COMPACT NEWS

A Periodic Newsletter of the International Dwarf Fruit Tree Association

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A MESSAGE FROM THE EDUCATIONAL DIRECTOR . . .

The article that comprises most of this issue was prepared by Jim Ballard with the assistance of Jim Cummins, Mike Sanders and others. I would suggest that you file this for future reference. It includes a good historical summary. As I work toward the development of Compact News issues, it would be helpful if you would drop me a note and share your thoughts as to the type of information you would like to see included in future issues. The annual conference is shaping up well.

Hope to see you in Penticton!

H.A. (Jack) Rollins, Jr.

Research Support

The funding of research proposals this year will be limited to a few carryover projects. We are working on plans to establish a foundation that will provide the opportunity to generate more tax-free contributions and result in increasing IDFTA support of research. We will keep you posted as the plans develop.

HAVE A COMMENT OR QUESTION ABOUT IDFTA?

Just call or write us at the addresses and phone numbers below. We are always happy to promote IDFTA and keep our members informed!

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A BRIEF UPDATE ON APPLE ROOTSTOCKS

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INTRODUCTION

Many of the commercial apple orchards in the Pacific Northwest are established on rootstocks derived from seeds. However, the situation is changing. Many fruit growers have adapted the use of clonal rootstocks. The trend is increasing as more and more growers recognize the advantages of these precocious understocks. The recognition of the success of the high density orchards now bearing in Eastern Washington has accelerated the interest in these clonal rootstocks.

Commercial fruit growers today have several choices of rootstocks from which the foundation of their orchard depends. Only with apples and pears have truly dwarfing rootstocks become available. However, dwarfing ability is not the only reason to choose an understock. Tree size control is important, but it must be accompanied with productivity, disease and insect control, compatibility between stock and scion, hardiness and longevity. Ease of propagation is also a serious concern for those nurseries producing the rootstocks.

Most commercial fruit growers are well aware of the performance records of the common rootstocks in general use today. These are Seedlings, MM 111, MM 106, M 7, M 26 and M 9. What many fruit growers ***do not*** know is that there is a continuing source of new and (sometimes) improved rootstocks. These are from active breeding programs scattered in many important apple producing countries. **THE PURPOSE OF THIS PAPER** is to give you a brief summary of the origin and history of these many apple rootstocks available today. Some of these facts are very important in light of the "misinformation" going about in responsible channels. We hope this publication will be of help to you.

NOMENCLATURE

Throughout the world of horticultural writers, a chaotic state of naming rootstocks exists. It is my goal to achieve some semblance of order to help clear the confusion present today.

Perhaps most readers would agree that the person introducing a new variety or rootstock should have the right to name his introduction. But original names do not always "stick." The public has a way of improving the nomenclature.

For example, when, in 1912, researcher Richard Wellington and Ronald Hatton began their work in categorizing the "Malling rootstocks," they used at least a dozen different names and abbreviations up to 1922. In 1923 Hatton and his associates settled upon their standard pattern: Malling I, Malling II, etc., using Roman numerals.

A BRIEF UPDATE ON APPLE ROOTSTOCKS. . .*continued*

Public opinion demanded the abandonment of the Roman numerals in favor of Arabic which is now standard for all horticulturists world-wide.

The East Malling Research Station's official abbreviation places a period (.) between the "M" and the number: M.7. Since most writers omit this, I have chosen to go with the simplified form of omitting the periods or dashes in the abbreviated names—and, it also looks better.

But we must not become too brief in referring to some of these rootstocks. Too many people simply say "Nine" when referring to Malling 9. But you will find in this report Bud 9, Jork 9 and Mac 9. These are not synonymous but distinctly different rootstock.

What about "Antonovka?" Dr. James N. Cummins, Professor at the New York Agricultural Experiment Station, Geneva, NY has a collection of *eleven* Russion Antonovka stocks. Each one, a distinct varietal strain, is identified with a name, such as: "Common Antonovka," "Antonovka Kamiennaja," "600 gram Antonovka," etc.

The author expresses gratitude for the assistance given in preparing this report. Constructive comments by Dr. James N. Cummins of Geneva, NY and Mike Saunders, Kelowna, BC, were of great help.

APPLE SEEDLING ROOTSTOCK

Seedling rootstocks in the USA are grown primarily from seed derived from juice and cannery waste. Some nurseries obtain seeds from Eastern Europe to induce the winter hardiness factor. The genetic makeup of these seeds, generally from Golden Delicious, Red Delicious, McIntosh and Antonovka, produces a variable progeny with tree size and efficiency differing from seedling to seedling. Pathologists have confirmed that the seeds of Golden Delicious carry the susceptibility to collar rot (Phytophthora species). Other genetic sources, mostly of crab apple origin, are known to offer a high percentage of incompatibility, of which some is virus induced, in varying degrees from one variety to another. Regardless of the source, most seedling stocked trees have very good vigor—capable of producing trees up to thirty feet high. Seedling understocks vary in their tendency to sucker and their susceptibility to collar rot and root galls.

These are some of the main faults with seedling rootstocks. They prompt the whole world of apple growers to continue their search for better rootstock.

However, regardless of these derogatory factors, research continues in the evaluation of certain seed sources for growing seedling apple rootstocks. During the past thirty years several of the hardy varieties of Eastern Europe have shown their ability to withstand damaging winter low temperatures. Some of the hardy sources of Eastern Europe are proving to be beneficial in adding winter hardy germ plasm into apple breeding programs. Many of these hardy varieties serve as seed sources for nurseries. If that seed is grown in Eastern Europe, it is fair to assume that the full genetic makeup of the seed is winter hardy. If, however, the hardy variety is pollinated with a tender variety, such as Golden Delicious, it is likely that the winter hardiness factor is diluted.

Virus indexing involves the budding of varieties onto certain apple "indicator" varieties to determine virus content. Some of the more sensitive indicator clones have been determined to be crab apple varieties. If certain viruses are present, the bud will fail to take or will demonstrate virus infection by other recognizable growth characteristics. This concept accounts for the poor stands when latent virus contaminated scions are budded onto crab apple seedling liners. For this reason, experienced nurseries will avoid crab apple liners except for flowering crab apples.

The following Malus varieties are available today as seedling liners *or* as seeds of those varieties. The suppliers of seed do not generally know or offer information as to what the pollen parent was. Therefore, we can logically assume that they were open-pollinated with one or more unknown varieties.

- **Malus anis** is an old East-Asian variety. It is popular in Finland where prolonged sub-zero winter temperatures demand a hardy understock.
- **Malus antonovka** is a hardy vigorous Russian variety. Seedlings of seed from this variety grown in Eastern Europe are known to be compatible rootstocks for most common American varieties.
- **Malus baccata,** better known as the "Siberian Crab Apple," is used as an understock for ornamental flowering crab apples.
- **Malus bittenfelder** is European stock with a poor record of performance for fruiting varieties grown in the Pacific Northwest.
- **Malus borowinka** is reputed to be synonymous to the "Duchess of Oldenburg," a hardy variety still grown in Eastern Europe.
- **Malus columbiana,** also known as the "Columbia Crab" rootstock, is often recommended as the understock for certain ornamental flowering crab apples.
- **Malus niedzwetzkyana** is crab apple variety with a dominant gene producing purple leaves. This advantage is for nurserymen to recognize their bud misses when propagating green leaved varieties of flowering crab apples.
- **Malus prunifolia** is a plum-leaved crab apple from China.
- **Malus sargentii,** another crab which produces seedlings with variable compatibility.
- **Malus selkirk** is satisfactory as an understock for ornamental crab varieties.
- **Malus sylvestris** is a ***very*** vigorous variety from Southwest Asia. Trees propagated on Malus sylvestris can grow to 40 feet in height.

Many commercial apple producers request "domestic" seedling rootstocks, because they want all the vigor they can get for some of the less vigorous spur type Red Delicious strains which have shown to "runt out" on MM111 or MM106. With the past history of the domestic apple seedling rootstocks being very successful for commercial apple producers, we should consider what the domestic seedlings of the future may be like if these seed sources are coming from orchards using crab apple pollenizers. There is the distinct possibility that the introduction of the crab gene into the seed source may bring about poorer stands in the nursery row as well as less efficient performance for the grower.

A BRIEF UPDATE ON APPLE ROOTSTOCKS . . .*continued*

THE ORIGINAL MALLING STOCKS

The "Malling" rootstocks used today to give size controlling ability for apple trees were derived from rootstocks selected and propagated for nearly two thousand years. One of the early Greek historians, Theophrastus, recorded in 300 B.C. the propagation of dwarf apple trees. He wrote about fruit cultural methods of Alexander the Great which included dwarfing rootstocks. Evidence recorded indicates that these dwarfing rootstocks were collected in Persia. They were propagated by the Romans and later by the missionaries of the Christian movement. With many obviously different rootstocks in use, much confusion prevailed throughout Europe until 1912 when the East Malling Research Station initiated the first rootstock evaluation. This was started by Richard Wellington but proper credit goes to his successor, Mr. Ronald G. Hatton who, in 1914, set about to categorize the many rootstocks in use at that time. His collection included the rootstocks used in all the main apple growing areas of Europe. Mr. Hatton and his able staff categorized them into sixteen groups—each characterized by similar genetic traits. Although this work was started in 1912, its significance did not emerge until after World War II.

This English research resulted in the classification of sixteen "pure" clonal lines which are now known as the *Original Malling Series.* Dr. Hatton designated Roman Numerals to these original rootstocks as "East Malling I" through "East Malling XVI." By 1950 the Roman numerals were discarded for the more practical Arabic numbers 1 through 16. Prior to Ronald Hatton's classification, these dwarfing rootstocks had localized names such as "Paradise," "Doucin," "Metz," "Ketzinger" and others.

■ **M 9** (synonyms: "Juane de Metz," "Yellow Metz," EM IX, EMLA 9 and EM9) This rootstock, selected as a chance seedling in France about 1879, produces one of the smallest, earliest bearing, and the most productive trees of any stock presently marketed for use in commercial orchards. M 27 gives a smaller tree but is ***not*** one of the original Malling series, and its adaption to commercial orchards is yet unproven. Apple cultivars propagated on M 9 will give trees 15% to 50% as large as those grown on vigorous seedling rootstocks. The wide variance depends upon the vigor of the cultivar and/or cultural methods. Because M 9 rootstocks are so brittle and break easily "like carrots," trees will need artificial (pole or trellis) support for the whole commercial life of the tree. Trees on M 9 rootstock initiate more flower buds than on any other Malling stock.

M 9, by 1980, emerged as the most important apple rootstock in Europe where intensive culture in frost-free areas has proven its sound economic value. In the Pacific Northwest, where many sites are frosty, and growers resist supported orchards, M 9 has not been accepted for commercial use. Consequently, its nursery availability is very limited.

It is obvious several natural mutants of the original M 9 has occurred. As of this date there are at least eight subclones of M 9 in heavy commercial use in the USA, according to Dr. James Cummins. There are at least fifteen subclones identified in Western Europe. There is a very wide range of vigor and performance among these offerings. Dr. Cummins suggests that all nurseries identify which M 9 they have.

M 9 is resistant to most collar rot species and strains but not to crown gall. Burr knot problems can be common on M 9 if the cultural method leaves the rootstock with adventitious root scars all the way to the bud union.

M 9 is deep rooted and responds best on deep, well-drained soils. Trees on this stock will "runt out" on shallow soils and on ***any*** soil if it is cropped too early and/or not given proper irrigation, weed and Woolly aphis control.

M 9 has proven itself to be adequately winter hardy in the Pacific Northwest. It is compatible with most any apple variety grafted or budded on. Spur type clones may become too dwarfish on M 9.

■ **M 7** (synonyms: Doucin, EM VII, EM 7, M7a, EMLA 7) M 7 is one of the most desirable rootstocks for Eastern Washington when production efficiency, longevity, ease of propagation, hardiness, compatibility and disease resistance is considered. In the Okanogan Valley of British Columbia M 7 has shown susceptibility to some strains of collar rot and occasional severe winter freezes.

M 7's popularity waned in the sixties with the introduction of the Malling-Merton series, but in recent years, Malling 7, particularly M 7a, has become one of the most sought after rootstocks.

M 7 is characterized with its tendency to sucker. This is aggravated with cultivation which injures roots near the surface, Woolly aphis, mouse or gopher damage and winter injury.

M 7's early heavy bearing tendency may cause the trees to lean and sometimes fall over on windy sites. For this reason it is advised that trees on M 7 be staked and held firmly in place during the first ten years of its life. This rigid support will permit the main side lateral roots to become strong enough to support the tree in its main productive life. This leaning tendency, which is also common to M 9, M 26 and M 27, suggests that the rootstocks be budded 12 inches high in the nursery and planted in the orchard with the bud union two inches above the ground to facilitate better anchorage.

■ **M 7a** The letter "a" designates that this selection of Malling 7 was tested and found free of ***serious*** virus-like problems in the late forties when virus testing programs first came into existence. Some of the M 7a offerings still ***carry*** non-important latent virus infections. Only the EMLA and the IR-2 series can be considered fully tested and free of all known virus-like diseases. The EMLA is the prefix applied to the Malling and Malling-Merton stocks after they were heat treated at Long Ashton, England and declared virus free. The IR-2 Series were the results of the heat treatment program by Dr. Paul Fridlund, Washington State University, Prosser, WA. The "Fridlund" heat-treated series are also virus free and available to all nurseries through the IR-2 program. Both the EMLA and the IR-2 Fridlund series have shown to have a little more vigor than their predecessors which often contain two or more viruses each.

■ **M 26** (synonyms: EM 3436, EMLA 26) Malling 26, as well as Malling 27, are really not part of the original Malling Series. But, since their names indicate such, we will include them under the original series. Both originated in a breeding program in England in 1929 by H. M. Tydeman at the East Malling Research Station. Malling 26 was originally distributed under the designation EM 3436 as a progeny of M 9 x M 16.

M 26 is more vigorous than M 9 and has a strong root system. Generally, M 26 is a free standing tree but has developed the reputation for being a leaner on wind swept sites with heavy fruit set. Most important apple varieties do very well on M 26 except the spur types, which often "runt out" before the allotted tree size is reached.

M 26 resistance to diseases varies from area to area. Under Eastern growing conditions (New York and Virginia) Apple Union Necrosis

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bility to Fire Blight and Woolly Aphis; propagation difficulty; tendency to sucker and subject to virus sensitivity (brown line decline). Some researchers regard Ottawa 3 as an excellent stock.

■ **OTTAWA 8** (Malus baccata Gracilis x M 7) Is similar to the performance of MM 106 but is much hardier. Its sensitivity to latent virus is unknown at this time. It has shown susceptibility to Tomato Ring Spot Virus in N.Y.

THE BUDAGOVSKY SERIES

These hardy rootstocks were developed in a breeding program at the Michurinsk College of Agriculture in Russia. Recently introduced, several selections are in test at research stations in the USA and Canada. To date, very little is known of their performance. Four of these Budagovski series have been imported by *Oregon Rootstocks, Inc.* and are available to American and Canadian nurseries.

■ **BUD 9** (M 8 x Red Standard, a hardy Russian clone) Its dwarfing ability is between M 9 and M 26, depending on the cultivar vigor. Bud 9, like Malling 9, requires tree support. Bud 9, sometimes referred to as B 9, is very resistant to Collar Rot and moderately resistant to powdery mildew and scab ***but*** is susceptible to fire blight. Bud 9 ***should*** be commercially tested in the Pacific Northwest.

BUD 118 (Moscow Pear x M 8 or M 9 [a pollen mix of each]) Bud 118 has vigor similar to MM 111 but much hardier.

■ **BUD 490** resulted in a cross between Bud 9 and Bud 9 and Bud 13-14. It produces a tree in the MM 106 size range. It has shown medium resistance to Collar Rot and is moderately susceptible to Fire Blight. Bud 490 has the unusual advantage of propagating well by both stooling beds and hardwood cuttings. It will develop burr knots, thus the bud union should be an inch or two above the ground level.

■ **BUD 491** is the most dwarfing of the four Budagovsky offerings. More dwarfing than M 9, this one may have a hardy dwarfing interstock. Bud 491 has shown susceptibility to Fire Blight. Tests of Bud 491 in Wisconsin show it is very attractive as rodent food.

THE POLISH SERIES

This series of hardy apple rootstocks came from the Research Institute of Pomology at Skierniewice, Poland. This breeding program produced about three thousand seedlings with M 9 and M 4 x Antonovka, and other hardy Polish varieties. After narrowing the selections down to 28, further scrutiny reduced the number to six which are now available for commercial tests in the USA and Canada.

■ **P 1** (Malling 4 x Common Antonovka) produces a tree in the M 26 or smaller size. Very precocious and early bearing, P 1 requires tree support. This rootstock requires well drained soil to avoid Collar Rot. Its susceptibility to Fire Blight, Mildew and Woolly Aphis is about the same as M 9 and is resistant to Crown Gall. P 1 should be commercially tested in the Pacific Northwest. Burr knots appear to be a critical identification characteristic.

■ **P 2** (Malling 9 x Antonovka) is another rootstock in the M 26 size range with excellent hardiness and precocity. Trials have shown it to be resistant to European Canker, Perennial Canker, Silver Leaf and Crown Gall. This non-suckering rootstock shows few burr knots. Trees on P 2 defoliate early in the fall and break bud late in the spring. P 2 should be commercially tested in the Pacific Northwest.

■ **P 14** (Open pollinated seedling of Malling 9) Trees on this stock are in the M 26 size range and, like P 1 and P 2, have excellent disease resistance. Trees on P 14 also go into dormancy early and are late to leaf out in the spring. P 14 is non-suckering and has no burr knot tendency.

■ **P 16** (Malling 9 x Antonovka) produces non-suckering trees that are comparable to M 9 in size. Except for Fire Blight, P 16 has good disease tolerance. This precocious rootstock will require tree support. It appears in some areas to be no hardier than M 9.

■ **P 18** (Malling 4 x Antonovka) produces a fairly vigorous tree in the MM 111 size range. It has shown good disease resistance except for Fire Blight and Woolly apple aphids love it.

■ **P 22** (Malling 9 x Antonovka) is Poland's answer to England's Malling 27. This ***very*** hardy rootstock is very resistant to most diseases except for Fire Blight. Woolly apple aphids love it. It is being tested extensively in British Columbia.

MISCELLANEOUS ROOTSTOCKS

As with apple varieties, there has been a continuous parade of new apple rootstocks from many major apple production areas of the world. The complexity of the potential problems associated with different rootstock-scion combinations makes it essential that the fruit grower be sure of the rootstock's capabilities before he risks a commercial planting. The following rootstocks have progressed to the point where they are suggested (by their promoters) for grower testing.

■ **KSC SERIES** (Kentville Stock Clones, Nova Scotia) This series offers six rootstocks which survived a very rigid screening involving hardiness, tolerance to mid-winter temperature fluctuations, disease resistance and efficiency of production. Of the six, KSC 28 has the most dwarfing ability producing a tree in the semi-dwarf range.

■ **CG SERIES** (Cornell-Geneva, New York) Developed from the evaluation of 158 seedlings of Malling 8 open pollinated. All the progeny have a strong tendency to sucker. Has shown susceptibility to Fire Blight.

■ **NOVOLE** (Geneva, New York) A very vigorous rootstock offered in 1982 which has the desirable trait of being upalatable to moles. It is being tested with dwarfing interstocks. Appears sensitive to the common latent virus.

■ **ALNARP 2** was introduced by the Alnarp Fruit Tree Research Station in Sweden. Alnarp 2 is very vigorous and induces early and precocious cropping. Canadian trials have reported burr knot tendency. Trials indicate excellent results using Alnarp 2 as a dwarfing interstem.

■ **BEMALI** (Mank's Codlin x M 4) is a Swedish introduction gaining rapid attention with a list of favorable characteristics. With dwarfing ability about equal to M 26, **Bemali** resists Woolly Apple Aphid, Fire Blight and appears to be well anchored.

■ **K 14** is a 1938 offering from the Kansas Ag. Experiment Station. It was chosen as a survivor of intense Midwest summer droughts and severe winter freezes. Vigorous, K-14 produces full sized trees. Induces late spring bud break when used as a rootstock with a dwarfing interstock such as M 8.

■ **C 6** is a Stark seedling selection of open pollinated M 8. C 6 is in the M 26 size range and, unfortunately, is very susceptible to Fire Blight.

■ **OAR 1** is a chance seedling having some dwarfing ability which survived a severe wind storm in Oregon in 1962. Origin of seedling rootstocks used in that commercial orchard is unknown.

■ **JORK 9** known as J 9, is a selection from the Jork Research Station in West Germany. It appears equal to M 9 except it is easier to propagate and has shown good hardiness. Jork 9 is ***very*** susceptible to Fire Blight. ■

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can develop into a problem for growers using M 26 (and/or MM 106) when this virus induced disease is present. It has been determined that the virus is Tomato Ringspot and is transmitted by the dagger nematode. Thus far, this disease has not surfaced as a problem in the Western States. However, fireblight has shown to prefer M 26 in many areas where blight strikes apple trees. Mildly susceptible collar rot, M 26 performs satisfactorily as long as the site is kept well drained.

Early support is important in the training of trees on M 26. The central leader must be tied up to keep the vigor coming in the years of development. Even nonspur cultivars can "runt out" with copious crop loads on unsupported M 26 stocked trees.

M 26 is considered shallow rooted and therefore subject to drought stress. Growers using M 26 rootstock should be aware that irrigation management is very important to this rootstock. Its failure is often erroneously blamed on the root instead of the irrigation manager.

M 26 heat treated for virus eradication is known as EMLA 26 and has shown a little more vigor potential than virus contaminated M 26.

■ **M 27** (EM 3431) is more dwarfing than M 9. It has not proven its adaption to commercial plantings but is being tested in Europe for high vigor cultivars like Jonagold. M 27 ia also being tested as a dwarfing interstock. M 27 developed from a cross of M 9 x M 13.

■ **M 4** (synonyms: Holstein, Dutch Doucin, Yellow Doucin, EM IV & EM 4.) Malling 4 makes a tree larger than M 7 but has much less vigor than seedling. It is fairly prolific, more than seedling, roots easily in the stooling bed and produces a tree which is generally free-standing. However, one of M 4's main faults is that the roots may develop on one side only producing a tree which leans.

M 4 has shown good resistance to most Collar Rot species. ***Do not confuse*** with MM 104 which is very susceptible. Propagation of M 4 lost favor with the introduction of MM 111 which has more advantages.

■ **M 2** (synonyms: Doucin [in France], English Paradise, EM II & EM 2.) M 2 is slightly more vigorous than M 4 and is equally precocious. It dropped from demand with the increasing interest in the MM series and is generally not available except on special order.

■ **M 25** (synonyms: EM XXV & EM 25.) M 25 is a seedling selected from a cross of Northern Spy x M 2 at East Malling in 1931. Interest in this very vigorous, very precocious rootstock has been rekindled with the fact that some spur selections of Red Delicious have the tendency to "runt out" on MM 111 and domestic seedling. It is available on special order.

OTHER MALLING ROOTSTOCKS IN THE ORIGINAL SERIES

All the following Malling numbers have been researched and characterized by the East Malling Research Station in England. They were discarded in England because of the superior characteristics of the other accepted numbers. No longer generally available, these are included in this paper for historic records.

■ **M 1** (River's Paradise 1860) Susceptible to Collar Rot, Fire Blight and drought.

■ **M 3** (Hollyleaf Paradise & Konigs Splittapfel) Suckers badly.

■ **M 5** (Doucin Ameliore & Red Paradise) Has poor uptake of potassium.

■ **M 6** (Nonsuch Paradise—River's selection) Suckers badly.

■ **M 8** (French Paradise, Red Paradise and Clark Dwarf) Widely grown in England from 1700 until 1900 as a stem piece. Difficult to propagate.

■ **M 10** (Name Doucin U-1 by Spath of Germany) Makes vigoro tree.

■ **M 11** (Known by many synonyms: Black, Green, Pracht's, Sander's Doucin, Tornescher's Special, Hohenhorster Ideal and Wessering's Paradise) 1904 German Selection widely used on the continent where its winter hardiness made it valuable. It is the only rootstock in this series with edible fruit. Performance is similar to M 2.

■ **M 12** Unnamed vigorous, unproductive English seedling. Roots poorly.

■ **M 13** (Black Doucin) Selected by Spath of Germany in 1890. Very vigorous, tolerant to heavy wet soils. Has very late dormancy—holding foliage all winter. Still used in Germany.

■ **M 14** (U-5 by Spath, Germany) Difficult to root, only fairly prolific.

■ **M 15** (U-6 by Spath, Germany) Not very prolific.

■ **M 16** (U-3 by Spath, Germany & Ketziner Ideal) Poor production but was esteemed in eastern Europe because of winter hardiness. Produces very vigorous full sized tree.

■ **M 17** Unnamed Dutch selection considered identical in performance to M 5.

■ **M 18** A Dutch semi-dwarf selection which rooted easily and was prolific.

■ **M 19** Another Spath selection of low vigor and low production.

■ **M 20** Known as "Spurious IX," it was erroneously distributed in France as M 9. This one is said to be in favor by some UK researchers.

■ **M 21** Known as "Cutleaved IX," erroneously distributed in England as M 9.

■ **M 22** A localized selection of Seabrook, Chelmsford, England.

■ **M 23** Another unproductive selection from Seabrook.

■ **M 24** Also known as Paradise de Menton, Noir de Menton and Ducin Noir de Menton. Vigorous fairly productive rootstock making a semistandard tree. *[M 25, M 26 & M 27 described previously.]*

THE MERTON SERIES

The collection and classification of the many rootstocks stimulated the desire to breed new and improved rootstocks. Early pioneers in this untapped field were Dr. M. B. Crane of the John Innes staff at Merton, and H. M. Tydeman of the East Malling Research Station in England. The first releases out of the John Innes Institute were designed with 700 numbers. Later, the combined efforts released their numbers with the prefix "Malling-Merton." All the 700 series were the progeny of Northern Spy x M 2. This program was specifically designed to offer the New Zealanders wooly aphis resistant stock. Only one of the four selections, **MERTON 793**, is still in use today "down under." It was never introduced into the USA and thus tests in North America are very rare. In England, the John Innes Institute officially discarded all the 700 series when it became apparent that the MM series had more advantages. It is of interest, however, that Merton 793 was used in breeding and is one of the parents to MM 111.

THE MALLING-MERTON SERIES

This breeding program started in 1924 with the combined efforts of the John Innes Institute of Merton, England and t East Malling Research Station in East Malling. The name is derived from the two locations. Woolly aphis and Collar Rot were two of the important goals in addition to tree size control,

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roductivity and ease in propagation.

The Malling-Merton project developed 3,758 seedlings using Northern Spy and various Malling numbers as the parents. Northern Spy was chosen because of its resistance to Woolly Aphis. As you can imagine, Woolly Aphids infesting rootstock stool beds was a formidable problem in the days before systemic insecticides.

Only sixteen of the 3,758 original progeny survived the critical testing. They were named MM 101 through MM 115. Today, only two are commercially used in the Pacific Northwest—**MM 106 and MM 111**. All the others have been discarded for one reason or another. **MM 104**, for example, had high hopes for filling the need for the Specific Apple Replant Problem in Eastern Washington but failed due to extreme susceptibility to Collar Rot.

■ **MM 106** (Northern Spy x Malling 1) Fairly vigorous, MM 106 was reputed to give the same size trees as M 7 but trials over the past forty years proved it to have a little more vigor—putting it in the semi-standard class. MM 106 crops early, requires no tree support and *is* Woolly Aphis resistant. Its resistance to Collar Rot varies from area to area and appears to be dependent upon the species and/or strain of the disease encountered. In general, MM 106 resists Collar Rot quite well in Washington State where copper trunk paints are applied, but, appears to be quite susceptible to more virulent strains in parts of British Columbia. Most nurseries offer trees on MM 106.

■ **MM 111** (Northern Spy x Merton 793) MM 111 has excellent performance in both the stooling bed and in the orchard. Early and prolific cropping of spur type Delicious makes it easy to maintain the semi-standard tree size. This heavy precocity demands precise fruit thinning in order to avoid small fruit size.

Both MM 106 and MM 111 have been heat treated for virus eradication. These have been reintroduced with the prefix EMLA or IR-2.

THE MICHIGAN APPLE CLONE SERIES

Michigan State University through the efforts of Dr. Robert Carlson initiated a search for improved apple rootstocks to meet U.S. conditions. The main work involved the evaluation of new seedlings grown from seed collected in 1959 from an open-pollinated field of Malling 1 through 16, Alnarp 2 and Robusta 5. Fifty-six were initially selected and field tested with Red Delicious, McIntosh and Golden Delicious. The number was reduced to five selections which were released as the "MAC" series for testing at research stations throughout the USA and Canada. All of these five are ***still*** considered "in test," even though one, MAC 9, was named "MARK" in 1979 and released to the public for commercial testing. Dr. Robert Carlson describes the five MAC rootstocks as follows:

■ **MAC 1** (Open pollinated seed from M 1) Trees on this stock are approximately M 7 in size. Advantages include ease of propagation, non-suckering and good anchorage.

■ **MAC 24** (Open pollinated seed from Robusta 5) Trees on this stock will be semi-standard. Its shallow rooting system will produce suckers if injured by rodents or tillage. It reproduces with ease in the stooling bed ***and*** with hardwood cuttings.

■ **MAC 39** (Open pollinated seed from M 11) A very restrictive rootstock producing trees small than M 9. This very precocious rootstock will require support.

■ **MAC 46** (Open pollinated seed from M 9) Produces a tree a bit larger than M 9, very precocious and requiring support.

■ **MARK**, formerly called MAC 9 (open pollinated seed from M 9). Trees on this stock will be as dwarf as M 9 or slightly larger. Its main advantages include: Non-suckering, strong anchorage and easy propagation. Mark rootstock is easily identified because it produces large "etiolation" swellings at the leaf nodes as the roots start to form. This character is not so apparent in the other Malling and Merton Malling rootstocks.

An updated report on ***MARK*** rootstock was printed in the ***COMPACT FRUIT TREE NEWSLETTER***, No. 3 April 1987 of the International Dwarf Fruit Tree Association. The statement was prepared by Dr. Ronald L. Perry, Department of Horticulture, Michigan State University and is reproduced here for your information: *"We have recently learned of a perplexing characteristic of MARK apple rootstock which had not been previously reported. We have found that MARK appears to be as susceptible to crown gall (Agrobacterium tumefaciens) as M 9 or M 7. Michigan State University (patent owner) and the nursery licensees are currently assessing the seriousness of this finding. This finding is perplexing not only because of the potential of this rootstock but also because it is almost impossible to discern tumors induced by the pathogen from a natural burr knot. We have found on nursery trees as well as on existing older trees that MARK has a natural characteristic to produce many root initials similar to those in a burr knot, but not in a concentrated pattern. MARK's propensity to produce root initials may be an explanation for its excellent anchoring. We have at this time no knowledge of the long term effects of trees on MARK which are established with these root tumors or galls.*

"My immediate recommendation is to avoid burr knot or root initials from festering by planting trees so that the rootstock shank is buried and not exposed to the air (union slightly above soil line) same as for M 26, MM 106, M 7 etc. My intention at this writing is only to make orchardists and nursery operators aware of this situation. It is too early to make judgement as this stock has proven to be outstanding in 30 years of evaluation." —Dr. Ron Perry, April, 1987 IDFTA NEWSLETTER No. 3

THE OTTAWA SERIES

The Ottawa Research Station in Canada undertook a breeding program in the sixties to develop a very hardy understock for apples. Six very vigorous hardy rootstocks were introduced in 1971. Parentage involved such hardy varieties as Heyer 12, Robusta 5, Osman and Antonovka. These hybrids were introduced as OH-1 through OH-6. They have performed well in the nursery row (most appear fully tolerant to latent viruses). Producing full sized trees, the **OTTAWA HYBRID ROOTSTOCKS** have not attracted interest with those growers wanting a dwarfing stock. Tests with spur Red Delicious may be appropriate in Eastern Washington.

A second Ottawa series, referred to as the *Ottawa Clonal Rootstocks* have some size controlling ability. Two of these have been released for commercial testing: *OTTAWA 3 and OTTAWA 8.*

■ **OTTAWA** (Robin Crab x M 9) Produces trees in the M 26 size range and is very productive and well anchored. It has shown some suscepti-

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COMPACT NEWS

A Periodic Newsletter of the International Dwarf Fruit Tree Association

No. 1 June 1990

A MESSAGE FROM THE EDUCATIONAL DIRECTOR . . . *The thirty-third annual conference of the I.D.F.T.A. held in Penticton, British Columbia, Canada was very successful and well attended. A total of 623 paid participants attended the educational session, 471 attendees took part in the day and a half of orchard tours and 340 attended the banquet. The support and hard work provided by our B.C. hosts was outstanding and contributed significantly to the success of the conference. Everyone went all out. It will be a tough act to follow when we go "back home" to Michigan for the thirty-fourth annual conference next year.*

We are particularly appreciative of the financial contribution provided by the Washington Tree Fruit Research Commission for assistance in travel support for our out-of-the-continent speakers.

H.A. (Jack) Rollins, Jr.

1990 Summer Tour

Steve Hoying and the total Lake Ontario Fruit Team have done an outstanding job of organizing the summer tour of the Western New York fruit areas. You should have received application forms and summary information in an earlier separate mailing.

A number of years ago the IDFTA summer tour was held in Western New York with Dick Norton providing the leadership. It will be very interesting to review earlier developments and the evolutions that have evolved.

If you do not notice your earlier mailing, the summer tour will start with an evening reception on Sunday, June 17, at the State University of New York at Brockport (SUNY-Brockport). SUNY is about 15 miles west of Rochester.

Monday's bus tour will load up at SUNY from 7-8:30 a.m. and and travel to Wayne County, east of Rochester. Experienced local growers will serve as bus guides. Stops will include: J.H. Verbridge, Williason, NY; Van de Walle Fruit Farm, Alton, NY; Wafler Farms, Wolcott, NY; Fowler Brothers, Wolcott, NY; Red Jacket Orchards, Geneva, NY; and New York State Agricultural Experiment Station, Geneva, where we will have an evening barbecue before heading back to Brockport.

On Tuesday the tour will head to Orleans County, West of Rochester. We will visit Lamont Fruit Farms, Lyndonville, NY; Lynoaken Farms, Lyndonville, NY; Orchard Dale Fruit Farms, Waterport, NY; Little Lake Fruit Farm, Albion, NY; and Green Acres Fruit Farm, Greece, NY. We will return to Brockport by 6:00 p.m.

For further details contact Lake Ontario Fruit Team, Cornell Cooperative Extension Service, Alton, NY 14413; attention Mary Durham or Steve Hoying (telephone 315-483-6918).

For those with interest, the N.Y. State Experiment Station, Geneva, will be holding its open house on Wednesday, June 20, where a more complete review of the fruit research that is ongoing in New York will be covered.

IN THIS ISSUE!!

BE SURE TO READ FRUITFUL INSIGHTS STARTING ON PAGE 7 ! !

1990 ANNUAL CONFERENCE SUMMARY AND HIGHLIGHTS

The 1990 IDFTA Conference educational sessions started off with foreign travel reports and observations Sunday evening followed on Monday with a full day and evening of presentations featuring fifteen speakers including the Robert F. Carlson Distinguished Lecture by Dave Ferree of Ohio, Training Slender Pyramid Trees by Stuart Tustin of New Zealand, and High Density Orchard Mechanization by H. Wiedenhoff of The Netherlands.

On Tuesday the program consisted of morning and afternoon tours of area high density orchards and pruning demonstrations presented by local growers. Tuesday evening featured a "Poster Session" which was a new effort for IDFTA. It proved to be highly successful. A total of 24 large 4 x 8 posters and exhibits consisting of summarized information filled a large open room. Those researchers and others that put up posters remained at their poster location to discuss their presentation with individuals and small groups with interest. It was well attended and provided an "open house" atmosphere where conference participants could share ideas with one another and seek out answers to questions. This approach to encourage the opportunity for personal interaction will be continued in the future.

On Wednesday morning the educational presentations were continued featuring an open panel discussion on Mark rootstock experiences and update. The afternoon was devoted to a continuation of local orchard tours.

The educational sessions were completed Thursday morning with presentations made by Stuart Tustin, H. Wiedenhoff, Dave Ferree, and others. A total of thirty-two papers have been received from the program speakers and are in the process of being printed for the proceedings. Also to be included in the proceedings will be summaries of a number of the "poster" presentations.

Patience!
The windmill never strays
in search of the wind.

The following is a summary of a poster presented at the annual conference in Penticton, B.C.

CONTAINER NURSERY TREE GROWING

Don Kato and Ted Ritchie
K and R Nursery
R.R. #1, Naramata, B.C., Canada VOH 1NO

OBJECTIVE:

Two container nurseries have been developed over the last two years. One is a conventional August 'T'-bud nursery, the second is a one year spring chip bud and bench graft nursery. Each nursery contained 2500 trees and each received partial funding from ARDCORP.

We pursued the container nursery concept for several reasons:

1. Site selection—virgin land in our area is scarce and expensive to develop (deer fencing, water, etc.).
2. Weed control is eliminated.
3. Ability to plant out at any time of the year.
4. Better control over feeding and hardening off for dormancy.
5. Reduced risk from winter injury—trees can be moved inside.
6. The nursery is reusable.

PROJECT:

The pots were placed 45cm x 90cm and buried in the soil in the two year nursery. In the one year nursery the pots were buried in sawdust in a double row configuration 60cm x 60cm x 90cm. We tried two sizes of both plastic and peat pots.

We prefer the deep plastic pot as it provided for deeper root development. The peat pots, while cheaper initially, are only usable for one crop and are therefore not recommended.

The benefits are lower costs due to one less growing year. . .

We planted *50 rootstocks in grow bags* and *50 in a trench lined with plastic.* The results from each system were comparable to the results achieved in the containers. The trees were grown in a medium mix of 3 parts shavings/1 part peat/; 10% total volume sand. Calcium sulphate (gypsum - 1.1 kg/cu. metre) and dolomitic lime (2.8 kg/cu. metre) were added to the container mix prior to planting. Tissue cultured rootstocks from Kelowna and Dutch stool bed liners were used. We were concerned that the tissue cultured rootstocks, which were tiny plants (3 mm) when we planted May 25, 1988 would not reach an adequate budding caliper (10-13 mm) by August 15, 1988. But, by budding time these plants had reached a height of 120 cm with a budding caliper of 13 mm.

The trees were watered and fertigated by drip irrigation systems that filtered the water using settling tanks. Two feeding regimes were followed:

1. Daily morning feeding with 1/2 L water. Daily evening watering with 1/2 L water
2. Daily morning watering with 1 L feeding every 3 days

The trees in the two year nursery were fed a total of 3 g N the first year and 12 g N the second year. The trees in the one year nursery were fed a total of 15 g N. Because the trees were grown in a semi-sterile medium, 20-20-20, a complete fertilizer, was chosen as the fertilizer.

We used a salt meter to monitor the nutrient levels going into each pot and also to check nutrient distribution throughout the nurseries.

As a precaution, the trees in the two year nursery were mulched with sawdust to protect the bud and the roots from frost. Thirty pots were left uncovered. No trees or buds were damaged from the hard winter of 1988-1989. We found the unmulched trees began to break dormancy earlier than the mulched trees because they warmed faster without the sawdust cover.

Continued on NEXT PAGE.

Container Nursery Tree Growing . . . *Continued*

HORTICULTURAL ASPECTS OF A CONTAINER NURSERY

The original fertigated container nursery was planted in 1988 and was grown conventionally (two year 'T'-budded trees). Due to the excellent growth response to the rootstock in the first year, 1.75 m high with 120-13 mm caliper, it was decided to try to grow a feathered tree in one year. The benefits are lower costs due to one less growing year, double the production of a conventional nursery (one year turnaround) or half the land area needed of a conventional nursery. The one year nursery can also react faster to new varieties.

The original 'T'-budded nursery was fertilized using two different methods. Top dressing with time release nitrogen fertilizer was tried with very poor results while the fertigated section had very good results. The rootstocks were budded in late August 1988, high cut at 10 cm above the scion bud on March 15, 1989 and cut to the scion bud on May 6, 1989. Other horticultural practices were the same as the one year feathered tree nursery. *The 'T'-budded trees reached a height of 1.75 m, a caliper of 15-20 mm and had seven feathers.*

In the one year feathered nursery there were two methods of propagation used on the liner rootstocks. One method used was the bench graft. These rootstocks were grafted on April 5, 1989, calloused and then planted on May 9, 1989. *These trees attained a height of 1.0 m and a caliper of 10-12 mm with 25% of the trees having five feathers.* We had a 3% loss on these trees. The other method of propagation used was the chip bud. These rootstocks were budded and planted from April 4, 1989 until May 9, 1989. *The 1250 rootstocks planted on April 12, 1989 reached a height of 1.1 m, a caliper of 12 mm and 75% of them had six feathers.* There was a 15% loss on the chip budded trees.

METHODS TO ENCOURAGE SCION BUD GROWTH

The plastic budding tapes were removed 4 to 6 weeks after budding. It was observed that the sooner the tape came off the scion bud the quicker the growth response of the bud. Care must be taken not to top cut the tape before the chip bud bark curls showing that it is not healted. The budding rubbers were cut off the bench grafts because they were under the grafting wax and did not break down.

Scoring above the bud was tried and proved effective but care must be taken to score above the chip bud in order not to break the chip bud off. The scoring can be carried out in conjunction with the removal of the plastic budding tape.

All buds were removed after they had grown an inch or two except the scion bud or the strongest growing bud on the bench graft and the top bud on the rootstock so it can be the safety valve. This was done to encourage strong scion bud growth. Instead of removing all the excess growth, the terminal growth could be pinched off leaving more leaf area to encourage more root growth. These buds will have to be removed after the rootstocks have been cut back to the scion bud.

To determine if the scion buds are viable or not, the bark can be nicked with a knife to see if it is alive. The main bud can be dead and if the bark is alive a latent bud can push. If the scion bud is a fruit bud, the flowers should be removed as soon as possible.

The chip budded trees were cut at different heights above the scion bud at planting time. It was found that the higher the cut the slower the growth response of the bud.

The rootstocks were cut to the scion bud at different times. It was observed that the longer the time before cutting to the bud, the slower the growth response of the bud. Concerns with cutting too soon to the bud is drowning of the scion bud especially if the rootstock is vigorous and the pseudomonas bacteria is present.

The bench grafted trees were handled the same as the budded trees except they were cut back to the strongest growing bud.

Continued on NEXT PAGE.

Container Nursery Tree Growing . . . *Continued*

METHODS TO ENCOURAGE FEATHERS AND THEIR LOCATION

Desuckering was carried out on suckers below 60 cm in order not to have any feathers below that height. Instead of desuckering, the terminal bud can be nipped off the suckers, leaving more leaf area to encourage root and caliper growth. If desuckering is carried out, the leaves should be left on the trunk to encourage root and caliper growth.

The top 4 to 6 leaves were plucked off the whips when they attained a height over 80 cm to encourage feathering. When plucking the leaves care should be taken not to remove the terminal growth. Extra fertilizer was given at this time. With the manipulation of the whips we had all our feathers between 60 and 80 cm.

The trees should be kept under observation for signs of stress and pests. The leaves should be large, dark green and have an oily appearance for the best nitrogen levels. Nitrogen and water levels should be increased with the leaf area. The leaves show signs of nutrition deficiencies and salt toxicities. The only problem we had was a magnesium deficiency showing up late in the growing season which can be corrected with epsom salts.

CONCLUSIONS:

The conclusions we have come to with a fertigated container nursery is that a very good feathered 'T'-budded tree can be grown in two years. With the bench grafted or chip budded trees it is more tricky to grow a feathered tree in one year, but even if it takes two years to grow a feathered tree there is no time lost compared with a 'T'-budded tree. To try to ensure success with a one year old feathered tree, transplant rootstock should be used instead of liners and the rootstock should be grafted or budded at the beginning of February and planted in late March.

The authors would like to acknowledge the following for their support and assistance with the projects:

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Mr. P. Waterman - BCMAF
Mr. M. Sanders - BCMAF
Mr. G. Geldart - BCMAF
Mr. N. Filipenko - Naramata Co-Op

TABLE 1*

Total amortized capital costs per year	$ 1,057.61	$ 0.56
Total cash and capital costs	13,286.67	6.77
Cost per tree (2000 trees, amortized capital and cash cost)		4.48

Each tree cost $4.54 to produce (1895 trees). This cost per tree includes a 10 year amortized period with a 13% interest rate for the capital material/labour costs and also allowed 94.76% take on the trees.

*Canadian currency

Continued on NEXT PAGE.

Container Nursery Tree Growing . . . *Continued*

TABLE 2* – ONE YEAR FEATHERED APPLE TREE COSTS

	Total	Per tree
Material cash costs		
2000 M9 rootstocks	$1800.00	$0.90
Sawdust/peat mixture	400.40	0.21
Fertilizer/pesticides	324.29	0.17
Max tape	57.05	0.03
Budwood	97.00	0.05
Labour cash costs		
Ordering/pick up materials	92.64	0.05
Planting	1895.32	1.00
Bud/graft rootstocks	796.72	0.42
Staking	277.92	0.14
Irrig fert and pest, main/oper	926.40	0.49
Salt monitoring	92.64	0.05
Tree training	741.12	0.39
Weeding	46.32	0.02
Total cash costs	**$7547.80**	**3.92**
Material/labour capital costs		
Sawdust/plastic mulch	1084.37	0.54
Plastic pots (2000)	1500.00	0.75
2000 stakes	177.20	0.09
Site preparation	416.88	0.21
Irrigation fabrication	374.87	0.19
Data gathering/reports	185.28	0.09
Ordering/picking up mat.	138.96	0.07
Irrigation equipment	1819.28	0.91
Total capital costs	**$5738.85**	**$2.85**

TABLE 3* – ACTUAL COSTS TWO YEAR NURSERY 'T'-BUDDED

Material costs per tree			
Rootstock	$1.30		
Pot	0.24	(amortized 5 years)	
Medium	0.15		
Irrigation System	0.12	(amortized 5 years)	
Fertilizers	0.15		
Budding	0.25		
Stakes	0.05		
Total	**$2.26**		**$2.26**
Labour costs per tree			
Irrigation Installation	$0.03	(amortized 5 years)	
Irrigation + Fertigating	0.57		
Planting	0.64		
Miscellaneous (spraying, training)	0.80		
Total	**$2.04**		**$2.04**
Total cost per tree			**$4.30**

*Canadian currency

Fruitful Insights

. . . FROM THE DESK OF THE BUSINESS DIRECTOR.

Well done, "AYE??"

That's how George Ing, in his column *Good Fruit Grower Reporting*, summed up our very successful IDFTA annual conference in Penticton, British Columbia. As your Business Director, I'd like to share some personal experiences on our trip to British Columbia—not the usual travelogue, but the *real* facts of getting from here to there.

Overall, pre-registration went very well. I did notice however, that regardless of our veiled "threat" to impose a penalty for late registration, very few registrations were received before the cut-off date. In fact, *so* few were received that I had an uncontrollable sense of impending doom. That sinking feeling, plus the rush (very expensive) shipping of fourteen cartons of registration packets to Jack Pheasant in Washington by UPS second-day air (rather than surface mail) . . . .and the fact that we were completing registration packets at 5 a.m. (when we were to leave at 5:45 a.m. to catch our flight), resulted in a greater than usual dosage of Maalox Plus. A late registration penalty will have to become a reality for future conferences.

Even with all the stress of last-minute registrations, we were ready to leave home by 6:30 a.m. (please note: 45 minutes late). Upon opening our front door, we noticed an abundance of traffic driving by our home. To most individuals this isn't unusual; but to us, *very* unusual. You see, we live so far out in the country, that very few vehicles pass our house and it's common for us to look at each car that passes to see who it might be. Our thought was that there might be an accident on the main highway and delay us.

"As your Business Director, I'd like to share some personal experiences on our trip to British Columbia— not the usual travelogue, but the real facts of getting from here to there."

Right away, Paulette (my wife) began to express concern that we might miss the plane. She's like that . . . .insists on being at the airport well in advance of the plane's departure. I'm just the opposite. As long as I arrive before the plane leaves, no problem.

With smooth sailing and no delays, the trip to the airport normally takes about an hour and a quarter. . . .and that's exactly the amount of time we had to get there. There was no accident, but I failed to allow for early morning traffic. You've probably figured out by now. . . . we got tied up in traffic and I received Paulette's blessing more than once. As a matter of record, by the time we arrived at the airport, the check-in counter had to be re-opened in order to check our luggage, etc. . . . and Paulette had "blessed" me so many times that I began to think I should be referred to as Saint Charles.

Thankfully our flight was uneventful. Had it not been, I can only imagine what I would have been referred to as! In Chicago we learned why there was so much traffic on our little back road at home—our neighbor's home had caught fire and burned to the ground.

When we arrived in Wenatchee, Washington, we were quite shocked. You see, none of us had ever been to the Pacific Northwest and, knowing the quantity and quality of fruit produced in the region, we expected to see lush green foliage all around. What we

Continued on NEXT PAGE.

Fruitful Insights. . . *Continued*

saw as we disembarked was tumbleweeds rolling across barren brown land.

I immediately went to the car rental desk and gave them my confirmation number. The gentleman just smiled as he informed me that no car had been reserved for us, even though we had confirmed it just two days before! I mentally "blessed" him as I had been "blessed" so many times since beginning this journey and gave serious thought to elevating him to Sainthood!

Board member Jack Pheasant and his wife Linda soon arrived. They confirmed that our second day air shipment of registration packets and other important materials had indeed arrived. Some good news! Things were starting to look better, and instead of getting the car we had requested, we ended up with a mini-van. . . .which turned out to be a blessing in disguise. We now had sufficient cargo space to haul all of our luggage, boxes, video camera, etc. plus the van provided transportation to individuals from the hotel to the convention center.

We spent a delightful evening and following day with Jack and Linda as we visited several orchards and storage facilities. We also had the opportunity to make some very interesting video tapes. (More on the tapes later.)

The trip from Wenatchee to Penticton was lovely. In contrast to Pennsylvania, there was very little traffic. I saw only one state patrol car, and he was going in the opposite direction. But as luck would have it, as the patrol car approached, the northern lights went on and I got that familiar knot in my stomach.

To the glee of my family, I was directed to pull over. As the officer walked toward the van I noticed he glanced at the license plate, and then he politely asked for my license and the year of the vehicle. I told him I had no idea about the year of the vehicle. For a moment he just looked at me. . . .out-of-state vehicle. . . . Pennsylvania driver's license! Then he informed me that I was traveling a little too fast. For lack of anything else to say, I asked him how fast. He told me, and wouldn't you know, his radar was correct!

Just when I thought I'd had it, he proceeded to give me several admonitions to which I replied, "Yes, Sir." each time. In the end, he only gave me a warning and we were on our way, with the rest of my family wailing that, if one of them had been stopped, they would have received a citation. I just smiled. Of course, the remainder of the trip was made at a much more leisurely pace!

Although "Jack" Rollins planned the educational portion of the conference, the fact that it went so smoothly logistically can be directly attributed to the efforts of Jack Pheasant in Wenatchee, Washington and Mike Sanders in British Columbia. Jack and Mike had been involved in the logistical planning since early 1989. About three weeks prior to the conference I met with Jack Rollins and Mike in Virginia to discuss final plans and preparations. I have to admit that when the meeting started, I was very pessimistic about the outcome. However, by its conclusion in the wee hours of the morning, I was certain the conference would be a success.

Mike Sanders has to be one of the most organized individuals I have ever met. He had everything planned to the smallest detail. . . .especially the tours, for which he had direct responsibility. For example, he faxed a complete synopsis of our meeting and outlined what we could expect upon our arrival in Penticton, including the name of one of our Canadian hosts who had experience in convention registration. That was particularly helpful because of the differences in currencies.

Registration itself was another story. Although all pre-registrations had been categorized according to US Zip Codes and Canadian Postal Codes, there was some confusion. In addition, there was a substantial number of "walk-in" registrations. Since I was involved in a meeting, Paulette opened registration, and by the time I arrived, her only statement was "how could we have been so prepared for this and become so instantly disorganized?" It was about this point in time that our Canadian

Continued on NEXT PAGE.

Fruitful Insights . . . *Continued*

friends arrived. They asked what our procedure was, and then they took over. That team operated like a well-oiled machine. No hitches, no glitches . . . . just complete coordination.

In addition to the Canadian team we had a generous amount of help from the wives of the board members during the entire convention. The smoothness of the registration process was a result of the efforts of all these individuals.

The facilities at the Penticton Trade and Convention Center were fabulous. We could not have asked for more congenial hosts. Regardless of what we requested or were concerned about, the convention staff was immediately available to help.

At registration and at times during the conference, many of you that attended ordered back issues of *Compact Fruit Tree* and *Compact News*. I believe all of the requests have been filled. If you haven't received the documents you requested, please let me know right away.

Earlier, I mentioned video tapes. Fact is, we taped many of the educational sessions and some of the tours during the Penticton conference. This was a first-attempt and we intend to improve the reproduction quality in future videos. We are in the process of editing the tapes in the hope of starting a video library. We will keep you informed on our progress.

You'll recall that in previous issues of *Compact News*, I discussed the need to increase our membership. I believed that you, the individual member, were the best source of potential members. I even asked that you send me names so I could forward information to them about our organization. This met with limited success. Very few of you took the time to submit names; but those of you who did, gave quite a lot of prospects. Each potential member was sent a personal letter and information about IDFTA. To those of you who took the time to send names, my sincere thanks and appreciation.

Since we received little response to my request, I thought that an insert in commercial publications might be the ticket. I asked the group that does the graphics for *Compact News* to design an insert. It was presented at the board of directors meeting in December 1989 and approved. Through the cooperation of the staffs of *Great Lakes Fruit Grower, American Fruit Grower,* and *Good Fruit Grower*, the insert appeared in each of these fine publications.

I believe this campaign was a success. More than 1,200 insert cards have been returned requesting information about IDFTA. I am pleased to report 285 new members so far in 1990!

Unfortunately, the success of the membership drive has to be tempered with the failure of a number of 1989 members to pay their 1990 dues. Second dues notices were mailed on May 1, and many have now been paid. If you are one of those who have not paid, please do so now. We consider each member to be a vital part of our organization! If you don't know whether or not you paid your dues, check the mailing label on this newsletter's envelope. If our records indicated that your dues were unpaid as of the mailing date, the label will clearly state "LAST ISSUE." We realize that some will have crossed in the mail.

As Jack stated earlier, preparations for publication of the 1990 conference proceedings are progressing rapidly. Our goal, and I stress "goal," is to have the publication to you before the end of August. With this production schedule in mind, we must make a decision on the quantity of books to be printed prior to July 15.

If you want to guarantee delivery of your very own copy. . . .your dues must be paid prior to this date. You certainly can't afford to miss out on this much-acclaimed, very informative book.

Thank you!

THE PACIFIC NORTHWEST FRUIT TESTER'S ASSOCIATION

James K. Ballard
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A group of 15 Yakima Valley growers got together in 1986 to sample and discuss several of the new apple varieties coming onto the scene. It was decided that growers testing these varieties and pooling their evaluation comments on an annual basis would be the quickest and best way to discover the varieties' true characteristics. After four years the group has grown to more than 300 with members in 22 states and seven foreign countries.

The interest in the organization has increased due to the many new cultivars being promoted into the commercial apple industry. There are nearly a dozen apple breeding projects around the world now coming forth with annual introductions at a much faster pace than with the old method of finding good chance seedlings. The apple industry, world-wide, has a big task sorting out which of these new ones have commercial feasibility. The evaluation process is a very complicated, costly and time-consuming one. The effects of different climates, rootstocks and grower management all play an important part in finding the true characteristics—often not as good as hoped for.

The Tester's Association summarizes the many grower evaluation comments annually and brings each variety's characteristic profile sheet up to date. It includes the significant comments on both the good and bad features of a variety. Collectively, these comments give insight on the status of a new (or old) variety—whether it is rising or falling in the commercial feasibility. This information is essential in helping growers find out what variety or strain of variety to plant. More important, it helps the nurseries decide on which cultivars to go with and which to drop.

The Tester's Association holds two or more variety tours each summer, publishes several newsletters and an annual report each year. Their annual meeting is held in conjunction with the Annual Meeting of the Washington State Horticultural Association in December. Their roster is published each March with their annual report giving each member's address, telephone number and the names of the apple and pear varieties in test. This gives the membership the chance to communicate among themselves.

Anyone interested in joining the association may inquire through the Tester's Association Secretary, Jim Ballard, 1101 West Orchard, Selah, WA 98942. (509) 697-8133.

Grower membership dues are US$30 for United States and Canada, $60 foreign. Nurseries are $60 world-wide.

Middle age is when you wish
you could have some of the naps
you refused to take as a kid.

GOOD FRUIT GROWER REPORTING

By George Ing

HOW ABOUT THOSE CANADIANS, AYE? They know how to be good hosts. And let's hear it for the administrative structure of the International Dwarf Fruit Tree Association!

The March meeting in Penticton, British Columbia was chock full of good stuff. But not without some levity.

Donald May of Massachusetts, a past president of the IDFTA, who claimed to be pinch hitting as master of ceremonies at the banquet, got in a lick or two.

When the Virginia delegation answered the call as to whether they were present or not, their spokesperson said they were proud to be from Virginia and wanted all present to know they were growing Red Delicious apples and making a profit.

Whereupon, Don noted that he had known of other instances of people from Virginia who were also guilty of hallucinating.

PRAY FOR $14 REDS

Jerry Sietsema from Michigan, covered quite a lot of territory with the dinner prayer. Chuck Peters of Wapato, Washington, president of the Washington State Horticultural Association, who was seated at our table, noted that Jerry had asked the Lord for many things, but had neglected to ask for $14 per box for Red Delicious apples.

I mentioned that to Jerry later, and he quickly prioritized things you ask the Lord for in a dinner prayer, such as peace in Europe versus requests for miracles, into which category the $14 Red Delicious price request would have fallen.

Jerry made another sizable contribution to the meeting with a well-illustrated summary of last summer's visit to Soviet fruit growing operations.

May was semi-successful in trying to use the western Canada expression of "AYE?" in his remarks. "AYE" or "EH," pronounced as "AYE," is used at the end of a comment with the connotation of: "Right?" or, "You agree?" It is an idiosyncrasy of Canadian speech to those of us "south of the border," who also do not use "oot" for out, or "aboot" for about.

May's dialectical and geographical speech impediments became obvious when he tried to disguise the inability of people from Massachusetts to pronounce the letter "r" in a comprehensible manner. Such as Koreer for Korea!

MIDWEST AND EAST WELL REPRESENTED

Washington State had many in attendance, and the Canadians were excellent supporters. At the same time, one has to compliment the large numbers of people from Michigan, New York, and Pennsylvania, who trekked west for the second year in a row with very large delegations.

The national and international flavors were present.

What did we learn? Lots, if we wanted to. The poster session was excellent. Tours were well organized and very informative. General education sessions enjoyed superior attention.

Some of my impressions:

1) In British Columbia, a lot of attention is being given to the first 10 percent of the life of the tree. That includes research aimed at growing nursery stock quicker, cheaper, and better.

2) Full knowledge of the environment, namely soil, into which the tree will be placed, continues to draw considerable research interest.

3) Scientists in British Columbia showed us a few years ago how to use phosphate-based nutrients in the planting program to greatly enhance tree response. Research continues, aimed at combining fertilizers with fungicides such as Captan and Maneb at planting time and/or following fumigation, to give the young tree a greater boost.

4) Fertigation is now "for real."

Continued on NEXT PAGE.

Good Fruit Grower Reporting . . . *Continued*

There are lots of devotees, not only those who can use the process to grow much better nursery stock, but also growers. It involves judicious mixing of nutrients with water, particularly during the early growing season.

5) The move to small apple trees in British Columbia is not a groundswell but is moving fast enough that supplies of Malling 9 rootstocks are exhausted, and most are coming from Europe.

I remember a few years ago visiting an orchard where British Columbia tree fruit specialist Mike Sanders was extolling the virtues of high density apple systems. Growers were dubious, had small plots, were experiencing problems germane to change.

One grower said, "We are going to try Sander's approach for five years and then decide what to do with Sanders."

I am sure that Mike Sanders has now been forgiven by those who thought him too revolutionary.

6) Not all are achieving the results that they might have expected with high density apples. They continue to experiment and learn. Some seem overly concerned about tree height; wanting mature trees eight feet tall, or less, where larger trees could certainly be efficient.

Fortunately, many of the experimenters are learning with Gala or Jonagold and have made tremendous profits, no matter their mistakes.

At 83 cents per pound (Canadian) to the grower, as one reported for Gala apples, things are tempered a little, even if you are not doing things perfectly in your high density systems.

7) The B.C. government has an innovative research program that allows growers to submit cost-sharing requests. The percent to be covered is limited, the dollar amount is limited, and the recipient must follow certain procedures and submit data for the duration of the project.

That system has enabled Leo Touw of Kelowna to grow half an acre of Elstar apples under commercial conditions, while developing valuable information for the industry and not suffering so severely himself if the variety is not suitable.

Several other projects, including some of those aimed at improving nursery stock, were partially funded from the same B.C. Ministry of Agriculture governmental program.

8) B.C. growers, like those elsewhere who have done well with McIntosh apples, are nervous about their ability to grow and handle that variety without Alar.

One gets the feeling that Empire apple is being planted nationwide where it can be grown and will soon become another national and international apple.

9) Some B.C. growers continue to plant Spartan apples, now quite profitable, but once almost doomed because of core flush and calcium deficiency.

10) Dr. Sam Lau, the post-harvest researcher funded by B.C. packing houses, played a significant role in saving Spartan. Dr. Lau had a display at the poster session and is concentrating much of his current effort on perfecting use of low oxygen in storage of apples.

The IDFTA meetings had many highlights. An intensive session on the merits of Mark rootstock generally gave Mark a positive image, although all would not agree.

SWALES, DAWSONS

Ted Swales, of Kaleden, British Columbia, who has now retired as a packing house field rep after previously retiring some years ago as B.C. horticultural specialist, was a most deserving recipient of a distinguished service award.

The Dawson brothers, Brian and Rob, from Cawston, British Columbia, were also appropriately honored as growers of the year.

Dr. Stuart Tustin, guest speaker from New Zealand, made two extremely well-organized presentations. More about those another time.

The meeting was well worth the time. One of those that was fast paced, informative, and where you did not want to leave when it was over.

Well done, "AYE??"

Reprinted from ***Good Fruit Grower*** *April 15, 1990.*

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COMPACT NEWS

A Periodic Newsletter of the International Dwarf Fruit Tree Association

No. 3 November 1990

A MESSAGE FROM THE EDUCATIONAL DIRECTOR . . . *As of November 1, 1990 I will be moving my office from Winchester, Virginia to Gilford, New Hampshire. My new address is 1290 Cherry Valley Road, Gilford, NH 03246. My home and office telephone number is 603-293-0008. A Fax machine will soon be installed. If you are ever in central New Hampshire, west of Lake Winnipesaukee, and near the Gunstock Recreation area, drop by and see us.*

H.A. (Jack) Rollins, Jr.

I.D.F.T.A. Updates

1991 SUMMER TOUR

Plans are progressing for the I.D.F.T.A summer tour. It will be held in Western North Carolina June 9-11. The headquarters for the tour will be in the Ashville area with orchard tours being scheduled for Monday and Tuesday. Mike Parker, Eric Young and Dick Unrath are working out the details. Mark your calendars and plan to take a few extra days to enjoy the beautiful scenery of the area.

34th ANNUAL CONFERENCE

The 1991 I.D.F.T.A Annual Conference will be held at the Amway Grand Plaza in Grand Rapids, Michigan, February 24-27. Speakers are being lined up and the education program will be concentrated on Monday and Tuesday with orchard tours tentatively scheduled for Wednesday. Based on a review of the results of the membership survey conducted a little over a year ago, efforts are being made to balance the program between experienced growers and researchers.

The poster session held last year at Penticton, British Columbia, was well received and we are attempting to develop a similar feature this year.

Rootstocks are an important component of high density plantings. However, tree training and culture are also key factors in the development of profitable productive orchards. A balanced program is being outlined in an attempt to stimulate concepts in the design and development of new plantings. I hope you will plan to join us in Michigan.

Tree fruit industries are in a state of transition. Future success will emerge only for those who take advantage of their opportunities today.

IN THIS ISSUE!!

MARK YOUR CALENDARS FOR THE 1991 SUMMER TOUR — JUNE 9-11

PINE AND MEADOW VOLE CONTROL IN ORCHARDS

R.E. Byers
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Winchester, Virginia 22601

Pine and meadow voles cause serious economic losses in orchards each year. Large productive orchards that have taken many years and a sizeable investment to establish can be destroyed in a single season if effective control measures are not taken. Population carry-over from last year is probably the most important factor influencing the current season's vole population. Populations may be very high or very low between individual trees or sections of an orchard. Proper vole management requires close observation and monitoring of the populations regardless of control methods.

The *optimum time* for rodenticide treatment to reduce vole damage to trees is in late fall (October, November, December). Snow gives the animals a great deal of cover and may prevent the grower from treating during this period. Since reproduction rates are high in the late summer and early fall, the optimal time for vole control is after harvest and just prior to the damaging period. In addition, early spring application (February) of rodenticides can greatly reduce vole populations for the following season. February is also a time when pine vole runways can be easily seen and treated.

POPULATION MONITORING

The potential for damage should be determined prior to and after treatment. To evaluate an orchard treatment, growers may place a whole apple (with a one-inch slice off the side) in an active vole run or tunnel at 20-40 tree intervals in each block prior to treatment. Twenty-four hours after placement, the apple can be checked for vole teeth marks. The percent of apples with gnawing provides an estimate of the percentage of trees that could be damaged. After the orchard is treated, a second 24-hour check for activity (after a 20-day interval and using new apples) can reflect the degree of control achieved. The maximum effect from baiting will be about 20 days after treatment. To mark the original location of the apple placement site, sites may be covered with split rubber tires, sections of straw, wood slabs, shingles, tar paper, etc. If a herbicide strip exists, vole monitoring must be done in adjacent cover because voles will seldom range on bare ground.

CONTROL MEASURES

Anticoagulant vs Acute Baits

Recent studies have shown that zinc phosphide baits usually kill more meadow voles than pine voles, and anticoagulants (chlorophacinone) kill more pine than meadow voles. For this reason, if only one application is to be made, the toxicant choice should be made so that chlorophacinone is used against pine voles and ZP Rodent Bait is used against meadow voles. If two applications are made against heavy populations of meadow voles, the zinc phosphide should be used first and followed 2-6 weeks later with chlorophacinone. For pine voles, two chlorophacinone applications may be used. Multiple applications of zinc phosphides (even different formulations) is not recommended because voles will become bait shy after the first applications and survivors will remain bait shy for 2-4 months. In mixed pine and meadow vole populations, the continued use of zinc phosphide against pine voles and chlorophacinone against

Continued on NEXT PAGE.

Pine and Meadow Vole Control . . . *Continued*

ROOTSTOCK RESISTANCE

John Wysolmerski, a graduate student, and myself have surveyed over 100 rootstocks supplied by Jim Cummins of the New York State Agricultural Experiment Station, Geneva, N.Y. Many selections from the breeding program as well as species have been surveyed. Stocks which appeared to have some resistance when compared to 'Golden Delicious' would have been Malus X sublobata PI 286613, 'Charlotte', 'Hucker No. 1', 'NY 11928', 'Robusta 5', 'Sissipuk', and 'Ivory's Double Vigor', Fusca, Hall, and a number of other seedlings, particularly crosses containing either Robusta 5 or PI 286613. The PI 286613 has recently been patented and introduced as 'Novole' by Cornell University.

This approach does not appear to me to be very practical for the immediate future since vole resistance would be only a minor character for which we would select a rootstock. Dwarfism, early bearing, fungus, insect, and virus resistance would probably take precedence. In addition, only a degree of vole resistance would be present and thus, vole populations would have to be controlled by other means anyway.

A NEW APPLE CULTIVAR

Growers are demonstrating increasing interest in new apple cultivars. The following is a description of Ginger Gold provided by Pacific Northwest Fruit Tester's Variety Characteristics Profile.

Cultivar Name: GINGER GOLD
Synonym: Mountain Cove 509
Origin: Discovered as a chance seedling growing in a Winesap orchard owned by Clyde and Ginger Harvey in Nelson County, Virginia in 1980
Percentage: Unknown
Patent and Trademark Status: US Plant Patent Number 7063 and "Ginger Gold TM" is owned by Adams County Nursery, Aspers, PA

FRUIT CHARACTERISTICS
Size Range: Medium to large
Fruit Shape: Round to oblate—Smooth and Typey
Stem Length: Medium
Flavor: Sweet but mildly tart—"very good"
Skin Russet: Only slight at stem end under eastern growing conditions—Not prone in Eastern Washington
Skin Color: Vibrant Yellow when tree ripe—otherwise, greenish golden
Flesh Color: White to cream, depending on nitrogen level
Storage Life: Good—6 months in regular storage, unknown in CA
Maturity Date: The last week in July in central Virginia

TREE CHARACTERISTICS
Vigor: An open spreading tree with medium vigor
Precocity: Good
Pollination Requirements: Any mid-to-late season diploid blooming at the king bloom time
Cold Hardiness Factor: Thought to be the same as Winesap
Disease Status: Unknown—thus far no major problems in original test block in Virginia—Susceptible to mildew
Physiological Problems: None known at this time
Availability Sources: Offered by Adams County Nursery at Aspers, PA and Van Well Nursery, Wenatchee, WA
Grower Comments: Fruit grown in Virginia and Eastern Washington in 1990 indicates this variety is far superior over any other early yellow variety—Quality is as good as the imported new crop of Braeburns from below the equator

THE AMERICAN POMOLOGICAL SOCIETY

"The Oldest Fruit Testers Organization in the World"

Jerome L. Frecon
Rutgers Cooperative Extension
Clayton, New Jersey

A group of fruit scientists and enthusiasts met in 1848 to form an organization dedicated to test fruit among other objectives including the publishing and cooperating in all areas of fruit research. Incorporated in 1887 in the state of Massachusetts, the American Pomological Society was a forerunner of the American Society of Horticultural Science, one of the largest horticultural science organizations in the world.

Currently under the leadership of Dr. James Cummins, fruit and rootstock breeder to the New York Agricultural Experiment Station at Geneva, membership consists of, and is open to growers, nurserymen, research and extension workers, and fruit testers.

One of the major benefits of membership is the well written and graphically illustrated quarterly publication "Fruit Varieties Journal" edited by Dr. David Ferree, fruit researcher for the Ohio Agriculture Research and Development Center in Wooster, Ohio. This approximately 40-page magazine is published every three months as it has been for the past 44 years and contains a wealth of information on fruit varieties of all types. For example, the January 1990 issue had an excellent review of Gala and Red Gala Spots: A Preliminary Comparison of Maturity by C.B. Walsh and R. Volz. The October 1989 issue had an article on Consumer Evaluation of Red Delicious Apple Strains by R.M. Crassweller and R.A. Hollender. For I.D.F.T.A. members there are also articles on apple rootstocks, new releases on fruit varieties and general reviews of old and popular varieties. Most agricultural libraries catalog "Fruit Varieties Journal" for review.

In addition to publishing test results, the Society is also involved in recognizing outstanding fruit researchers and workers, preserving fruit germplasm, registering fruit varieties and rootstocks, maintaining fruit gardens, and rootstock development.

Anyone interested in fruit varieties and rootstocks should be a member of the American Pomological Society. Membership is $16.00 per year or $48 for 3 years and can be obtained by writing to:

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COMPACT NEWS

A Periodic Newsletter of the International Dwarf Fruit Tree Association

No. 2 September 1990

A MESSAGE FROM THE EDUCATIONAL DIRECTOR . . . *This is my last day (August 31) on the faculty of the Virginia Polytechnic Institute and State University after serving thirty-six years in Horticulture Departments in Virginia and Ohio. I am looking forward to my retirement and the opportunity to concentrate more time and energy to the role of Educational Director of I.D.F.T.A. The tree fruit industries are undergoing dramatic changes and through I.D.F.T.A. we will continue to make every effort to provide information and programs to meet the fruit production challenges of the future.*

H.A. (Jack) Rollins, Jr.

I.D.F.T.A. Updates

1990 SUMMER TOUR

This past June the I.D.F.T.A. summer tour was held in Western New York and was a great success due to the efforts of Steve Hoying, the fruit extension team, and orchardists throughout the area. Participants saw many high density apple production systems and learned from growers' past experiences and future production system plans. Tentative plans are being developed to hold the 1991 summer tour in North Carolina.

FUTURE COMPACT NEWS

The next issue of Compact News is scheduled to come out in November. It will include highlights of the upcoming annual conference and an update of 1991 summer tour plans.

FOREIGN TOUR ANNOUNCEMENTS

Each year there are foreign educational tours scheduled by I.D.F.T.A. members. While such tours cannot be sponsored by I.D.F.T.A. because of legal liability concerns, the Board has approved the opportunity to announce such tours in Compact News providing the tour fulfills the basic mission of I.D.F.T.A. If you would like to have a tour announced, send me a copy of the tour details for review by a committee of the I.D.F.T.A Board.

The following is a copy of a talk presented by Ron Perry at the New England Fruit Meeting and Trade Show held January 31 – February 1, 1990 in Sturbridge, Mass. It was published in the proceedings of that meeting.

34th ANNUAL CONFERENCE

The 1991 Annual Conference will be held at the Amway Grand Plaza in Grand Rapids, Michigan February 24-27, 1991. The I.D.F.T.A. was originally founded in Michigan and annual conferences were held in Michigan for many years. This year's conference will in many respects be a "coming home." Preliminary plans are underway to hold the 1992 conference in Niagara Falls.

IN THIS ISSUE!!

PLAN TO ATTEND THE 1991 ANNUAL CONFERENCE FEBRUARY 24-27!

TRAINING AND PRUNING THE SLENDER SPINDLE AND VERTICAL AXE TREE

Ronald L. Perry
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INTRODUCTION:

Many training systems have been described and tried for apples grown on dwarfing rootstocks in close spacings. In all cases the trees must be given structural support to make the venture profitable. Many North American apple growers have generally been slow to seriously adopt these systems because of the added expense of support materials and the initial capital outlay that is required to establish the high density orchard. Western Europeans have been growing almost all fruit intensively for some thirty years largely because land is a highly valued commodity. An economic assessment prepared by Geldart (1989), indicates that the high density slender spindle and axe systems have a greater potential for profit in North America than low density systems. The extent of profitability and affordability is heavily dependent on a farm by farm analysis. Two systems which have gained the most attention, primarily because of their economic returns and their moderate input, are the slender spindle and the vertical axe. Both are of European origin and have been described in detail by Wertheim (1970, 1978), Oberhofer (1987) for the slender spindle and by Lespinase (1980), Maillard & Herman (1988) for the vertical axe.

Many factors go into choosing the orchard system as described by Barritt (1989). The orchardist must be aware that intensive systems require the use of dwarfing rootstocks such as M.9, Mark, M.26 and even possibly M.27. Secondly, pruning and training is much more exact and intensive through the growing and dormant season, particularly in years 1 to 4.

The following procedural outline may be adjusted to fit the objectives and needs of an individual's orchard operation. Note that the suggested steps for the slender spindle have changed slightly over the years of use in Northern Europe. Since Lespinase's first description of the axe, the commercial industry in France (Maillard & Herman, 1988) and in Quebec (Granger & Philion, 1989) have made major modifications of the system. These modifications will be described below.

SLENDER SPINDLE:

The slender spindle tree is identified by its slender conical canopy with a distinct, supported vertical central leader (Fig. 1). A permanent structure of limbs, in varying number, are allowed to exist at its base. This arrangement of branches is sometimes referred to as the "production table." Short, horizontal fruiting branches, shorter in length than the lower table branches, extend from the central leader in the upper one-half of the canopy. Trees are kept low in height (not more than 8-9 feet) and thus require the use of the most dwarfing rootstocks such as M.27, M.9, M.9 EMLA, and Mark. The first 3-4 years require extensive labor, training and materials. With proper initial care, mature trees require relatively little input.

RECENT MODIFICATIONS:

Modifications in training are now being recommended in Europe regarding treatment of the leader in formative years. The classical slender spindle system suggested that the leader should be headed the first one to three years followed by pruning to a weak lateral in later years. The weak lateral would then be brought up to verticality and tied to the stake as the new central leader. This process weakened the upper portion of the canopy and encouraged fruiting. It was recommended earlier in life for trees that appeared too vigorous

Continued on NEXT PAGE.

Training and Pruning the Slender Spindle. . . *Continued*

for closely spaced plantings. The advent of multi-row, 1,500 trees per acre plantings in Europe has spawned a newer philosophy where pruning shears are now replaced by the use of limb bending and tying of limbs rather than their removal. Now the central leader is bent over rather than headed to force laterals even at planting time. For sake of description below, we'll refer to this latter technique as "super slender spindle."

YEAR ONE, POST PLANT:

Trees without laterals (feathers) are cut back to 30 to 35 inches depending on vigor. Feathered trees (trees with unpruned laterals 12 inches or longer) should be cut at one foot above the highest useful lateral or not cut at all (super slender spindle) for extremely well-feathered vigorous trees. All laterals should be removed below 20-24 inches. For cold growing areas of the north, growers may wish to delay any branch bending until after 2-4 inches of growth has developed. Trees shorter than 30 inches likely should be cut at 18 inches to encourage the development of a stronger more well developed tree (similar to Knit Boom trees in Holland). Should only one lateral remain, it should be removed to prevent one-sided development. Remaining laterals should not be stubbed or cut back. Stakes or posts should be driven 6 inches from and on the windward side (west) of the tree. Trunks should be secured to the support stake at or below the first lateral and with a temporary tie ("Max-tapener" or weak plastic tie) near the uppermost cut. For trees started with feathers, tie down laterals, particularly strong ones, to a horizontal position soon after planting.

At 2-4 inches of growth, remove 2-3 shoots below the chosen leader. Tie new leader to stake after 12-15 inches terminal growth with temporary tie.

Modifications in training are now being recommended in Europe regarding treatment of the leader in formative years.

Repeat this procedure after an additional 15 inches of growth. Tie down or attach weights to vigorous lateral branches (18-24 inch length) in July-August (trees starting without feathers).

YEAR TWO:

Treatment of the leader in years 2-4 depends heavily upon the variety and natural vigor of the tree. Central leaders of varieties which don't naturally branch well, such as Red Delicious, Northern Spy, etc. need to be headed at one-half of the previous season's growth or treated in super slender spindle fashion described above in order to encourage branching. This is also done to weak growing trees regardless of variety. This should be done until the tree reaches 5-6 feet in height. For well branched varieties such as Jonathan, Empire, Gala, Golden Delicious, and Idared, and vigorous trees, the central leader is often removed and a competing lateral is allowed to become the new leading shoot. Tie down or weight vigorous branches (18-24 inch length) for developing the "production table." Bending of laterals in mid-winter may force undue stress on wood tissue causing branch and crotch splitting. Vigorous upright branches (near same diameter as leader) should be removed.

At 2-4 inches growth, remove 2-3 competing shoots below the leader. In beginning-to-mid July, attach 2-3 oz. weights (weighted clothespins are most efficient and allow reuse readily) to lateral branches which have grown 12-16 inches. Branches should extend to below horizontal in the upper region of the canopy and closer to horizontal plane for branches arising in the lower portion (Fig. 2). Accomplishing this will encourage flower and fruit development on the respective branches. Secure trunk to stake with a more permanent tying material if it hasn't been done as yet. Continue tying or weighting lateral branches in July to August. For trees which

Continued on NEXT PAGE.

Training and Pruning the Slender Spindle. . . *Continued*

appear to be extremely vigorous at this point, the central leader may be slowed by bending the leader down to below 120 degrees (point terminal bud to base of trunk of neighboring tree). Tie up fruit laden limbs where necessary. Limbs in the lower region of the canopy should not be allowed to extend to below the horizontal. Limbs below the horizontal plane and bearing fruit will age quickly and lose vigor. This procedure is effective for weakening branches in the upper region.

YEARS THREE-FOUR:

As noted above, the treatment of the central leader depends on the variety and vigor of the tree. Likely, the tree at this point has reached 5-6 feet in height. Cut out the central leader and tie up a new leader by extending a chosen lateral in a vertical direction or follow up with the super slender spindle method described above. Cutting of the leader to a weak leader can be delayed to late June (known as the "June cut") for trees with more vigorous top rank growth. Remove upright, narrow-crotched branches and strong competing growth.

Tie or weight new 12-16 inch laterals to below horizontal in July or August to encourage fruit production for next season. Tie down vigorous vertical leader growth if necessary. Tie up lower "production table" branches laden with fruit.

The height of the bearing slender spindle tree should be maintained at 8-9 feet by annually converting a weak lateral branch into the new leader. Summer prune the upper region if vigorous water-sprouts appear and shade lower fruit bearing canopy. Upright and inward growing branches are continually removed. Tree width must be maintained by annual pruning. All branches that are too long and are encroaching into the alley-way or neighboring tree space should be reduced to appropriate lengths. Shortening of a branch is most effectively done by cutting back to a seasoned side branch. Preferably the side branch may have spurs or will have recently borne fruit. Avoid cutting back to upright and downward growing shoots or to previously grown vegetative shoots. The basal branches should be kept within their allotted space and should be tapered towards the terminal section. Avoid making heading or tipping cuts on one-year-old growth, unless necessary to induce branching on some varieties or to encourage new fruiting branches.

Quality fruit will only grow on young, vigorous fruit branches.

A regular renewal of fruit wood is necessary in a bearing tree. Quality fruit will only grow on young, vigorous fruit branches. New fruit branches are obtained by removing bowed, old, exhausted fruit branches and heading back bowed branches and fruit whips during dormant pruning (Fig. 3). Specifically, this is accomplished by making a beveled cut known as a "Dutch cut" (Fig. 4). In this technique, the pruner gives the buds on the underside and side portion of a branch a better chance to force (adventitiously) and grow wide than the less desirable more upward growing upperside buds. Not all the stubbed "Dutch cut" branches will force shoots. Our experience indicates that branches force some 30-50% of the time, depending on branch age, variety and canopy exposure to light. This branch cycling process is repeated quite frequently especially in the middle and upper portion of the tree in the classic slender spindle. Characteristically a branch may go through the following chronology:

Renewing and cycling fruiting branches in the bearing slender spindle tree.

- **FEB. 90** – Three to five-year-old branches removed by Dutch cut near central leader.
- **JULY 90** – One or two shoots develop and are bent or weighted down to encourage fruit-bud differentiation.
- **FEB. 91** – One or two 18-inch shoots have developed and remain for 91.

Continued on NEXT PAGE.

Training and Pruning the Slender Spindle. . . *Continued*

JULY 91 – Shoot produces spur and/or fruit with borsch shoot.
• **FEB. 92** – Shoot now a bearing branch system, shortened if necessary.
• **JULY 92** – Branch system bearing fruit load (second year).
• **FEB 93** – Dutch cut performed on the branch system (may hold off another year or two depending on location in the spindle. Shortest tenured branches are located in most upper portion of the spindle in order to maintain conical shape form.

VERTICAL AXE:

The vertical axe training system developed by its mentor, J.M. Lespinase (1980), has received considerable attention in the last several years. Originally the axe system basically proposed that a central leader should develop to a height of 10-12 ft. and that all branches extending from the leader are considered to exist in a temporary state of fruit production. Therefore, the bearing tree would resemble the upper tier of cycled fruiting branches as described above for the slender spindle. In 1985 M. Lespinase (Philion, 1989), recommended a modification of this system by suggesting that a "production table" consisting of permanent fruit bearing scaffolds needed to be established in order to compete ("strangulate") with the leader and reduce the overall height and vigor of the tree. The commercial orchards in France now sport orchard systems that appear more like tall slender spindles or "spindle-axe hybrids" (Perry, 1989).

The axe introduced a tree training concept known and described as "free flow development." In this approach Lespinase proposed that trees should be allowed to develop according to each cultivar's own unique morphological tendency. In this method it is crucial to know the fruit and vegetative producing characteristics of each cultivar. By knowing these characteristics, the orchardist can avoid the needless shoot development which will yield vegetative shoots rather than more desirable fruit. He grouped cultivars into 4 categories:

Type I – Very Basitonic

Central leader not dominant, fruiting zone in basal area of branches, fruiting spurs on 2-year-old wood, growth of lower branches enhanced, fruiting has no influence on tree form. (Ex. Spur-types, Lobo)

Type II – Slightly Basitonic

Central leader dominates but under vigorous conditions lower branches enhanced, fruiting spurs and habit on branches 2-4 years of age, therefore fruiting has little influence on form. (Ex. McIntosh, Spartan)

Type III – Slightly Acrotonic

Trunk leader dominates wide-angled branching, fruit borne on many short weak shoots, fruiting area moves away from tree center. (Ex. Golden Delicious, Jonathan, Jerseymac, standard Red Delicious, Idared, Cox, Mutsu, Winesap, Akane, Prima, Gala, Empire)

Type IV – Acrotonic

Opposite of basitonic, fruiting zone develops in upper one-third, no laterals develop in lower area, spurs on 1-2-year-old wood in terminal or lateral position after limb arching with weight of fruit. (Ex. Granny Smith, Rome, Cortland, Paulared, Red Haralson)

According to experience, the Type III cultivars appear to adapt easiest to the axe concept. Trees can be planted on dwarfing rootstocks and be planted in tree densities similar to the slender spindle. Type I and II cultivars will require slightly more vigor and should be planted on M.26, M.7, or MM.106.

Branches are periodically renewed after bending under the weight of fruit and do not become permanent scaffolds. The tree is maintained in a natural equilibrium; fruit production controls its vegetative growth, distributing shoot growth equally throughout the tree. The primary difference between the axe and the slender spindle is the treatment of the developing tree in the first 4 years. The terminal bud on the leader is never removed and kept in an erect position. Further, the axe tree is encouraged to reach 20-30% more height than the slender spindle. Because of the expected height, a trellis system

Continued on NEXT PAGE.

Training and Pruning the Slender Spindle. . . *Continued*

is suggested. A post is installed at 30-40 feet intervals and one to three wires strung at 8-9 feet, and optional 6 feet, and 2 feet heights. A more rigid support system will enhance more linear development of branches and leader (Perry, 1989).

The following procedural outline describes training of Type III cultivars in the newer modified axe, which includes the development of a whorle of permanent lower scaffolds or "production table" (similar to slender spindle).

YEAR ONE, POST PLANT:

Leader should not be headed unless trees have been precut in nursery or the trunk caliper is less than one-half inch or planted after May 15 (Michigan). If heading is necessary, cut at 24 inches on poorly feathered or whipped trees. Install stakes and/or trellis system if not accomplished as yet. At least a stake or string to a top wire (9 feet) needs to be in place for training by the time shoots extend to 2-4 inches. Remove laterals on weak trees and those below 16-18 inches. Tie trunk to stake or string (temporary flexible material plastic tape, i.e., Max Tapener). At 2-4 inches pinch (done by fingers; remove or damage apical bud of lateral) of first 3-4 laterals (upper one-third of tree). Repeat procedure on same laterals (regrowth) following each successive 3-6 inch new increment in growth. Likely, this will be needed two-three times. Always leave terminal bud of leader developing without harm. Pinching laterals is an extremely quick operation requiring little skill by labor. Continue through the growing season to temporary tie new developing leader to support structure at 15-18 inch intervals.

Feathered trees should be planted and laterals pinched as described by Maillard & Herman (1988) only to keep feathers (developed in nursery) from being too competitive with the developing leader. Whip trees and treat as above if trees have less than 4 good laterals (feathers) to keep. Should leader start well with good vigor, leave 3-4 feathers alone and spread with clothespins or tie down in slender spindle fashion (develop lower "production table").

YEAR TWO:

No pruning done in dormant season except to remove any upright vigorous lateral shoots. Notch (Fig. 5) leader where laterals didn't develop and are desired or bend leader down (temporary; 30-45 days) to horizontal plane (Fig. 6) to force new laterals. Reinstate leader verticality after 30-45 days of bending. This procedure appears more consistently effective in forcing branchless leaders than notching, which only appears to work about 30% of the time. Select and spread or tie down 3-4 lower lateral shoots which can be developed in the slender spindle fashion "production table." Caution, when tried in Quebec, this lower table caused excessive choking and weakening of the leader (Philion, 1989). As in year 1, pinch the first 3-4 new laterals competing with the leader after extending 2-4 inches. Repeat this process as in year one until the terminal reaches the top wire. Pinch back or remove terminal shoots of strong laterals in the lower part of the canopy in July or August.

YEAR THREE:

Shorten fruit bearing table branches where necessary as in slender spindle training in winter pruning. Keep terminal bud intact on leader. Remove unwanted upright growth. As growing season progresses, tie or weight down new laterals in upper half of canopy as in slender spindle. Do not prune or touch leader or laterals near upper wire.

YEAR FOUR:

Keep terminal bud intact on central leader even though it probably has extended above the top wire by now. Do not cut into growth less than two years of age above the top wire. It is best to wait until fruit has developed in this upper region before reducing growth to top wire height. Continue training as described above in slender spindle. Fruit branch cycling will likely need to be implemented using the Dutch cut.

YEAR FIVE +

Prune and manage in slender spindle fashion.

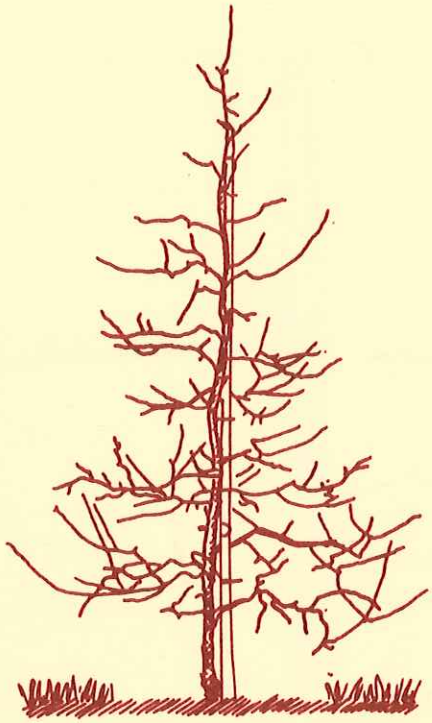


Figure 1
THE IDEAL SLENDER SPINDLE TREE (Oberhofer, 1989).

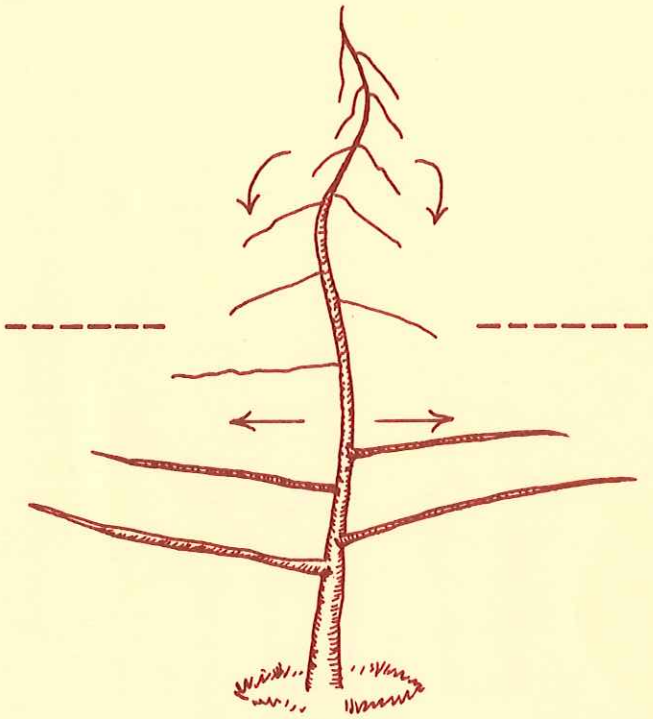
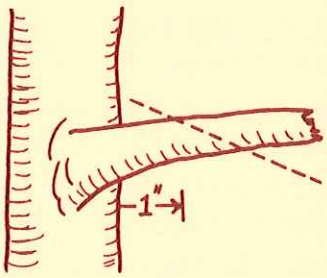


Figure 2
DESIRED BRANCH ANGLES FOR DEVELOPING LATERALS IN THE SLENDER SPINDLE.



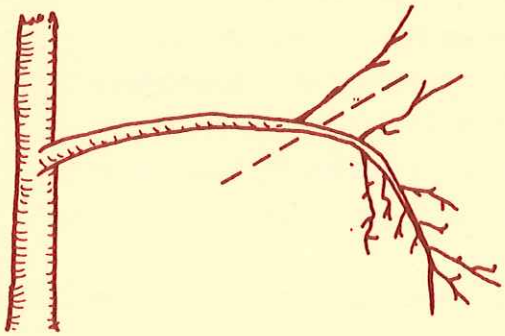


Figure 3
REJUVENATING AN OLD BOWED BRANCH.

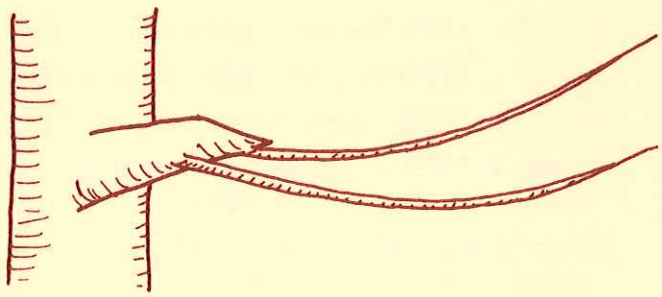


Figure 4
THE "DUTCH CUT."

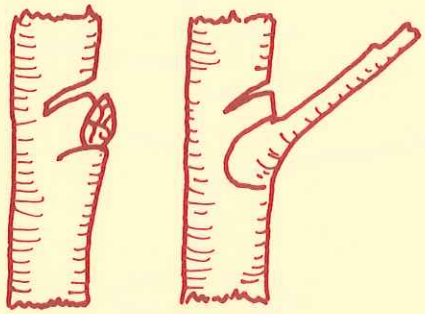


Figure 5
NOTCHING TO FORCE LATERALS.

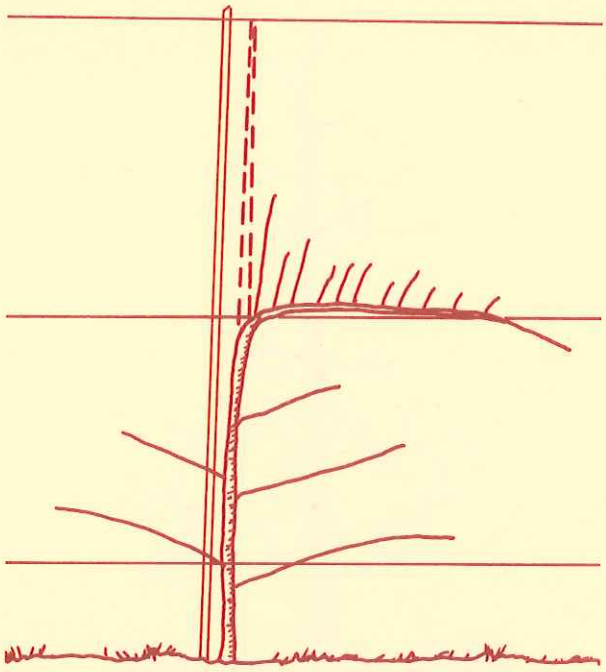


Figure 6
BENDING TO FORCE LATERALS ON BRANCHLESS VERTICAL AXE LEADERS.

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