The trees are dug in the fall before the ground freezes and put into storage where they are protected from winter weather. In storage the humidity is kept high to keep the trees from drying out.

During the winter months — December through February — the trees are graded according to specific standards set forth by the State of Washington Department of Agriculture, and by the American Association of Nurserymen.

Following the grading and warehousing of the trees, comes the sales and shipping season. During the month of April over 50% of the trees we have in storage are shipped or delivered. Shipping and storing the trees is another important link in the chain from the seed to the planting of the tree in the orchard.

All of the different steps of production and delivery of fruit trees requires careful and organized effort by all who are involved in the fruit tree nursery business.

BUDDING HEIGHT AND ORCHARD PLANTING DEPTH FOR MALLING APPLE ROOTSTOCKS

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The budding height on the dwarfing Malling apple rootstocks are presently 6 in above ground level, but budding height for apple seedlings are still at about 2 inches above the soil line. Let us describe the history of the Malling budding heights and how and why it changed.

In the 1950's when the dwarfing Malling rootstocks were first used in the United States many of the nurseries budded these new rootstocks at the same height as the seedlings — two inches. It was discovered soon in orchard plantings that these low-budded, high-planted Malling trees tended to lean badly. The budding height was increased in the 1960's to a maximum of 10 to 12 in. so that the plants could be planted at least 6 in. deeper at the orchard site thereby, hopefully, stabilizing the tree and always keeping the bud union out of the ground 4 to 6 in. to prevent scion rooting.

In the last 10 years the budding height has been lowered back down to 6 or 7 in. above the ground. This height of budding works very well with either a sled type mechanical planter or a 24 in. augered hole. Most mechanical planters travel at a 15 in. depth. The total vertical length of the root-

stock and shank is about 16 in. — 8 in. for the nursery planting depth, 2 in. for a nursery cultivator hill and a bud union at 6 in. height. So, if the new fruit tree is planted to the bottom of the trench the bud union will remain 1 in. out of the soil.

The advantages to this planting depth are:

1. The nursery-grown root system is planted in the top soil and not too deep.

2. The orchard tree's anchorage is improved by planting at a 5 in. deeper depth than in the nursery row.

3. No danger from rootstock aerial rooting or burr knot growth.

4. A little greater fruit tree vigor.

5. Greater tree uniformity in the orchard.

6. Greater bud union winter protection by being planted only 1 in. out of the ground.

7. Some allowance for soil erosion in the tree rows caused by heavy rain storms or sprinkler irrigation washing the herbicide-treated bare soil away from the tree trunks.

The budding height of the seedling-rooted trees is still about 2 in. in the Pacific Northwest. In California the budding height on seedlings has been observed to be 5 or 6 in. I feel that this greater height of 5 inches fosters the additional problem of root or trunk suckering and seedling burr knot growth. Also, for our northern apple growing areas the bud union area would definitely be more winter-tender if planted several inches above ground level. I personally plant all seedling-rooted trees with the bud union about 3 in. below the ground.

I would like to mention that there is a continuing trend in the Pacific Northwest toward the 12 ft. high orchard tree. This medium-small sized, heavy bearing tree is a realistic compromise between the big, high tree spaced too far apart and the small, spring frost-susceptible tree. Whatever rootstock is used, it must have the capacity to fill up the allotted tree space quickly and to produce a healthy, very productive orchard tree. With the growth controlling chemicals and scoring technology available today, a progressive plantsman can steer the growth intensity and productiveness throughout the fruit tree's life. Incidentally, this year our orchard operation, Royal Crest Orchards and Columbia Basin Nursery, scored apple and pear trees to induce branching, stunting, blossoming, and early fruit ripening. These desired responses require timeliness and precision. This year we scored 600 acres with a tree age of 2 to 18 years, beginning 8 weeks before apple blossom and ending 10

weeks later. The precision scoring crew of 15 to 18 people worked at 4 distinct times — a total of 5 weeks.

If you are ever in the Quincy, Washington area please drop in for a tour of our nursery and orchard operations.

FINGERPRINTING APPLES: A CHEMICAL METHOD OF IDENTIFYING CULTIVARS

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Abstract: To identify apple, *Malus pumila* Mill. [syn. M. *domestica* Borkh], cultivars, electrophoretic separation of proteins and isozyme patterns from shoot bark extracts was investigated. Cross-examination of enzyme banding patterns allowed the identification of 33 clonal apple rootstocks. Virus-tested rootstocks were distinguishable from the original contaminated material, and selections of 2 rootstocks propagated by tissue culture expressed rather broad isozymic differences compared with their respective original stocks. Of 57 clonal apple scion cultivars and sports, all cultivars were identified. Sports within each cultivar, however, were indistinguishable, with the exception of 'Wijcik', a natural compact mutant of 'McIntosh'. Isozymic patterns of scion cultivars showed no apparent effect of sample timing, rootstock, growing location, or age of the wood where the sample was taken.

A precise method of identification of tree fruit cultivars is needed, especially during the early vegetative growth phases and during dormancy when many morphological criteria cannot be used. Tree fruit nurseries are especially interested in an identification method to help correct labeling errors or losses and to assist in patenting or with patenting infringement. Growers need a technique to positively identify suspected scion and rootstock errors in their own plantings or to establish true identities where orchard purchases have been made or are anticipated. A chemical identification method has the potential to be more precise than the usual morphological approaches to identification.

Chemical taxonomy, that is, the classification of plants based on chemical differences, is not a new method. It has been used to help establish taxa, genera, species, and ecotypes and is an invaluable aid in evolutionary studies (3). Many chemicals have been used as so-called genetic markers, i.e. oils in citrus, resins in conifers, and phenolic compounds in many plants. More recently, extensive work has been done with proteins, and more specifically enzymes. Proteins provide