (right).

endodermis and pericycle of roots grown at the 30- and 100-ppm Al appeared to be condensed and to have a high stain affinity.

The result of tissue analyses showed that a larger proportion of the total Al was retained in the roots than in the stems and leaves (Table 2). Soluble Al increased in the roots as Al concn increased. The soluble Al level in the stems and leaves did not change appreciably at the 3 or 10 ppm Al. At the Al concn greater than 10 ppm, the soluble Al levels increased in both the stems and leaves.

Calcium, Mg, P, and Mn level decreased in the 'Lovell' seedlings (Table 3). Although no statistical analyses were possible, the data show the influence of increasing Al concn on some of the nutrient elements in peach seedlings. The data suggest that soil Al available concn greater than 3 ppm may induce a nutrient imbalance in peach seedlings. Aluminum concn of 3 ppm and greater injured peach roots and decreased plant growth. Root weight decreased 30% with even greater reduction in stem and leaf dry weight (Table 1). The effect of reduced soluble Ca, Mg, and Mn level as the Al concn increases may contribute to the early death of peach trees in the Southeast.

Table 2. Aluminum concn in roots, stems, and leaves of 'Lovell' peach seedlings grown for 74 days in sand-nutrient culture at various Al concn.

Al concn (ppm)	Al concn in peach tissue (ppm)					
	Root		Stem		Leaf	
	Total	Soluble[z]	Total	Soluble	Total	Soluble
0	1,572	96	45	23	121	21
3	1,700	121	48	16	113	29
10	2,600	381	39	25	159	29
30	2,634	515	56	30	237	43
100	3,054	40	115	65	437	112

[z]That part associated with a 2% acetic acid extract of plant parts.

Table 3. Effect of Al concn in soil-nutrient culture on total and soluble concn of Ca, Mg, P, and Mn in 'Lovell' peach tissue.

Al concn (ppm)	Ca (%)		Mg (%)		P (%)		Mn (ppm)	
	Total	Soluble	Total	Soluble	Total	Soluble	Total	Soluble
0	2.00	0.31	0.30	0.24	0.45	0.35	382	304
3	2.04	0.26	0.31	0.21	0.38	0.29	370	272
10	1.61	0.23	0.24	0.18	0.37	0.31	288	194
30	1.06	0.16	0.17	0.12	0.35	0.27	206	141
100	0.98	0.20	0.09	0.04	0.33	0.26	138	93

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Calcium Concentration and Distribution in Healthy and Decline Peach Tree Tissues[1]

R. N. Gallaher[2], H. F. Perkins[3], and J. B. Jones, Jr.[3]

University of Georgia Agricultural Experiment Stations, Experiment and Athens

Abstract. **Most of the leaf Ca collected from healthy and declining peach trees (*Prunus persica* L. Batsch. cv. Loring) growing on both limed and unlimed field plots was found to be non-extractable in acetic acid irrespective of leaf age, health status, or lime treatment. The concentration of extractable leaf Ca was less than 100 parts per million. Concentration of total Ca was highest in leaves from declining trees but declining trees had fewer and smaller leaves resulting in less total Ca in decline as compared to healthy trees. Large numbers of Ca-oxalate crystals were observed throughout the leaf and stem tissues. Crystals were primarily concentrated in leaf midveins. Midvein sections of leaves from decline trees contained greater numbers of crystals per unit area than did those from healthy leaves from healthy trees.**

[1]Received for publication August 8, 1974.

[2]Assistant Professor of Agronomy, University of Georgia College of Agriculture Experiment Stations, Georgia Station, Experiment.

[3]Professors of Agronomy, University of Georgia College of Agriculture Experiment Station, College Station, Athens.

Decline and eventual death of young peach trees has been a world-wide problem for more than a century (13). The problem has become acute in old orchard sites in the Southeastern United States in recent years. Yields can be maintained and tree survival extended by following good liming and N fertilization practices (5, 13, 16). However, the primary causes for peach tree decline, whether a peach tree replant and disease problem, or a malady known as "soil sickness", or winter injury, have not been discovered. Applying lime to the soil does not increase the Ca content of the tree leaves. This was observed in Georgia studies where Ca content of leaves from trees in plots in which longevity had been extended was not higher than that of leaves from trees from unlimed plots. This study is a more detailed analysis of the macro-Ca (total) and micro-Ca