fluence of several shoot development parameters, and showed a significant positive increase with thinning severity (Figure 3). Similar shoot growth responses were found for *Malus sargentii* (1).

Thinning had no effect on root production in this study (Figure 2) or in previous work with *Malus sargentii* (1). Reports cited previously (1) found that heading back branches of bare-root trees reduced root growth the following season, and suggested a competitive inhibition of root production by shoot growth. However, the stimulation of shoot growth observed here after thinning did not affect root growth. In addition, no correlation was found between new root production and various traditional predictors such as the shoot:root ratio before or after pruning; or the weight of the whole tree or its root system.

The correlation between leaf and new root weights at harvest was poor (r = .32). The coefficient of variation in new root weight (38%) was much larger than that in leaf weight (16%). Consequently, the leaf:new root ratio, which may represent the balance of transpiration and absorption better for woody plants than the traditional shoot:root ratio (5), was determined primarily by the variation in new root weights (Figure 4). For *Malus sargentii* under similar conditions, there was also no effect of pruning on root production or leaf:new root ratio, although thinning had resulted in a decrease in leaf production (1). For both species, the leaf:new root ratio varied widely with no effect on tree survival or growth.

Literature Cited

1. Evans, P.S., and J.E. Klett. 1984. *The effects of dormant pruning on leaf, shoot, and root production from bare-root Malus sargentii.* J. Arboric. 10(11) 298-302.
2. Flemer III, W. 1982. *Successful transplanting is easy.* J. Arboric. 8: 234-240.
3. Janick, J. 1979. Horticultural Science. W.H. Freeman, San Francisco.
4. Kozlowski, T.T. 1976. Drought and transplantability in trees, p. 77-90. **In:** Better trees for metropolitan landscapes; symposium proceedings. USDA Forest Service Gen. Tech. Rept. NE-22.
5. Ledig, F.T., and T.O. Perry. 1965. Physiological genetics of the shoot-root ratio. p. 39-43. Proc. Soc. Amer. For. Detroit, Michigan.

Graduate Assistant and Associate Professor
Department of Horticulture
Colorado State University
Fort Collins, Colorado 80523

ABSTRACT

FINCHAM, R.L. 1984. **Variegated trees and shrubs.** Am. Nurseryman 159(9): 38-43.

When discussing variegation, nurserymen do not think of blue but of different shades of gold and white. Plants with golden variegation have reduced amounts of chlorophyll in their variegated portions. Some plants are even completely gold. The presence of chlorophyll can easily be detected by placing one of these golden plants in heavy shade. It will turn green. White variegations are due to an absence of all pigmentation — no chlorophyll is present. Any completely white plant cannot survive. Many white-tipped forms show their variegation only in their summer flushes. Variegation may be due to a variety of factors. evidently, heredity plays a major role. Genetic aberrations are probably the origins of variegated seedlings that can pass the variegation trait to their decendants. Some plants originate as sports on otherwise normal plants. Such variegations are probably not genetic in origin. Insect or lightning damage or viral attacks may cause a sport. Propagations from branch mutations may retain the parents' characteristics and would be most likely to revert.