duced the smallest tree with both cultivars, this interstock also resulted in the lowest yield and efficiency value and thus would be impractical for use as a size controlling interstock. The hardy intermediate stocks in this study did not cause either cultivar to bear earlier than when propagated on apple seedling rootstocks.

Since the winter temperatures during this test were not cold enough at Wooster to cause trunk injury to apple trees, the hardiness of these intermediate stocks was not adequately tested. However, the efficiency (114 and 100) and tree size reduction (18% and 28%) caused by 'Byshe Hardy Crab' was very satisfactory with both cultivars. It appears that 'Ruby' on 'Byshe Hardy Crab' is similar in size and yield to the same cultivar on 'M.7.' Since it is reported to be hardy, 'Byshe Hardy Crab' might well be given consideration where a semi-dwarf trunk hardy tree is desired if it proves tolerant or resistant to problem diseases which were not present in this study and could not be evaluated. The infrequent occurrence of low temperatures that cause injury, coupled with the added propagation costs of topworked trees, make the widespread use of hardy interstock trees unlikely in Ohio. However, the need still exists for a hardy rootstock or interstock with size controlling ability and production efficiency that is resistant to problem disease.

Training Apple Varieties for Over-The-Row Harvester

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The transition period from standard large apple trees to the smaller compact, semi-dwarf semi-standard trees has come about in an orderly manner by growers following suggestions from persons working with experimental and grower tests. Production, efficiency in management, and general acceptance of the newer planting systems have been rewarding to all concerned. There have been some problems in tree losses, in improper tree spacing and tree training and pruning, in poor soil sites, etc.; however, these hurdles have been overcome by correcting mistakes and learning, and keeping informed.

The New Challenge — Now we are facing another new challenge—more mechanization in the apple orchards. The agricultural engineers, the innovative growers and the pomologists, who have worked hand in hand in developing the shake and catch system of harvesting fruit, are to be commended for their achievements. The system works well for some fruit crops, such as the cherries, plums, almonds, oranges, etc.; however, for the harvesting of apples, it appears to be a step toward something better.

Tree Training — Before the mechanical harvester will perform well in removing blemish-free apples from the trees, the pomologist and the fruit grower must train the trees to "mesh" with that special machine. One or two precise training patterns need to be developed. Although varieties differ in growth habits, the apple trees

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can take most any form or type by pruning, shaping, bending, tipping, stubbing, etc., yet grow and bear quality fruit. The engineers know what sort of tree will be best suited for efficiency and economy in removing the fruit and channel it from the machine. So, here is the new challenge for the pomologist and the engineers to get their minds in agreement for a common goal — mechanically harvested, blemish-free apples.

Varieties — Each variety requires a definite tree training pattern. In preparing several varieties to adapt to the over-the-row harvester, a system of training and pruning each variety must be established. Certain varieties such as 'McIntosh' and 'Golden Delicious' may be grouped as simple trees for establishing central leader types; whereas 'Jonathan,' 'Rome' and 'Tydeman's Red' more difficult.

This will be more complicated when different shapes or tree forms must be prototyped to conform to a certain harvester. These new concepts of growing and training newly planted trees must be given detailed attention in order to keep each variety at maximum fruiting.

Alternatives Available — Trees planted 10 x 20 feet on 'MM 106,' 'MM 111' or seedlings (spur type strains preferred) and shaped spindle bush form held at 15 feet in height and 6 foot spread at the bottom and 2 at the top, could perhaps be harvested by smaller (trunk) shake and catch harvesters with minimum bruising. No pre-branch cutting would be necessary. Due to the conical shape of such trees, much of the fruit would gently roll down fruit laden branches. Other improved engineering features would further "cushion" fruit fall.

Over-the-Row Alternatives — Using the more dwarfing rootstocks ('M.9,' 'M.26' and 'M.7') commercial apple varieties can be grown (tree spacing depending on variety and rootstock) in solid hedges into a height of 10 to 12 feet and a spread of 2 to 3 feet. A wire trellis or a single stake by each tree is needed to support varieties on 'M.9' rootstock. Well propagated, 'M. 26' and 'M.7' can be free standing.

These narrow hedges require special branch training to handle the "over-the-row" harvester. The engineers inform us that no branches should be allowed to grow perpendicular to the row, but rather parallel with the hedge row. Smaller stub spur branches should be encouraged to form in positions not interfering with the "mechanical hands." The most appropriate name for this type of tree system at this time might be "intermittent tree wall." In other words, some space or slots will need to be provided in the trees when pruning and shaping these trees (hedges) for the mechanical hands or "gadgets" to gently remove fruit by the "over-the-row" harvester. Such training systems and appropriate machines will no doubt be developed for harvesting quality apples for both the fresh and processed markets.