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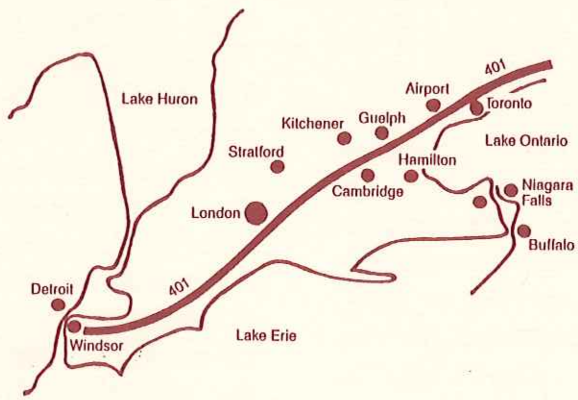
COMPACT NEWS

A Periodic Newsletter of the International Dwarf Fruit Tree Association

No. 2 April 1993

DISCOVER ONTARIO! IDFTA Summer Tour 1993



WHERE:
University of Western Ontario (UWO), London, Ontario. Orchard tour stops in the counties of Lambton, Middlesex, Norfolk, Oxford and Elgin.

WHEN:
June 20th — Check-in at UWO (3 p.m. on)
June 21st and 22nd — Orchard Tours
June 23rd — Departure

REGISTRATION:
Registration forms enclosed with this newsletter must be received by May 31. Late registration forms will be accepted until June 11. **No** registrations accepted after June 11th. (Disregard the May 21 deadline as printed on the enclosed registration forms. Extra time has been allotted — so be sure to register!) All registrants will be mailed maps for London and the UWO campus. FIRST 100 REGISTRANTS RECEIVE AN OFFICIAL FIRST DAY COVER WITH THREE STAMPS DEPICTING SOME OF CANADA'S TREE FRUIT.

EVENINGS:
June 20th — Barbecue at UWO featuring two presentations, "Ontario Tree Fruit Production: An Overview" and "Integrated Pest Management in Ontario Apple Orchards."

June 21st — Barbecue supper at Vittoria Community Centre in Norfolk County. Special video presentation of an exciting new tree crop.

June 22nd — Outdoor supper at Warwick Conservation Area.

TOUR HIGHLIGHTS

TOUR DAY 1 — JUNE 21

VanDenBorre Orchards — *"Success with M.9 on Trellis"*
A pioneer in production of supported M.9 systems in Ontario, Maurice VanDenBorre has opted for a trellised orchard. The canopy reaches up to about eight feet high. To reach the upper tree canopy without using ladders, Maurice has designed and built a "work" platform to carry four to six workers during pruning and harvesting. Maurice has also designed a unique "traveling greenhouse" that covers peaches, cherries and Granny Smith apples at various times of the year.

Farmer Jones Orchard — *"Equipment Innovations"*
Owner Andy Spanjers has invented some ingenious orchard equipment to facilitate management of his three wire trellised planting of M.9 and M.26. An "over-the-►

row" self-propelled orchard sprayer with hydrostatic transmission and four wheel drive is powered by an 80 HP engine. Curtained sides and a ducted, direct air flow contributes to excellent tree coverage. A self-propelled bin loader and carrier built on an old truck frame and bin "sleds" are other must-see inventions. Andy added a C.A. storage with a capacity of storing 19,000 bushels in 1988.

Horticultural Experiment Station, Simcoe — *"Cultural Management Research on Apples"*

Currently under the direction of Dr. Don Elfving, a wide variety of different trials is in progress in the apple program at the Horticultural Experiment Station in Simcoe, Ontario. Cultivars and rootstocks are being evaluated in ongoing experiments. Cultivars under consideration include disease resistant cultivars from various sources, new selections from the breeding program in Summerland, B.C., and cultivars of interest from around the world. Various rootstocks are under evaluation in the NC-140 1984 and 1990 plantings. The 1990 NC-140 planting also contains a comparison of three different training systems with ten training system-rootstock combinations. Different thinners are being investigated including a number of experimental chemicals. In 1992 a replant trial was initiated in which the effect on tree growth of various pre-plant treatments to a nematode infested soil are being compared. Various vigor reduction techniques such as trunk ringing, root pruning, and varying the planting depth are also under consideration. Other experiments include the effect of early fruiting on tree performance and canopy restructuring to improve crop quality and efficiency.

Norfolk Fruit Growers' Association — *"Packing Plant and Storage"*

The Norfolk Fruit Growers' Association is the largest apple storage facility this side of the Rockies with an excess of 3.5 acres of buildings with capacity for Cold C.A., Low Oxygen C.A., Common and Dry Storage, packing plant, service facilities and retail outlet. The "grower owned and operated" co-operative has 40 growers representing 3,300 acres of orchard representing over 320,000 trees in the ground. Estimated production in 1992 was in excess of 2.25 million bushels of apples. Apples are marketed locally in other provinces, the U.S., the United Kingdom, other E.E.C. countries and the Caribbean. The plant handles the largest proportion of Empire apples grown in the province.

Schooley Orchards — *"Making the Transition to High Density Supported Systems"*

A long-time member and past-president of the IDFTA, Harold Schooley has been an innovator in higher density supported systems in Norfolk County. The farm consists of two orchards totalling 130 acres of apples. The majority of production comes from plantings of Empire, McIntosh, Delicious, Idared and Mutzu on M.26 and 9/106 interstem planted in the late 1970s and early '80s. Recent plantings have been centered around Mark and M.9 rootstocks on spindlebush (10th leaf), a trellised block (17th leaf), vertical axis (6th leaf), and slender spindle (2nd and 3rd leaf). Harold keeps block-by-block production records. His four year old planting of McIntosh on vertical axis yielded a whopping 1,253 bushels/acre in 1992.

TOUR DAY 2 — JUNE 22

Herb Versteegh Orchards — *"Continual Establishment and Replacement"*

The emphasis Herb has placed on his management program is to annually replace about five percent of his older, less productive blocks with new plantings using a good record keeping system of production costs and profits based on block-by-block analysis. Replanting is mainly to higher density supported systems on M.9 rootstock trained to slender spindle. Forty percent of Herb's orchard is currently on supported systems. The family also grows their own trees in a small nursery planting. Newer cultivars on the farm include Empire, Jonagold and Gala.

Gerry Crunican Apple Orchard — *"Vigor Control Management"*

Older trees are mainly on MM.106, M.7, MM.111 and some M.26 rootstocks. Gerry has gradually made a transition to higher density blocks on Empire, Mutsu, Gala and Jonagold. Gerry was one of the first producers in Ontario to practice various techniques to control vigor in his larger rootstocks. These include summer pruning, scoring, root pruning and limb positioning. Through these methods Gerry has increased precocity, quality and production.

Warwick Orchards and Nursery — *"Production Blocks, Pruning and Training Tools, Ontario Cultivar Trends"*

John VanDiepen and family grow 32,000 trees on M.9 trained to slender spindle. Many newer cultivars such as Gala, Fuji, Braeburn and Jonagold are being grown. The operation also has a C.A. storage facility for 1,600 bins, a warehouse, and a nursery operation which has grown to about 100,000 units per year. Rootstocks for budding and grafting are purchased in The Netherlands. The family also grows plums, pears, grapes, currants, berries and vegetables.

Farmer Jack's Orchards — *"Roadside Marketing and Organic Apple Production"*

Location, location and location make Jack VanDiepen's►

roadside market an extremely popular one with London area consumers. A wide variety of fresh produce is sold, much of it grown on the farm, and a bakery operates out of the market as well. Most of the apple trees on the 94 acre farm are on M.9 and M.26 rootstocks and trained to support systems. A portion of the apple crop has been grown organically over the last 10 years resulting in some unique pest management strategies. Much of the crop is sold as organic "value added products" such as cider and apple butter.

Brooymans Orchards — *"Success with M.9 on Modified Spindle"*

One of Ontario's pioneers in high density, supported systems production, Adrian Brooymans, grows his trees on a modified spindle bush. Various methods of limb bending and tying materials ensure good light interception, precocity, and high quality fruit production. Adrian and son, Rene, have been successful starting trees from whips rather than the recommended two year old, feathered nursery trees. Their horticultural expertise has resulted in trees having well balanced vegetative growth and fruit production. □

The Status of Apple Rootstock Development at East Malling

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(Originally presented as the Batjer Memorial Address to the Washington State Horticultural Association, Yakima, WA, December 1992)

The use of rootstocks for raising fruit trees is not new; horticulturists from as far back as the ancient Greek and even earlier civilizations utilized them more than 2000 years ago. They were used, primarily, to help the fruit grower raise trees of selected desirable scion varieties. Most temperate fruit species are highly heterozygous, that is to say they do not come true-to-type from seed. Also, they are usually difficult to propagate vegetatively, from cuttings or layers. The easiest and most reliable method of raising scion trees, therefore, would have been by grafting them onto easy-to-propagate rootstocks. Most, if not all, rootstocks used in early times were raised from seed, which was generally collected from wild populations. Substantial numbers of rootstocks are still raised from seed in many parts of the world and the technique has advantages of low cost and less risk of virus transfer. However, those using seedling-raised rootstocks frequently forego many other benefits of rootstock use which may be gained by using clonal rootstock selections; some of these potential benefits are listed in Table 1.

Most of the early records regarding clonal rootstock selection focus on apple and this interest has continued up to the present day with an abundance of new apple rootstock selections currently under test. Several different clonal apple rootstocks, such as the 'Paradise' and the 'creeper apple tree' were mentioned by horticulturists as early as the 17th century, and by the middle of the 18th century several others, including Doucin, were mentioned. By the middle of the 19th century the number of clonal apple rootstocks available had increased to six. Unfortunately, these clones had become badly mixed in commercial nurseries in Britain and other parts of Europe, and this inevitably resulted in very variable tree performance when the stocks were grafted with scions and planted in orchards. Although several attempts were made to sort out the confused naming in the second half of the 19th century all of these were to no avail.

Early Rootstock Selection at East Malling

In 1913-14, the first director of East Malling Research Station, Mr. R. Wellington, set about sorting out the mixed Paradise rootstocks and, when he left to serve in the first World War, the work was continued by his successor Ronald Hatton. They began by collecting apple rootstocks from 35 nurseries in Britain, Germany, France and Holland. In all, 71 different named types of apple rootstocks were procured and planted in the nursery at East Malling. Then began the slow and painstaking process of sorting out the different clones, which was done principally on their morphological and anatomical characteristics. At the completion of this initial phase of the work nine different clones were identified and, because of the considerable confusion associated with their original names, they were called Types I to IX (Hatton, 1917). Later the word 'Malling' was ►

substituted for 'Type' and, more recently, Arabic numerals have replaced the roman numerals originally used to designate these rootstocks. These early selections are shown in Table 2.

Hatton and his staff continued the work of selection and by the early 1930s the list of Malling (M.) apple rootstocks had extended to 16 (Pearl, 1932). Some of these later selections originated in Britain, others in Germany, and all were classed as vigorous or very vigorous.

Although two rootstocks in the original Malling series, M.9 and M.7, have retained or even gained in popularity with fruit growers, the others, most of which are invigorating when worked with scions, are now only occasionally used.

Breeding of Apple Rootstocks in Britain

In the early 1920s researchers in Britain recognized that, despite the merits of the Malling series of rootstocks, they did not match the needs of all apple growers and rootstock breeding programs were needed if these needs were to be met. The first objective was to breed rootstocks resistant to the woolly apple aphid *(Eriosoma lanigerum)*, a pest of only minor importance in northern Europe but extremely damaging when it attacked the roots of trees growing in Australia, New Zealand and South Africa. One apple variety, Northern Spy, was known to show resistance to woolly aphid and this was crossed with existing Malling series rootstocks to produce new resistant clones. The earliest work was conducted by the John Innes Institute at Merton in Britain and from this the Merton series of resistant rootstocks evolved. One of these, Merton 793, (Northern Spy x M.2), despite its strong vigor, is still one of the most popular rootstocks with fruit growers in the Southern Hemisphere, showing resistance to several soil pathogens as well as to woolly aphid.

Collaboration in apple rootstock breeding, between the John Innes and East Malling Institutes, focusing on woolly aphid resistance subsequently produced the Malling-Merton (MM.) series of rootstocks. Initially 16 clones, MM.101 to MM.115, were selected for further testing (Tydeman, 1953), but these were soon reduced to the four most promising (Table 3), and in recent years only two of these, MM.106 and MM.111, have retained their popularity with fruit growers. One rootstock, also produced in the same series of crosses with Northern Spy, showed poor resistance to woolly aphid but had sufficient other merits, particularly induction of precocious and abundant cropping in the scion, to warrant release. This vigorous rootstock is now distributed as M.25.

None of the Merton or Malling-Merton rootstocks is very dwarfing and growers wishing to plant dwarf trees, albeit only as temporary fillers between larger trees, were limited to the choice of two rootstocks, M.9 and M.8. Both of these were difficult to propagate and when used as rootstocks for scion trees were poorly anchored and intolerant of droughty or poor soils. To satisfy the demand for better dwarfing rootstocks further breeding work was begun in 1929, in which M.9 was crossed with many of the other Malling series rootstocks. It is from this series of crosses that the popular M.26 and M.27 rootstocks were selected (Preston, 1954). Two other selections from this series of crosses are still under evaluation today (Table 4).

As a consequence of this selection and breeding work undertaken in Britain, mainly at East Malling, by the early 1960s growers had at their disposal a series of rootstocks which provided a full range of vigor control for apple scions. Moreover, many of these rootstocks also provided benefits such as induction of precocious, consistent and abundant cropping, large fruit size, and resistance to some of the more damaging soil pests and pathogens. The Malling and Malling-Merton series rootstocks were by this time widely used throughout the world.

Despite the extensive range of apple rootstocks available, all of the popular rootstocks still have one or more serious disadvantages (Table 5). Also, recent changes in systems of cultural management, particularly density of tree planting, have highlighted the need for new rootstock attributes.

Apple rootstock breeding and selection at East Malling has continued, therefore, in an endeavor to improve upon the existing rootstocks and to find new clones better suited to modern and constantly evolving systems of tree management.

One new rootstock clone, 86-1-20, selected from a cross between MM.106 and M.27, will be distributed for further trials in Europe, Britain and New Zealand early next year.

Trees on 86-1-20, which are a little smaller than trees on MM.106, cropped precociously and abundantly in trials in Britain, and the rootstock shows greater resistance to crown rot *(Phytophthora cactorum)* than MM.106 in preliminary experiments (Webster et al. 1986). However, 86-1-20 is sensitive to fireblight *(Erwinia amylovora)* and should not be used where this is a problem on apple trees.

At the opposite end of the vigor range is the very dwarfing rootstock M.20. Selected at East Malling many years ago but never officially released, M.20 is slightly more dwarfing than M.27. Fruit size from trees on M.20 is usually larger than from similar trees on M.27 and, despite its greater tendency to sucker, it is currently of interest to Dutch growers wishing to establish super-intensive planting systems.

Amongst the rootstocks bred more recently and currently being screened in orchard trials at East ►

Malling several show sufficient promise to warrant further testing (Table 6). Of most interest to British and other growers in northern Europe are rootstocks in the vigor range between M.27 and M.26, although some interest in the more vigorous rootstocks still persists, especially in parts of the Southern Hemisphere. Specific breeding goals are for a) a rootstock between M.27 and M.9 in vigor, b) a replacement for M.9 which is easier to propagate and better anchored and c) a replacement for M.26 which is free of burr knots.

Novel Techniques for Rootstock Improvement

As well as continuing apple rootstock breeding using conventional hybridization techniques, scientists at East Malling are also exploring the potential of novel breeding techniques for rootstock improvement. Previous research showed that repeated sub-culturing of micropropagated Pixy plum rootstocks induced a type of 'juvenility' in the plants, which was associated with improved propagation. These improvements in propagation persisted for more than five years, when the plants grown from the 'rejuvenated' micropropagules were established in nursery hedges and severely pruned each winter.

Recent research has shown that conventional propagation of M.9 may also be improved following induction of 'juvenility' in culture. Although 'rejuvenated' M.9 plants sucker badly if plants weaned directly from micropropagules are used for budding, an intermediary nursery hedging of the M.9s seems to alleviate this problem. 'Rejuvenated' M.9 is currently in orchard tests at East Malling as a rootstock for Cox's Orange Pippin.

Some apple rootstocks, such as M.27 and M.25, may be regenerated quite successfully from one or just a few cells of leaf discs grown in vitro. The chances of somatic mutations occurring when such techniques are used is thought to be quite high, and the potential for generating useful somatic mutants has been explored with M.27. However, the most recent evidence from this experiment shows little or no change in the M.27 clones regenerated from leaf discs, indicating surprising stability in plants regenerated in this way.

References

Hatton, R.G. 1917. Paradise Apple Stocks. *Journal of the Royal Horticultural Society XLII*: 361-99.

Pearl, R.T. 1932. Apple Rootstocks I - XVI. *Journal of the South-Eastern Agricultural College*, Wye, Kent. No. 30. 194214.

Preston, A.P. 1954. Apple rootstock studies: The M.IX crosses. Report for East Malling Research Station for 1953. 88-94.

Tydeman, H.M. 1953. A description and classification of the Malling-Merton and Malling XXV apple rootstocks. Report for East Malling Research Station. 1952. 55-63.

Webster, A.D., Smith, R.A. and Watkins, R. 1986. Apple Rootstock Studies. I. Preliminary evaluations of several MM.106 x M.27 hybrids. *Journal of Horticultural Science*. 61. 429-37.

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TABLE 1
Advantages and Disadvantages of Seedling and Clonal Rootstocks

	Advantages	Disadvantages
SEEDLING	• Easy and inexpensive to raise • Plentiful supply of seeds • Reduced possibility of virus transmission	• Variable scion growth and compatibility • Minimal control of scion vigor • Scions slow to come into cropping
CLONAL	• Uniform growth of scion trees • Control of scion vigor • Induction of cropping • Improved fruit size • Resistance or tolerance to soil borne pests and diseases • Tolerance of unfavorable climatic or soil conditions	• More difficult and expensive to propagate

TABLE 2
The Original Nine Paradise (Malling) Apple Rootstocks

Type No.	Previous Common Name	Current Malling Clone Number	Vigor
I	Broad leaved English Paradise	M.1	Vigorous
II	Doucin	M.2	Vigorous
III	(no name)	M.3	Semi-Dwarf
IV	(no name)	M.4	Intermediate
V	Doucin Ameliore (Improved Doucin)	M.5	Vigorous
VI	Rivers' Nonsuch Paradise	M.6	Very vigorous
VII	(no name)	M.7	Semi-Dwarf
VIII	French Paradise (Clark Dwarf)	M.8	Dwarf
IX	Paradise Jaune de Metz	M.9	Dwarf

TABLE 3
Popular Malling-Merton Rootstock Clones

Clone No.	Origin
MM.104	M.2 x Northern Spy
MM.106	Northern Spy x M.1
MM.109	M.2 x Northern Spy
MM.111	Northern Spy x Merton 793

TABLE 4
Malling Rootstocks Derived From Cross With M.9

Original Clone	Malling Name	Origin	Vigor
3426	—	M.7 x M.9	Extremely dwarf
3431	M.27	M.13 x M.9	Very dwarf
3432	—	M.9 x M.13	Very dwarf
3436	M.26	M.16 x M.9	Semi-dwarf

TABLE 5
Some Problems With Existing Dwarfing and Semi-Dwarfing Rootstocks

Rootstock	Problems
M.27	Small fruit size, sensitive to woolly aphid
M.9	Difficult to propagate, poor anchorage, sensitive to winter cold injury, susceptible to fireblight and to woolly aphid
M.26	Uneven scion growth, burrknotting, sensitive to fireblight and to woolly aphid
MM.106	Sensitive to collar (crown) rot

TABLE 6
Performance of Several of the New Apple Rootstock Clones Under Test at East Malling

Clone No.	Origin	Crown Volume (% of M.9)	Yields 1988-91 (% of M.9)
69-7	10-2-6 o.p.	33	65
628-2	Ottawa 3 x MM.106	35	82
486-1	Ottawa 3 x M.27	75	65
295-6	Robusta 5 x Ottawa 3	73	110
M.27		35	56
M.9		100	100

European Orchard Tour

Once again, Fritz Wafler, a fruit grower in NY state, a native of Switzerland, and an IDFTA Director, will lead a European orchard tour July 30 to August 14, 1993. In the last nine years, Fritz has organized and led six tours to various parts of Europe. Tour participants will visit orchards and research stations in England, Holland, Belgium, Germany, Switzerland and Italy to observe the newest technology in orchard management. Along with his background, Fritz's familiarity with the European fruit growing community and native culture offer a unique opportunity to see what the average tourist never gets a chance to see. In addition to technical stops, there are interesting local sights and breath-taking scenery.

Tour fares begin at $3,290 (per person, double occupancy) and include round trip airfare, all travel in Europe by luxury bus and train, fine hotel accommodations, and many meals. **Sign-up deadline is May 20, 1993.**

Further information and a travel brochure may be obtained by contacting Fritz Wafler, telephone (315) 594-2649; or Wally Heuser, Summit Sales, telephone 1-800-424-2765. ☐

European Techniques to Enhance Nursery Stock Performance and Generate Early Production

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(Part of a presentation to the Washington State Horticultural Association, Yakima, WA, December 1992)

Why do western European orchardists require high nursery tree quality? To answer this question, the positive and negative features of European intensive apple culture must be analyzed.

Positive features include:

- early productivity
- high productivity per ha
- high proportion of quality fruit for fresh consumption
- good and uniform fruit size

Negative features are:

- labor: limited availability and high cost
- restricted sunlight quantity
- land: limited availability and high cost

These factors determine the economic strength of apple culture. A more specific analysis of each one of them will prove that tree quality often—not to say always—emerges as the main parameter determining successful management and economic survival. The cited criteria pertain to every fruit variety.

Early Productivity

Early production is becoming increasingly critical in western Europe. Nowadays extreme examples of apples and pear are known, which produce 30 bins/acre during the planting year. It is generally acknowledged that an apple orchard repays itself in the fourth growing year. This refers to the investment costs in establishment and in production (trees, posts or other supporting material and various small necessities) together with the annual costs of maintenance (pruning, spraying, mowing, etc.), which can be recovered by the production from the first few years. Naturally this depends on the average prices, but there can be no doubt that early production must be present.

The early productivity depends on tree quality, rootstock and tree training during the first years. Research has shown that there is a relationship between: a) the number of lateral branches (feathers) produced in the nursery and the trees' production later in the orchard; b) the thickness of the nursery tree and later production; c) nursery tree top:root ratio and later production.

High Productivity

Fruit production expectations vary with the region and the orchardist. It is generally accepted that northern Europe can never reach the south European production because of lower sunlight. Nowadays there are, however, Jonagold plantations in northern Europe which can annually reach 70 bins/acre, whereas numerous Golden Delicious plantations in southern Europe cannot reach this amount.

It should be noted that the average quality of the Jonagold cultivated in northern Europe measures up to the average quality of the south European Golden Delicious. This does not mean that sunlight is not important for production level and quality. Illumination is important, but not just the number of hours of sun a year. The distribution of sunlight throughout the tree is particularly critical. Not only is production a function of the light distribution in the tree, but so also is the proportion of quality fruit and the fruit size.

It is obvious that the volume and the form of the tree determine the light distribution and interception. Therefore northern Europe has actively looked for a small tree with very early production, which results in a dense or an intensive plantation. It is, however, interesting that the new plantings in southern Europe with a high intensity of light are planted at the same tree density.

More trees per ha involve higher investment costs, which means that they are only economically justified if they lead to quick production. This connection has been discussed above, where it is shown that the tree volume in the nursery (number of feathers and caliper) is correlated with early productivity in the orchard.

Adequate light distribution is critical for the development and the strength of the buds. A tree in the nursery must have enough space in order to:

- form the necessary branching ►

- develop enough buds, which bring the trees immediately into a generative (fruiting) phase
- guarantee a sturdy structure (pyramid structure)

In conclusion, it can be stated that tree quality is reached during the nursery period because of good sunlight distribution. A large tree will later intercept sunlight very efficiently in the orchard and thus guarantee high, early production.

High and Uniform Fruit Quality

To produce fruit means to incur expenses. An economically justified culture aims at the production of a quality product at the lowest cost. If the cost to produce a kg of apples amounts to 100%, economic analysis shows that the cost is roughly speaking equally divided between the costs made before and after the picking. In other words, all costs per kg of the yield before the fruits are picked account for 50% of the total costs.

Picking and storage costs, also 50% of total costs, can be kept down when uniform fruit size is achieved. To this end fruit bud quality is very important. In the future bud quality to achieve uniform fruit size will become more important. Bud quality is influenced by the previous crop which means that chemical thinning can have an influence. Hand thinning can only adjust fruit size, but it comes too late in order to define the strength of the bud. The distribution of sunlight within the tree is a factor which is often underestimated.

The central leader produces the best quality and the most uniform fruit size. Vigorous branches are often the least productive. Moreover, they often produce variable fruit size. The tree quality is once again very important. A high-quality (large, well-branched) tree is immediately generative (with fruit buds) and makes use of the incoming sunlight (high light interception) in the orchard.

Planting Systems

Northern Europe has taken the initiative for more intensive plantations. The fact that this tendency toward intensifying also takes place in more favorable production regions (longer and warmer growing season) has to do with the negative factors in fruit production which are everywhere, the limited availability and high cost of land and labor. With regard to labor it should be stated that the fruit culture has become very labor and capital intensive. Fruit culture no longer has the traditional peak labor periods for picking and pruning.

The nursery tree has to be a finished (branched), generative (fruit-bearing) product in order to avoid a long and expensive cultivation (vegetative) phase in the orchard. The fruit grower should not be a part-time nurseryman. He does not have the knowledge and never produces a uniform planting which is money making. He often gets into trouble by speculating with cheap and poor tree quality.

Nursery Tree Quality

The tree caliper must be uniform in order to obtain a homogeneous orchard planting. The minimum diameter must be 1/2 inch four fingers above the bud. The nursery tree must have at least five useful lateral branches, which are 12 inches long with wide crotch angles. There should be no laterals below 20 to 24 inches. As a result the fruit grower has trees with only a few branches that must be pruned or bent.

The tree must be budded rather high in the nursery so that the rootstock can serve its purpose (dwarfing) and in order to obtain a uniform planting. I recommend a budding height of 8-10 inches above the soil with the exception of M.27 for which 6 inches can be the minimum height.

The tree must have sufficient light in the nursery in order to switch from the vegetative to the generative (reproductive) phase as quickly as possible. Minimal distances in the nursery are: 36 inches between rows and 12 inches within the row.

Producing High Tree Quality

The most important principle is the requirement for new land. An apple nursery can never follow an apply nursery, not even after 25 years, unless the soil is disinfected with Methylbromide-chlopicrine. Herbicides should be limited to an absolute minimum. Dwarfing rootstocks are very susceptible to herbicides.

A fruit tree nursery requires a vigorous soil that is in excellent condition. It is necessary to give a basic fertilization without an excessive nitrogen fertilization because an excess of nitrogen makes the trees susceptible to disease and produces wood that remains herbaceous (vegetative).

Rootstock Linear Selection

The grading of rootstock liner material according to thickness should be as uniform as possible. Therefore at the NV Jo Nicolai nursery rootstocks are graded into 2mm (1/16 inch) divisions. The sizes which are planted are from 5 to 7 mm (3/16 to 5/16 inch), from 7 to 9 mm (5/16 to 6/16 inch) and from 9 to 11 mm (6/16 to 7/16 inch). When rootstock size is more than 11 mm (7/16 inch), they are used for winter (bench) grafting.

Certain apple varieties perform better on a particular thickness of the rootstock. For example, Jonagold is always grafted on 5-7mm and never on 9-11 mm rootstocks. This results in a more uniform product in the nursery (and ►

later also in the orchard), particularly the amount of branching and branch height and the thickness of the tree. This uniformity facilitates standardized labor and timing of Promalin applications in the nursery.

Positioning of the Feathers

Next to the digging, producing branches at the right locations is the most critical work in the apple tree nursery. For a one-year-old nursery tree the following principle is applied: all twigs (branches) which have developed up to 20 inches are unusable for the fruit grower so they must be removed. This must be done by breaking out the branch by hand as pruning with scissors is too laborious and too expensive. Moreover it might regrow if pruned. The leaves under the removed feathers are not taken away.

Removal of low branches has a positive influence on development of the upper branches. In bigger nurseries the removal of low feather occurs two or three times.

Branching

Branching is a result of depressed apical dominance. An apple tree does not normally branch because of a process of inhibition of lateral bud growth by activity at the top meristem. Auxins, the inhibiting hormone produced in shoot tip leaves, move downward in the stem, preventing bud break and therefore branching.

The development of branches should occur at regular intervals along the central leader. In fact every bud on the central leader between 20 to 32 inches should develop into a branch. This regular development around the central leader requires adequate spacing in the nursery. The branches must have a wide angle with the central leader.

In order to obtain branching in the nursery we apply two main techniques, the growth regulator Promalin and leaf removal. The concentration of Promalin (or one of its components, benzyladenine) depends on the branching ability of the variety and the timing. Reduced rates are used for varieties which form branches easily by nature and for early applications. The weather conditions should be optimal for growth at the time of the application. We do not want to reduce apical dominance for longer than 24 hours. Leaf removal, removing the youngest cupped leaves surrounding the apical meristem, is only reserved for varieties which are very difficult to branch. It is very time consuming and will always be used in combination with a chemical treatment.

The optimal result of branching treatments depends on:

- the uniform growth of the trees in the nursery
- the right time of application
- the weather conditions, good growth is essential
- the application of chemical branching agents to obtain optimal wetting of the under surface of the leaves.

Handling Branched Trees

Producing branched trees in the nursery is a challenge. Guaranteeing the same high quality after the tree is dug and delivered to the final customer is a second challenge. The tree must be without broken branches. To avoid broken branches with feathered trees a simple palletization without reloading is a must. The branched tree is very sensitive to dehydration because of its large volume. After the tree has been dug, my company guarantees delivery within 24 hours. Longer delivery times always occur for trees from cold storage (with a relative humidity of 98%) and with refrigerated transport trucks.

Tree Training at Planting

The recently planted tree should be pruned immediately after it is planted. Pruning decreases evaporation, and the root system restores its balance with the tree canopy. As a consequence of pruning, better growth occurs during the planting year, which also means higher fruit production during the second year.

The central leader must be pruned rather high or not at all. Production in the first years is situated around the central leader, which also results in an additional growth inhibition.

Every lateral branch must be pruned to an uprighted bud. Pruning results in the production of lateral branches which reduces bare (blind) wood. The pruning reduces the need for tying branches up or down. ☐

Compact Fruit Tree Index

A subject and author index for issues of the *Compact Fruit Tree* from 1980 to 1992 has been prepared and will be available shortly for $10.00 from the IDFTA Business Office, 14 S. Main Street, Middleburg, PA 17842.

Apple Rootstock Breeding and Selection Around the World

Tony Webster, Horticulture Research International
East Malling, Maidstone, Kent, U.K. ME19 6BJ

(Originally presented as the Batjer Memorial Address to the Washington State Horticultural Association, Yakima, WA, December 1992)

Most of the rootstocks bred and released by East Malling in recent years were selected with the needs of the British grower in mind. Although Malling rootstocks are widely used throughout the world, with the exception of the Malling-Merton series, they were not selected on the basis of the requirements of other countries. It is logical, therefore, that governments and researchers have seen fit to initiate complementary apple rootstock breeding and selection programs in other parts of the world.

Clones of M.9

The difficulties of propagating M.9 in the nursery and the poor performance of some European clones of the rootstock when budded have prompted researchers and nurserymen in several countries to look for M.9 clones which are easier to propagate. Most of the 'improved' clones now available or under test originated as selections from within existing, often old, M.9 stoolbeds and many, such as the French Pajam and some of the Belgian Nicolai clones, are significantly easier to propagate than traditional clones such as M.9 EMLA. Orchard trials comparing these M.9 clones in Britain and several other countries show only small (maximum of 20%) differences in the vigor and cropping of scions grown upon them (Table 1). Trees on M.9A, Pajam 1 and several of the Dutch clones are usually slightly weaker in vigor, whilst those on many of the Belgian and some of the German clones are slightly more vigorous than those on M.9 EMLA. Apart from the differences mentioned above all of these new M.9 selections have similar characteristics to conventional M.9 clones.

Polish Apple Rootstocks

The sensitivity of M.9 to winter cold injury stimulated Polish rootstock breeders to try to produce new rootstocks of similar vigor but greater cold tolerance. Crosses, mainly involving M.9 and the cold tolerant Antonovka, produced a series of rootstocks, most of which show tolerance to collar rot *(Phytophthora sp)* and to some nematodes and which include both dwarfing and invigorating clones. P.1 and P.18 are considered too vigorous to be of any interest to most growers and whilst the former suffers from burr knotting and is sensitive to collar rot, trees on P.18 exhibit very poor yield productivity. Consequently, attention has focused on the more dwarfing P.2, P.16, and P.22 from the first released series of Polish rootstocks. Table 2 shows some of the merits and weaknesses of these three rootstocks.

The performance of these rootstocks is greatly influenced by site conditions, particularly depth of soil and water supply, and plentiful irrigation will be essential if adequate fruit size is to be achieved on these rootstocks. P.22 may be of value as a substitute for M.27 where winter cold injury is a problem on the latter rootstock, whilst the intermediate vigor of P.2, between M.27 and M.9 on some sites, and improved cold tolerance may make it of value for some planting system and scion combinations on strong soils. Both P.22 and P.2 induce good yield precocity and productivity in scions worked on them, but P.2 suckers badly on some sites. The poor cold tolerance and abundant suckering of P.16 make it a much less attractive rootstock and despite the very good yield productivity of scions worked upon it, it is not likely to become a popular rootstock. Unfortunately, all of the Polish rootstocks, like most other dwarfing stocks, are susceptible to woolly aphid root damage.

A second series of Polish apple rootstocks, including numbers 59, 60, 81 and 92, has recently been made available for trials in Europe and the USA. There is insufficient information available yet to appraise the worth of these new rootstocks.

Russian and Czechoslovakian Apple Rootstocks

Winter cold tolerance was also one of the objectives of a Russian apple rootstock program which produced the Budagovsky (B.) series of rootstocks. B.146 is one of the dwarfest in the series, having vigor similar to M.27. Suckering was bad on this rootstock in trial at East Malling and fruit size smaller than for trees on M.27.

The most widely tested of the Budagovsky series is B.9, which is intermediate in vigor between M.9 EMLA and M.26 EMLA and shows extremely strong resistance ►

to collar rot. Cropping productivity on B.9 is generally similar or slightly poorer than that on M.9 EMLA, but fruit size is good. Two other Budagovsky clones, B.469, and B.491, both dwarfing, need further trials before their true worth can be judged, although early records suggest burrknotting may prove a problem with both. Trees on B.490 and B.118, which are both much more vigorous than M.26 and which produced small fruit size in Dutch trials, are considered unsuitable for modern intensive systems of culture. Unfortunately, most of the Budagovsky clones, (except B.9) sucker and burrknot profusely.

Several apple rootstock clones bred in Czechoslovakia have recently been planted in trials in western Europe. The J-TE series of rootstocks, which have M.9 in their parentage and which are of M.27 to M.26 vigor, need further testing before any firm conclusions can be made on their merits.

Swedish and German Apple Rootstocks

Interest has been shown in Bemali, a rootstock selected at the Balsgard Institute in Sweden from a cross between Manks Codlin and M.4. This rootstock propagates well on the stoolbed and is hardier than M.9. Vigor of trees on Bemali is reported to be between that of M.9 EMLA and M.26 EMLA but with better anchorage than on M.9 and good yield precocity and productivity. One of Bemali's great merits is its strong resistance to fireblight.

The rootstock Jork (J.) 9 was produced at the Jork Institute in northern Germany from an open pollinated M.9 parent. Trials in Holland show it to be of similar vigor to virus-tested M.9, although this may vary depending upon the site and the scion chosen. Although easier to propagate and slightly hardier and better anchored than M.9, J.9 has produced excessive burrknots on some sites and is very sensitive to fireblight.

Breeders at Dresden, in what until recently was East Germany, have produced a series of new apple rootstocks, few of which have yet been tested outside their country of origin. Pillnitz 80 (Pi-80), one of the early releases from this program, gives vigor between that on M.26 and MM.106 and variable yield productivity. Perhaps of more interest will be the Pi-Au Series, several of which in German trials are of similar vigor and yield productivity to M.9.

USA Apple Rootstocks

Mark (previously MAC.9), a rootstock derived from open pollinated M.9 and developed by researchers at Michigan State University, has been distributed and promoted by nurseries in many parts of the world recently. Vigor of trees on Mark is approximately 30% less than that of trees on M.9 in most USA trials. In contrast, trials in Britain and Holland show Mark vigor to be slightly greater than M.9. Part of these site differences may be attributable to Mark's drought sensitivity; where irrigation is inadequate trees on Mark overcrop and produce stunted growth. Cropping is precocious and abundant on Mark, sometimes excessively so with trees needing heavy thinning if optimum fruit size is to be achieved.

Mark is better anchored than M.9 and shows similar resistance to collar rot. However, it has no resistance to fireblight or woolly aphid and burrknots badly if planted with much of the rootstock above the soil line. On some sites a large swelling has developed on the Mark rootstock shank at, or just below, the soil surface. The cause of the swelling is not yet known, but trees badly affected grow much more poorly than unaffected trees.

MAC.39, another rootstock from Michigan State University, forms trees slightly larger than those on M.9 in some USA experiments. Its brittle roots and poor anchorage suggest that it is unlikely to become a popular rootstock with fruit growers.

Apple rootstock breeding has been in progress at the Geneva Research Station in New York State for many years and some of the more promising selections are now beginning to be released. Geneva 65 (G.65), which originated from a cross between M.27 and Beauty Crab, was released in 1991. Unfortunately, little or no testing has yet been conducted outside New York State and many more years will be needed before G.65 can be fully appraised. In the few orchard trials conducted to date it forms trees slightly smaller than those on M.9 and crops precociously and productively. Two of its principal merits are its resistance to fireblight and to collar rot. It is, however, susceptible to woolly aphid. Two other new dwarfing rootstock clones from the Geneva program, both resistant to woolly aphid, are due for release later in 1993.

Earlier selections from the Cornell-Geneva program, such as CG.10 and CG.24, proved inferior to M.9 and M.7, respectively.

Canadian Apple Rootstocks

Several rootstocks bred at the Vineland Research Station, all derived from open pollinated crab apple Kerr, have received only limited orchard testing to date. In one of the oldest trials in Washington State, trees on V.3 (V.5-3) are intermediate in vigor, between those on M.9 and M.27. Clone V.1 (V.5-l) produces trees of M.9 size, whilst clones V.7 (V.5-7) and V.2 (V.5-2) form trees of M.26 size or slightly larger, respectively. Preliminary research indicates that all four clones induce good cropping precocity and efficiency.

Ottawa 3 (O.3), also bred in Canada from a cross between M.9 and the hardy crab apple Robin, ►

produces trees slightly larger than M.9 but smaller than those on M.26. Yield precocity and productivity are usually very good on Ottawa 3, which is resistant to collar rot and winter cold injury. Unfortunately, Ottawa 3 has proved extremely difficult to propagate using conventional nursery techniques and this problem has greatly limited its use. Attempts to 'rejuvenate' the rootstock, using in vitro techniques, show promise in trials at East Malling. □

TABLE 1
Vigor and Productivity of Cox's Orange Pippin Grown on Clones of M.9 Rootstock at East Malling, England

M.9 Clone	Vigor (% of M.9 EMLA)	Cumulative Crop (% of M.9 EMLA)
M.9A	88	77
Dutch 337	80	84
Dutch 338	101	79
Dutch 339	84	87
Belgian 14	100	99
Belgian 19	121	81
Belgian 22	123	92
Belgian 29	111	79
French Pajam 1	85 - 91	107
French Pajam 2	101	113
German 984	110	96
German 751	100	82

TABLE 2
Characteristics of Three Polish Apple Rootstock Clones

	P.2	P.16	P.22
Vigor	Very Dwarf (between M.27 and M.9)	Variable (M.27 up to M.9)	Very Dwarf (M.27)
Cropping precocity	Good	Good	Good
Yield productivity	Good	Good	Good
Fruit size	Average	Average	Poor
Hardiness	Good	Average	Good
Woolly aphid	Moderate susceptible	Susceptible	Susceptible
Fireblight	Moderate susceptible	Susceptible	Moderate susceptible
Suckering	Bad	Very Bad	Bad

IDFTA Calendar

June 20-22, 1993 . . . . Summer Orchard Tour, London, Ontario

February 27, 28, March 1-3, 1994 . . . . IDFTA Conference, Grand Rapids, Michigan

February 26-28, March 1, 2, 1995 . . . . IDFTA Conference, Hershey, Pennsylvania

February 25-29, 1996 . . . . IDFTA Conference, Kelowna, British Columbia

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COMPACT NEWS

A Periodic Newsletter of the International Dwarf Fruit Tree Association

No. 4 November 1993

IDFTA CONFERENCE

The 37th annual International Dwarf Fruit Tree Association conference will be held at the Amway Grand Plaza Hotel in Grand Rapids, Michigan, February 27 through March 2, 1994. The conference begins on Sunday with registration and an evening program, "Adopting New Technology in the Michigan Tree Fruit Industry," featuring Michigan State University research and extension faculty as speakers.

The Robert F. Carlson Distinguished Lecture, "New Wave of Apple Rootstocks," will be presented by **Dr. Jim Cummins**, Cornell University apple rootstock breeder. Dr. Cummins recently retired following more than 25 years in research at the New York State Agricultural Experiment Station in Geneva. He remains active in the evaluation and release of the Cornell-Geneva apple rootstocks. Dr. Cummins will describe two newly released disease- and insect-resistant apple rootstocks, G.11 and G.30, in addition to the 1992 release, G.65. There is worldwide interest in the Cornell-Geneva apple rootstocks because of their resistance to fire blight, collar rot and woolly apple aphid.

Dr. Stuart Tustin, horticulturist with Hort Research in Havelock North, New Zealand, will present the New Zealand perspective on orchard management. Since 1984 he has conducted research in the Hawkes Bay fruit district to improve production efficiency and enhance fruit quality. Dr. Tustin's research on light interception and distribution, canopy physiology and canopy architecture led to the development of a new orchard system, the slender pyramid. He will summarize his research in a presentation entitled "Rootstock and Spacing Effects on Precocity, Yield, and Fruit Quality of Fuji Apple Using Slender Pyramid Tree Management."

Dr. Tustin has studied fruit industries around the world and has helped put into perspective the effects of climatic factors and orchard management practices on fruit quality and marketing strategies. In a second presentation he will discuss "Future Directions of the New Zealand Apple Industry – a Hard Look into the Crystal Ball." The New Zealand apple industry has been a trend setter – as New Zealand goes, at least in terms of new apple varieties, so go the rest of the world's apple districts.

As a partner in a commercial orchard operation, Dr. Tustin has production experience with Gala, Braeburn and Fuji. On the IDFTA program he will discuss the unique features of each of these new-to-North America varieties as they influence orchard management practices.

Dr. Tony Webster, pomologist at Horticulture Research International (formerly the East Malling Research Station), will present the European perspective on dwarfing apple rootstocks. At East Malling since 1972, Dr. Webster's research has involved selection and development of plum and cherry rootstocks, including the introduction of Pixy and Colt. Since 1982 his research has included the evaluation and selection of apple rootstocks from the East Malling rootstock breeding program as well as from other breeding programs. He will summarize his work in the presentation "European and East Malling Rootstock Research – New and Promising Apple Rootstocks."

How do apple rootstocks influence such critically important factors as tree size, productivity and fruit quality? Dr. Webster will discuss these tree physiology questions in a second presentation, "Rootstock Effects on Tree Growth, Precocity, Yield Efficiency and Anchorage."

The performance of new and promising dwarfing apple rootstocks in trials in Ohio, Michigan, Washington and Massachusetts will be presented by **Drs. Dave Ferree, Ron Perry, Bruce Barritt** and **Wes Autio.**

The interactions of tree growth, flowering and fruiting will influence the success of an orchard. **Dr. Curt Rom**, University of Arkansas, will discuss "Balancing Tree ►

Growth and Cropping" and **Dr. Frank Dennis**, Michigan State University, will speak on "Orchard Management Factors that Influence Flowering, Pollination and Fruit Set." These presentations will lay the groundwork for a comprehensive discussion of chemical thinning by **Dr. Max Williams**, USDA Plant Physiologist at Wenatchee.

Apple tree canopies can be trained vertically or at an angle of 60 to 70° above horizontal. Success with high density vertical tree training systems, e.g., vertical axis, HYTEC and slender spindle, will be discussed by a panel of orchardists from Washington and Michigan. The challenges of angled canopy systems, e.g., Tatura, Y-trellis and Guttinger-V, will be presented by growers from New York, Oregon, Washington and Michigan.

The annual IDFTA awards banquet will be held Monday evening. On Tuesday evening IDFTA and the American Pomological Society are jointly sponsoring a program on the development and evaluation of new apple varieties.

Orchard Tour Following the educational program on Monday and Tuesday, a full day of tours will be held on Wednesday to nearby high density apple orchards and the Michigan State University Clarksville Horticultural Experiment Station. New developments will be featured including bagging to stimulate branching, double-row angled canopies, vertical axis, Guttinger-V, HYTEC and slender spindle systems with Empire, Jonagold, Gala and Fuji.

Conference registration material, along with the full program, will be distributed to IDFTA members in late December and can also be obtained at that time from the IDFTA Business Office, 14 S. Main Street, Middleburg, PA 17842; telephone 717-837-1551 or FAX 717-837-0090. □

apple pie order. One old story holds that New England housewives were so meticulous and tidy when making their apple pies - carefully cutting thin slices of apples, methodically arranging them in rows inside the pie, making sure that the pinches joining the top and bottom crusts were perfectly even, etc. - that the expression *apple-pie order* arose for prim and precise orderliness. A variant on the yarn has an early American housewife baking seven pies every Monday and arranging them neatly on shelves, one for every day of the week in strict order. Nice stories, but the term *apple-pie order* is probably British in origin, dating back to at least the early 17th century. It may be a corruption of the French *nappes-pliees,* folded linen (neatly folded) or *cap-a-pie,* which means "from head to foot" in English usage. Yet no use of either *nappes-pliees* order or *cap-a-pie* order appears in English. "Alpha beta order" has also been suggested, but seems unlikely. The true source of the term must still be considered a mystery, the matter far from *in apple-pie order.*

1994 IDFTA Summer Tour

California will be the site for the June 19-21, 1994, IDFTA Summer Orchard Tour. Accommodations will be in moderately priced motels in Sacramento, California's historic capital. Registration will be on Sunday, along with an evening presentation on the California tree fruit industry. Orchard tours on Monday and Tuesday will include two fruit districts: the Stockton area south of Sacramento and the Marysville district north of Sacramento. Orchard stops will feature the oldest commercial Fuji plantings in the U.S.; high density central leader Fuji and Gala on Mark, M.26 and M.7; the use of Promalin to stimulate branching in the orchard; overhead cooling to reduce fruit sunburn; apple and pear on Tatura trellis; moving the nursery into the orchard; sweet cherry tree training including central leader, Spanish bush and Tatura trellis systems; and rain covers for cherries.

Start making plans now. Visit northern California for the IDFTA summer tour and come early or extend your stay to see the sights. Sacramento is not far from many of California's most popular tourist destinations. From Sacramento it is a short one and one-half hour drive to Napa Valley wine country, a two-hour drive to San Francisco, two hours to Reno, Nevada, and four hours to Yosemite National Park. Join IDFTA in California in June 1994. □

How Many Apples is California Going to Grow?

Warren C. Micke, Extension Pomologist
University of California, Davis

(Reprinted from 1992 Proceedings of the Washington State Horticultural Association 88:86-88.)

To look at where California's apple industry is going we first need to look at the historical situation for this industry. Prior to 1970 the industry was fairly stable and located in three major districts: the Sebastapol district or north coast area of San Francisco, the Watsonville district or central coast area south of San Francisco, and the foothills of the Cascade and Sierra Nevada mountains. There was also limited acreage at higher elevations in southern California and scattered plantings in the interior central valleys of California.

PRIOR TO 1970

The north coast district was centered around the town of Sebastapol in Sonoma County. This was largely a district where apple trees were grown without irrigation. It was an area of fairly heavy rainfall and reasonably good soil-water holding capacity. However, because of lack of available irrigation water, yields were often somewhat reduced. The major variety grown in this area was Gravenstein but there was also significant acreage of Red Delicious, Golden Delicious, Rome Beauty and Jonathan. This district has historically been heavy to processing, especially with Gravenstein going to applesauce.

In the Watsonville district most orchards were irrigated except some mountain areas that had relatively high rainfall. The two primary varieties grown in this area were Red Delicious and Yellow Newtown. Production was good and apples from this district also went largely to processing. The Yellow Newtown has been favored by the freezing industry and this was an important part of the processing in this area.

Orchards in the foothill district were scattered all the way from northern California to the Tehachapi Mountains that separate central California from southern California. Generally the orchards in this area were small and sales were primarily on-farm or to local markets. Red Delicious, Golden Delicious and Rome Beauty were the primary varieties grown in this area as well as a few older or local varieties that were in demand by some customers.

In southern California there were several small localized areas at higher elevations. One was the Oak Glen area in San Bernardino County and another was the Julian area in San Diego County. These were relatively small areas and most apples were sold either on-farm or in local markets.

In 1970 there were only about 2,000 acres of apples in the San Joaquin and Sacramento Valleys that I will refer to throughout this paper as the Central Valley. In the early 1960s there were actually less than 1,000 acres in this area.

SINCE 1970

In the north coast area there has been a decline in apple acreage and production, especially in the Sebastapol area. There is urban pressure, as this area is a nice place to live and within commuting distance of the San Francisco Bay area. Because of the lack of irrigation water for many orchards, yields tend to be lower than in other areas. However, an increase in on-farm sales has occurred in this area, and a local group has been organized to promote apples produced here. There are commercial north coast growers, especially those with irrigation water, who are in apple production for the long-term and this area will continue to have significant apple production for many years though at a somewhat lower level than in past years.

In the central coast area, especially around Watsonville, some decline has occurred but not as much as in the Sebastapol area. The primary reason for this decline has been competition for land with strawberries and high value, cool season vegetable crops. There has also been a limited increase in urban pressure in this district. A little further south in the central coast area around San Luis Obispo and northern Santa Barbara counties there has been an increase in apple plantings that is very similar to what is occurring in the Central Valley. ►

In the foothill and southern California areas little change has occurred in recent years, although there has been a little increase in acreage in the south, especially in Riverside and San Diego counties. In both districts on-farm and local sales continue to be the primary marketing outlets.

The big change in apple production in California in the last 20 years has occurred in the Central Valley.

CENTRAL VALLEY

Why has apple acreage in the Central Valley expanded? The start of this expansion occurred with consumer interest in the Granny Smith variety. The Central Valley has a long but fairly hot growing season in which many red-colored varieties do not always color well. Granny Smith, being a green apple that required a long growing season, seemed to be ideally suited for this growing area. More recently the Fuji variety has been widely planted. This area produces a very sweet Fuji with soluble solids measured as high as 20% in some areas and in some years. Fruit color is variable depending on year and area. Even more recently substantial plantings of Gala have been made. This area can produce reasonably good fruit color on Gala in at least some years and areas. The advantage for the Central Valley in Gala production is earliness on the market.

Growers looking for profitable alternate crops is another reason for increased apple plantings in this area. Other crops often grown in this area include almonds, walnuts, pistachios, peaches, plums, nectarines, apricots, prunes, pears, grapes for raisin, wine and table use, and many field and row crops including cotton, tomatoes and potatoes. The people who first planted Granny Smith apples in the 1970s received high returns and this word spread rapidly and helped push this expansion of acreage in the Central Valley.

Apple production in the Central Valley is not without some problems. Fruit color on red varieties is variable in the area because of high temperatures, not only daytime but also nighttime. The heat also causes significant fruit sunburn, particularly with Granny Smith. Modifications in tree training and use of semi-dwarf (rather than full dwarf) rootstocks have helped reduce this problem. Tree training changes include increased heading to reduce blind wood in the Granny Smith variety and to develop better canopy protection for fruit. M.26 rootstock has not always been successful, especially with Granny Smith, in this area and will not tolerate drought conditions. Semi-dwarfing rootstocks have performed better and have been the most used in recent years by the California industry in the Central Valley and other areas as well. The more recently planted Fuji and Gala varieties are somewhat less susceptible to fruit sunburn than is Granny Smith.

What has happened to the apple acreage in California? According to the California Agricultural Statistics Service, the apple acreage in California was fairly stable between 1960 and 1980 with total acreage (bearing plus non-bearing) during the 1960s and '70s ranging between about 25,000 and 28,000 acres. During the 1970s there was some reduction in acreage in coastal districts that was offset by increases in the Central Valley. However, during the 1980s the acreage in California has increased by about 25% so that by 1991 the California Agricultural Statistics Service reported that there were 33,000 acres of apples in California, and there were some within the industry who feel that the acreage could be somewhat higher. The percentage of California's apple acreage located in the Central Valley has increased from 3% in 1961 to 9% in 1971 to 25% in 1981 and to 52% in 1991.

WHAT WILL THE FUTURE HOLD?

The future for California apples and possible apple acreage expansion will depend largely on markets. There is plenty of land in the Central Valley to plant more apples, especially if apples are more profitable than other crops. Thus prices and returns to growers will probably be the most important factor determining how much additional expansion will occur in the California apple industry. However, availability of irrigation water could be another factor affecting acreage expansion.

Another consideration will be the varieties in demand by various markets and which of these can be grown successfully in California and especially in the Central Valley.

The last several years California has been close to Michigan as the number three ranking state in apple production. Certainly California's production is increasing but also Michigan has had some weather problems which reduced its crop in some of these years. However, a significant portion of California's apple acreage is either non-bearing or has not yet reached full bearing. In addition, much of the recently planted acreage has the potential for higher production than some older acreage. So even without any additional apple plantings this state's production will undoubtedly increase.

If apple planting continues at the present rate and markets are maintained and increased, then California will probably begin challenging New York for second place among the states.☐

California Apple Production Practices

Mark Lewis • Sierra Hills Packing, Inc. • Stockton, California

(Reprinted from 1992 Proceedings of the Washington State Horticultural Association 88:227-229.)

Sierra Hills Packing is a successful family-run packing and farming operation in the Stockton-Lodi-Modesto area of northern California. We pack and market over 600,000 boxes of Fuji, Granny Smith, and Royal Gala apples, and we are growing. This area of California has a unique micro climate influenced by San Francisco Bay 50 miles to our west. We get cool evening breezes that do not occur further south. This helps us achieve better color than other areas of California. We farm close to 1,000 acres of land, mainly apples and cherries, and operate two packing operations for these commodities. I'm director of field services for our packing operations and I'm also responsible for managing 500 acres of orchards. We are a family organization that dates back to 1922.

We started growing apples in 1979 when my father wanted to diversify his farming operation. He decided to plant 25 acres of Granny Smith apples, which at the time was the hot apple for California, and he needed a pollenizer. The nurseryman, Jim Sanguinetti, mentioned Red Delicious, but my dad said that would interfere with his August vacations. Jim then mentioned an apple that would be a good pollenizer but didn't know much about its commercial potential. That was the Fuji apple. Little did my father know what being in the apple business would mean. From 25 acres of apples we now farm over 500 acres of apples, mainly Fuji, along with Granny Smith, Royal Gala, and a few Braeburn, and we're still planting.

We started with a 12 x 18 central leader system on MM.111 rootstock. We were novices at growing apples. Training the limbs with wood spreaders caused many broken limbs. Over the next few years we learned little by little. However, we couldn't just do things in California the way it's done in Washington or elsewhere. We have unique growing conditions. We made lots of mistakes those first few years until we started to adapt to our climate.

Granny Smith started the apple boom in the Central Valley in the '70s. The variety does well in the valley as it is a grower friendly variety. However, after those first few years we realized we needed help. In 1987, the California Granny Smith Association hired Dr. Dan Strydom of South Africa as a pruning consultant to help with reducing sunburn on Granny Smith. The climate of South Africa is very similar to ours in California, with hot days reading up to 112 degrees or above. He had a tremendous effect on reducing the sunburn problem in California over the next few years. Dan used delayed heading to prevent blind wood on Granny Smith. This is a practice of heading one-year-old wood in the spring, between green-tip and full bloom, to devitalize the branch and make more branches below the cut. In addition, Dan brought to California a knowledge of growing apples which many in California lacked at the time. Very few if any Granny Smith orchards are being planted now and, if this year is any indication of the future, there won't be many more planted. Our own operation stopped planting Granny Smith over eight years ago.

Presently, the variety of choice is Fuji. In our orchards standard Fuji is still the major part of our operation. However, other strains such as BC2, Nagafu 6 and 12 and TAC114 are being planted as part of our program, also Yataka to a limited degree. The need to experiment in our environment is important to us in the long run. We don't have years of experience in apple growing, so there must be some trial and error. We planted double-row Fuji, but found them difficult to manage.

This is what led us to single row high-density orchards. We are planting orchards of 5 x 14 with 622 trees to the acre. Our goals are earlier production, better light management, and ease of labor with less work on ladders. So far we've had mixed results. Our first attempt at this spacing was with Fuji on M.7A rootstock in 1989. This has proved to be a vigorous combination. In the third year, when we needed a crop to help slow the tree down, it didn't materialize. The tree has grown very large with light distribution becoming a problem. From this we learned how important the soil + rootstock + variety combination is. Now in our strong soil we are using M.26 success- ►

fully as the rootstock of choice with good third-year production, while our weaker soils will require a stronger rootstock such as M.7A or even MM.111. In some of our orchards no fertilizer is used, while in others it is spoon-fed all summer long. This makes for difficult planting decisions. Labor on this system is a plus as we can do most of the work from ground level. Also, thinning and harvesting costs are decreased due to less ladder work. Another consideration for high density is the need for capital investment in narrower tractors and equipment. The same equipment for cherries just does not work.

We use delayed heading in our pruning and training methods of Fuji, starting from the time we plant the tree, through the first three years. We delay head the central leader after planting to help make branches below the cut. These branches will be weak and many, rather than strong and few. They will also have better crotch angles. This gives us a strong base of limbs with weak fruiting wood up the leader. The timing of these cuts is very important for the desired results—too early and you get a vigorous response, while too late is devitalizing. If we get a good feathered tree from the nursery, we use it; otherwise we make it into a whip. In years 2 and 3 we delay head the leader at 36 inches to get branches below the cut. We are looking for multiple branches rather than a few strong ones. Heading also alleviates the need for any trellis system. However, on some of our M.26 plantings we have used 6-foot stakes to help support the base of the tree, depending on the soil.

Color development is enhanced by fall pruning on the Fuji. Mostly the strong upright growth is cut out 2 to 3 weeks before harvest. We must be careful on the timing. The heat in California can get extreme and continue for many days, causing excessive sunburn. Tree training in these systems consists of tying down limbs using nails and kite string. Bags or weights do not give us the positive limb positioning we like. This is normally done in the spring or early summer after the tree has had some time to grow.

Another variety that is widely planted in California is the Royal Gala. Royal and Imperials Galas grow well in our area of California, with high packouts, good production and a tendency not to sunburn severely. The pruning techniques on Galas are very similar to that of Fuji. However, Fuji delays fruit set if pruned vigorously, while Gala can overproduce if not pruned enough. Another plus for Galas in California is that we are first to market with a fresh apple. This gives us a window of opportunity before the Pacific Northwest gets started. However, Gala does not have the storage capabilities of a Fuji. Significant plantings in the state will rapidly increase production, however there is still room for growth in the marketplace.

The Braeburn variety may not go far in California because it is not heat tolerant. Our oldest trees are 4 years old and we've seen internal breakdown on the tree. Also they drop prematurely and are not grower friendly. We'll keep watching them to see if they come around. I don't believe there is a large amount of Braeburn in the state.

California has the toughest chemical and environmental restrictions of any state in the country. We must be progressive or be forced out of business. That is why we use professional consultants to advise us on specific needs in our orchards. Our Pest Control Advisor is an independent consultant who works for us and many other growers in the area. He is like an employee for our company. He keeps current on the ever-changing world of regulations in California and has a broader range of acreage to learn from.

New this year will be an irrigation specialist to monitor our orchards for more specific water needs. Deep well irrigation is our main source of water. All our acreage is in sprinkler systems. Our use varies from impact systems to micro systems. Currently we are using Nelson R-10 in apples and they are working well. This is all dependent on the type of soil and tree density. Evaporative cooling is another area being looked at. Currently we have two test plots and the results are encouraging. However, cracking increased in this area so we need to study the cycle times and amounts of water being applied. We also want to cool the orchard floor during the hot summer, so full coverage is important to us. We plant Covermate or Companion grass on our orchard floor. This has two benefits, the ability to get in the orchard in the spring for spraying and it helps cool the orchard floor in the summer.

In addition, we use custom spray applicators to apply our materials. This may be an expensive way to operate, but in the ever-changing regulatory world it is very difficult to keep up on all the new rules, regulations and materials coming our way.

Our labor force is mostly Hispanic. We do all harvesting on an hourly basis and thinning by piecework. However, this year some harvest crews were paid piece rate so that we had something to compare. But at the value of Fuji apples we do not want to take too many chances. We don't have to house our labor force, but we do supply some housing for full-time employees. During our peak labor needs, such as thinning and harvest, we use labor contractors to supply us with personnel. ►

This allows us to use our labor more efficiently and effectively.

When we drive around the Washington fruit districts we notice large cold storage facilities, CA buildings and bins everywhere. This is California's future. In Washington they may take this for granted because this is the way it has always been. In California we are a growing industry and this infrastructure is not there yet. The need for common cold storage is great, let alone the need for CA. Bins are another item needed by the state to handle crops of the future. Many are rented and not of the best quality, so there is some damage to the fruit. We are buying bins every year and never seem to have enough, yet the increase in the apple supply in California over the next five years will tax facilities currently built and future buildings as well.

This increase in supply will not only affect the infrastructure but will be a marketing challenge also. Export demand is very strong for Fuji apples at this time, which is driving the planting boom. However, with the increased production, the domestic market can't be ignored. We need to cultivate this untapped market. Large plantings of Fuji apples in California over the last five years will produce large crops of varying quality in the future. What this means for California is we need an organization that can represent the industry in our state, collect information such as acreage and other statistics that are important to our growing industry, and play an active role in research that will solve some of the problems that we encounter. Last but not least, we need an organization that can use promotion to help us market the product at a profitable level.

The future of apple growing in California has many new challenges ahead. But we have great resources in our state and we will overcome our growing pains. We are close to three major markets and have 25 million people in our state. This has definite marketing advantages. Soon we will be the number two apple-producing state in the country. Don't underestimate California. We are gaining knowledge as we go and this will make us all better apple growers. ☐

IDFTA CALENDAR

February 27 - March 2, 1994	IDFTA Conference, Grand Rapids, Michigan
June 19-21, 1994	IDFTA Summer Tour, Sacramento, California
February 26 - March 2, 1995	IDFTA Conference, Hershey, Pennsylvania
February 25-29, 1996	IDFTA Conference, Kelowna, British Columbia

Selecting Apple Rootstocks to Achieve a Balance of Growth and Cropping

Bruce H. Barritt
Washington State University • Tree Fruit Research and Extension Center • Wenatchee

It is quite common to have either too much or too little shoot growth. It is also possible to have a very light crop or to crop trees too heavily. A proper balance of shoot growth and cropping is necessary for successful apple production.

DESIRABLE SHOOT LENGTH

Just what is too much or too little shoot growth? Desirable average shoot length will not be the same in all fruit-growing districts. In cloudy fruit-growing districts with low sunlight levels, desirable shoot length might be relatively short to allow the available sunlight to reach all zones of the canopy. However, in areas with clear skies and high light intensity where fruit sunburn is a problem, it may be necessary to have longer average shoot length to shade fruits. In central Washington, with clear and hot summer days and sunburn problems, average shoot length between 12 and 24 inches appears to be appropriate. If average shoot length is longer than 24 inches, shading becomes a concern and the effort needed to remove excessive shoot growth becomes a burden. If average shoot length is less than 1 foot, fruits are generally too exposed to direct sunlight and fruits sunburn. Trees where shoot length averages less than 1 foot are often described as weak, runted out, or spurbound. When there is insufficient shoot growth, there is often an excessive crop load and a reduction in fruit size. It is essential to determine the correct average shoot length for each fruit district before designing a program to achieve it.

ESTIMATING SHOOT LENGTH

How do you estimate average shoot length? Average shoot length, for the purposes of this discussion, is the mean length of approximately a dozen shoots that are located at shoulder height in the tree. It is not necessary to actually measure a dozen shoots as a visual estimate of average shoot length is sufficient. Lateral and bourse shoots should be included in the estimate. A shoulder height estimate avoids vigorous shoots high in the tree and weak shoots low in the tree. Shoot length is always variable, even in the zone at shoulder height. On a given tree shoot length may range from 6 to 36 inches with most shoots between 12 and 18 inches. In this situation, the estimate of average shoot length might be 15 inches. Most orchardists instinctively know if a tree is too vigorous or if it lacks vigor and will not have difficulty determining average shoot length.

PREPLANT DECISIONS

Adjusting tree vigor and cropping to obtain a suitable balance is more than a management operation to correct a problem. It is not just corrective pruning and training or nutrition and irrigation management. Preventing problems of improper balance of cropping and growth is accomplished with careful planning **before** the orchard is established. It involves selecting an appropriate rootstock and tree density for the variety and the growth potential of the site.

ROOTSTOCKS

Carefully integrating two important orchard system components (pieces of orchard system jigsaw puzzle), the rootstock and tree density, will almost always achieve a proper balance of growth and cropping. Rootstocks from dwarfing to vigorous are available. The rootstock influences both crop load and shoot growth. It is important to evaluate potential rootstocks not only in terms of their growth control but also their precocity and yield efficiency. For example, if early cropping is an important goal, trees with M.7 will not be as productive in the first 3 or 4 years in the orchard as trees with M.9 because they are less precocious. Dwarfing rootstocks are usually more yield efficient than more vigorous rootstocks (Table 1). ►

YIELD EFFICIENCY

A characteristic of rootstocks that takes into account both yield/tree and tree size, two critical factors when trees are planted at high densities, is yield efficiency. It is the ratio of fruit yield/tree (kg) to tree size in cm^2 of trunk cross-sectional area (TCA). A reliable measure of relative tree size is TCA. Yield efficiency can be thought of as the fruit-to-wood ratio. Obviously, fruit is more important to profitability than wood. The greater is fruit weight to a given amount of wood (to tree size), the higher is yield efficiency. Yield efficiency can be used to predict yield/acre for a rootstock when it is planted at the appropriate density for its tree size.

Because the calculation of yield efficiency includes both cropping and tree growth measurements it is an estimate of the balance of growth and cropping. If yield efficiency is low, tree growth will be excessive, and if yield efficiency is very high, overcropping may be a concern.

Yield efficiency for M.9 is typically two to three times greater than for M.7 (Table 1). Therefore, if an M.7 and an M.9 tree were the same size, the yield/tree would be two to three times larger with M.9. Yield efficiency of M.26 is intermediate between M.9 and M.7. Four dwarfing rootstocks with tree size close to M.9 EMLA, V.1, P.2, B.9 and O.3, all have yield efficiency similar to M.9 EMLA (Table 1). Yield efficient trees have less structural wood than trees with low yield efficiency. Because of this, the cost to the orchardist for using dwarfing and yield efficient rootstocks is that a support system must be provided.

TABLE 1

Tree Size and Yield Efficiency
of Seven-Year-Old Golden Delicious Trees on 13 Apple Rootstocks

(Listed in Order of Increasing Tree Size)

Rootstock[1]	Trunk Cross-Sectional Area, Year 7[2] (TCA, cm^2)	Cumulative Yield Efficiency; Yield Years 3 to 7 ÷ TCA Year 7 (kg/cm^2)
V.3	23	3.0
P.22	24	2.6
Mark	28	2.2
V.1	34	2.5
M.9 EMLA	37	2.4
P.2	39	2.7
B.9	45	2.4
O.3	47	2.6
V.2	56	2.3
M.26 EMLA	57	1.7
V.7	58	2.4
M.7A	81	0.8
V.4	99	1.3

[1] M., Malling; V., Vineland; P., Poland; B., Budagovsky; O., Ottawa.
[2] Trunk cross-sectional area (TCA) is a reliable measure of relative tree size.

►

CROP LOAD INFLUENCES VEGETATIVE GROWTH

In Europe it has been estimated that for every kilogram of fruit on a tree, there is a reduction of 1 meter in shoot growth. In English units, for every 1 pound of apples on a tree, shoot growth is reduced by 18 inches. Or, for every box of apples on a tree, shoot growth is reduced by about 60 feet. By striving for heavy and consistent cropping, vegetative growth will also be controlled.

What is the cost to an orchardist for **not** using dwarfing and yield efficient rootstocks? The first cost, which can be very expensive, is for pruning and training excessively vigorous trees. A second cost is delayed cropping due primarily to the lack of precocity but also to low tree density. The third cost is low production and particularly low quality that results from excessive shade within large trees. The fourth cost is for labor associated with thinning and harvesting large trees.

The price an orchardist must pay for using dwarfing and yield efficient rootstocks is a tree support system and a high cost/acre for trees.

Rootstock traits such as precocity and yield efficiency influence crop load. Crop load influences shoot growth. It is therefore critical to select rootstocks which are precocious and yield efficient. These are generally dwarfing rootstocks. To achieve a proper balance of cropping and tree growth, the most important factor is choosing the right rootstock for the variety and site. □

Additional Reading

Barritt, B. H. 1992. Apple rootstocks: From vigorous to dwarfing and precocious. p. 129-157. In: Intensive Orchard Management. *Good Fruit Grower.* Yakima, WA.

Barritt, B. H., B. S. Konishi and M. A. Dilley. 1993. Dwarfing apple rootstocks. *Good Fruit Grower* 44(3):22-25, 46.

Applescotch Dessert

1¼ cups packed brown sugar
1 tablespoon cornstarch
¼ cup butter *or* margarine
1½ teaspoons vanilla
2 cups all-purpose flour
¼ cup sugar
1 tablespoon baking powder
⅓ cup shortening
3 cups chopped, peeled apple
¾ cup milk
1 tablespoon sugar
½ teaspoon ground cinnamon

For syrup, in a medium saucepan combine brown sugar and cornstarch. Stir in 2 cups cold water. Cook and stir until thickened and bubbly, then cook and stir 2 minutes more. Stir in 2 tablespoons butter or margarine and 1 teaspoon vanilla. Pour into a 13x9x2-inch baking dish.

For biscuit topper, in a medium mixing bowl combine flour, the ¼ cup sugar, baking powder, and ¼ teaspoon salt. Cut in shortening till pieces are the size of small peas. Stir in chopped apple. Stir in milk and remaining vanilla till moistened. Drop by tablespoons over syrup in baking dish. Combine the 1 tablespoon sugar and cinnamon. Sprinkle over topper. Dot with remaining butter or margarine. Bake in a 350° oven for 50 to 55 minutes. Makes 10 to 12 servings.

Serve this cobblerlike dessert with a scoop of vanilla ice cream or a dollop of whipped cream.

Rootstock Research Grants – Call for Proposals

Monies contributed to IDFTA and designated for the support of rootstock research are maintained in a separate IDFTA account for use in funding research grants. The IDFTA Board of Directors determines the amount that will be available each year. The Rootstock Research Committee meets at the time of the annual conference to review submitted proposals and make recommendations for funding to the IDFTA board.

The IDFTA board has allocated $30,000 for the support of 1994 research projects. Researchers are encouraged to submit proposals for research funding.

The following guidelines are used in evaluating proposals:

1. Research topics: preference will be given to proposals with deciduous tree fruit species in the following areas:
   - rootstock development (breeding)
   - rootstock and interstem performance (tree size, productivity, fruit quality, etc.)
   - rootstock characteristics (disease resistance, winter hardiness, abnormalities, nutritional requirements, etc.)
   - enhancement of rootstock survival and adaptation
   - rootstock propagation (nursery management, micropropagation, etc.)
   - rootstock identification
   - intensive orchard management systems (including interaction of rootstocks with tree density, support system, pruning and training, etc.)
   - tree size control (other than by rootstock)
   - solving pest and disease problems of rootstocks and interstems
2. Value of research:
   - importance of research to IDFTA membership
   - impact on commercial fruit growing (whole industry or a small section)
   - practical nature of findings
3. Research proposal must:
   - be adequately justified
   - be scientifically sound
   - have clearly stated objectives and procedures
   - have a high likelihood of reaching objectives

Proposals should be submitted on 'Application for Research Funding' forms which can be obtained from Bruce H. Barritt, IDFTA Education Director, 1100 N. Western Avenue, Wenatchee, WA 98801, (509-663-8181, ext. 233). The deadline for submitting proposals is January 14, 1994. For projects funded in 1993, the 'Research Progress' section of the application form should be completed whether or not 1994 funding is being requested. □

Man is the only animal of which I am thoroughly and cravenly afraid. I have never thought much of the courage of a lion-tamer. Inside the cage he is at least safe from other men. There is not much harm in a lion. He has no ideals, no religion, no politics, no chivalry, no gentility; in short, no reason for destroying anything that he does not want to eat.

—GEORGE BERNARD SHAW

N O W A V A I L A B L E

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COMPACT NEWS
A Periodic Newsletter of the International Dwarf Fruit Tree Association
No. 3 September 1993

IDFTA's Highlights of the Ontario Summer Tour

The IDFTA summer tour in southern Ontario was blessed with good weather, great hosts, excellent attendance and an outstanding program organized by Bernie Solymar and his host committee.

The insight this committee had into grower interests was ably demonstrated at each of the first two tour stops where medium to medium-high density orchards were observed but not featured. The interest instead was focused on the mechanical inventiveness of each of the growers.

Maurice Van den Boore had an interesting mobile greenhouse on a track to facilitate protecting different crops from frost or rain at the proper time or to create heat to advance a portion of a crop for early harvest and the realization of higher prices. However, his commercial harvest aid which was also used for pruning, thinning and summer suckering created considerable interest. This aid utilized individual hydraulically controlled working platforms both along side the row and over the top to permit two complete rows to be worked at one time.

Andy Spanjers next wowed the tour with a picking shed of his own design, a smooth hydraulic bin carrier for swapping bins in the orchard using a unique 180 degree swivel loading fork, and an over-the-row sprayer with enclosed sides. The unit was made from a converted tobacco harvester and could spray in wind with excellent coverage at 35 gallons per acre and at six miles per hour. Andy Spanjers has two dairy farms as "across the fence" neighbors, hence an environmentally sound method of spraying central leader trees created the necessity of creativity.

The awe and intrigue of these two growers was best summarized by Paul Rood as he boarded the bus and said, "I was obviously born with a handicap, I am not Dutch."

Dr. Don Elfving, former researcher at the Simcoe Station, led an excellent tour through trial blocks dealing with tree spacing, training systems, flowering crab selections and variety resources. This research once again demonstrates the crucial need of growers to be aware of the needs of different varieties for their respective requirements of spacing, training system, support needs, rootstock responses and timing of pollination requirements.

Harold Schooley, immediate past president of IDFTA, provided an excellent example of the evolution of growers when moving from the standard format of the past to the medium density, and on to plantings of increasingly higher density. These well managed blocks demonstrated the planning and commitment that high density plantings demand of the successful grower. The change of direction to new rootstocks, newer varieties and new spacings with the resulting changes in equipment and management are challenges that still overwhelm any grower without the forethought needed to meet the challenge.

Adrian Brooyman provided color and philosophy as he detailed a well established slender spindle orchard. This stop provided excellent insight to illustrate that, regardless of the system or age of the trees, annual cropping and continuous limb and vigor management are required to successfully keep trees under control.

Dick Van Diepen, through his own retail outlet, illustrated the frustration in today's market of trying organic fruit production. The requirement of codling moth control and higher costs still limit a growers ability to stay in that business. Use of Maryblyt computer model was credited ►

with providing the timing necessary to prevent severe fireblight outbreak.

Jerry Crunican and Herb Versteegh provided their own dimensions of the care and emphasis necessary to maintain producing orchards in varying stages of medium density and the continued shift in direction to M.9 and M.26. The need for greater efficiency while maintaining yield is evident everywhere one travels and continues to be illustrated throughout Ontario.

John Warwick provided the final illustration for the IDFTA summer tour of the direction for all fruit areas, not just Ontario. An excellent planting of M.9 with a vertical wire trellis has just been established. This is the first seen on the tour but represents the direction being taken in other fruit areas. John's orchard was an outstanding example of good management and that high density systems can only be successful if the grower understands the variety/rootstock needs for spacing and training. The grower must have a plant in mind before planting if the block is to achieve the goals desired.

The summer tour illustrated once again the value of visiting different areas, seeing different systems, training approaches and spacings. All are pointed in the direction of higher density, more dwarfing rootstocks, earlier economic yields and greater labor efficiency. How a grower achieves these goals is not nearly as important as the direction the goals provide.

Thanks again, Ontario, for hosting the IDFTA and the excellent program. □

The History of the 'Empire' Apple

M. Derkacz, Graduate Student;
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(Reprinted from Fruit Varieties Journal *47(2):70-72, 1993.*
This article received the American Pomological Society 1992 U. P. Hedrick Award)

Many apple cultivars widely grown today, such as 'Delicious,' 'Golden Delicious,' 'McIntosh' and 'Granny Smith' were discovered by chance.[3,4,6,13] Today, most apple cultivars originate from controlled crosses in breeding programs. Occasionally, however, even this process can have its improbable combinations of chance and good luck. Such is the case with the 'Empire' apple.

By 1945, apple breeding had been underway at the New York State Agricultural Experiment Station in Geneva for over half a century.[5] In 1945, unusually warm temperatures reaching 31 °C occurred in late March and early April.[7] Daily minimum temperatures during that period were also unusually high, falling to freezing occasionally. Apple orchards in western New York began to bloom by April 14, about one month earlier than normal.[7] Several frosts following this early bloom eliminated virtually the entire apple crop in western New York.[7]

The apple breeders at Geneva made their usual crosses during this early bloom, but the late April freezes left virtually no apples from which seedlings could be obtained.[1]

Dr. A. J. Heinicke, Head of the Department of Pomology and Director of the Experiment Station, identified the solution to this dilemma. The apple breeding program emphasized crosses between commercially important cultivars to obtain late-maturing apples.[1] One frequently used cross was 'McIntosh' and 'Delicious.' Dr. Heinicke suggested that the breeders locate relatively isolated, cropping commercial orchards containing only any two cultivars normally used for crosses (C. G. Forshey, personal communication with Dr. A. J. Heinicke). Since the apples from such orchards would most likely represent natural cross-pollinations between those two cultivars, the necessary seedling material for the 1945 breeding program could still be obtained.

Since almost all the New York State apple crop in 1945 was in the Hudson Valley, orchards meeting the necessary criteria were selected there for seed collection. One such orchard owned by Mr. Asrow Miller, was located south of Claverack, NY[21,22] (C. G. Forshey, personal communication with Dr. J. Einset). This relatively isolated orchard consisted of mature 'McIntosh' and 'Delicious' trees only. At harvest 4,035 seeds were extracted from 'McIntosh' apples in the Miller orchard and were sent to Geneva.[22] 1,199 seedlings originating from the Miller orchard were planted in the station test orchard in spring, 1947.[22] ►

In 1954, a Miller-orchard seedling having desirable, 'McIntosh'-type fruit characteristics was assigned the selection number NY45500-5.[22] The identity of the person who selected NY45500-5 is unrecorded. Mr. Leo G. Klein, Research Associate at Geneva from 1949 until his death in 1962, was actively involved in the apple breeding program, wrote extensively on apple cultivars and selections during his career (e.g., [5, 8, 9, 10, 11, 12]), and may well have made the selection. Curiously, although he devoted considerable attention to alternatives for 'McIntosh,' Klein never mentioned NY45500-5 in any of his written material.

Dr. Roger D. Way, who also joined the Pomology Department in 1949, took responsibility for the apple breeding program in 1962, the year Mr. Klein died.[19] By 1965, Dr. Way had recognized the potential of NY45500-5. NY45500-5 was first described in writing in two listings of apple cultivar characteristics authored by Dr. Way and dated January 8, 1965.[14, 15] He also mentioned NY45500-5 in his presentation on apple cultivars at the annual meeting of the New York State Horticultural Society a few weeks later.[16] By December 1965, Dr. Way had described NY45500-5 briefly in three published articles[16, 17, 18] and featured it on the cover of a station circular.[19]

In late 1965, the decision was made to name and release NY45500-5. Suggestions for a name were solicited from the fruit industry.[20] At least 104 suggestions were received from growers, packers and others.[2] The name 'Empire' was included among those suggested, but the originator(s) of the name are unrecorded. The final list of candidate names included the following: 'Delight,' 'Delmac,' 'Empire,' 'Joy,' 'Nymac,' 'Polymac,' 'Red Jacket,' 'Sparkle,' 'Sprite' and 'Tasty.'[2]

The shippers expressed a strong preference for the name 'Empire' (C. G. Forshey, personal communication with Dr. J. Einset). A majority of those polled also favored this name. NY45500-5 was officially released by the New York State agricultural Experiment Station as 'Empire' in September, 1966.[22]

It is impossible to calculate the odds against the one seed with the genetic traits of the 'Empire' apple being formed in 1945 and also being in the right place at the right time to be collected, sent to Geneva and grown in a test orchard. In addition to the unusual weather and crop loss at Geneva in 1945, several people had important roles in the discovery and development of the 'Empire' apple. We are fortunate that these unlikely events occurred, because the 'Empire' apple represents a worthy addition to the cultivars available to both growers and consumers. ☐

Literature Cited

1. Anonymous, 1946. Annual report of the Pomology Department. An. Rpt. N.Y. State Agr. Expt. Sta. 65:51.
2. Anonymous, 1966. 104 names suggested for N.Y. 45500-5. N.Y. State Hort. Soc. Newsletter 22(2):2.
3. Ballard, J. K. 1981. Granny Smith – an important apple for the Pacific Northwest. Washington State Univ. Coop. Ext. Bul. 0814.
4. Baugher, T. A. and S. H. Blizzard. 1987. 'Golden Delicious' apple – famous West Virginian known around the world. Fruit Var. J. 41:130-132.
5. Einset, J. and L. G. Klein. 1960. Apple improvement – early history and current aims. Farm Res. 26:4-5.
6. Fear, C. D. and P. A. Domoto. 1986. The 'Delicious' apple. Fruit Var. J. 40:2-4.
7. Hoffman, M. B. 1946. Why some trees and varieties set fruit and other did not in 1945. Proc. N.Y. State Hort. Soc. 91:96-101.
8. Klein, L. G. 1958. New varieties. Amer. Fruit Grower 78:58-59.
9. Klein, L. G. 1960. Notes on newer apple varieties. Proc. 66th Annu. Mtg. Mass. Fruit Growers' Assn. 66:105-112
10. Klein, L. G. 1962. Keep your eye on these varieties. Amer. Fruit Grower 82(7):10-11, 18.
11. Klein, L. G. and J. Einset. 1957. Newer dessert apples. Fruit Var. Hort. Dig. 12:18.
12. Klein, L. G. and R. D. Way. 1961. Newer apple varieties. Farm Res. 27(4):11.
13. Proctor, J. T. A. 1990. The 'McIntosh' apple. Fruit Var. J. 44:50-53.
14. Way, R. D. 1965a. Tree characteristics of some apple varieties. N.Y. State Agr. Expt. Sta. Mimeo.
15. Way, R. D. 1965b. Fruit characteristics of some apple varieties. Proc. N.Y. State Agr. Expt. Sta. Mimeo.
16. Way, R. D. 1965c. Description and evaluation of apple varieties. Proc. N.Y. State Hort. Soc. 110:157-161.
17. Way, R. D. 1965d. Newest New York apple varieties. Fruit Var. Hort. Dig. 19:19.
18. Way, R. D. 1965e. Description and evaluation of apple varieties. Eastern Fruit Grower 28(5):12-14.
19. Way, R. D. 1965f. Tree and fruit characteristics of some standard and new apple varieties. N.Y. State Agr. Expt. Sta. Res. Circ. 3.
20. Way, R. D. 1966. Wanted: a name for the new apple NY45500-5. N.Y. State Hort. Soc. Newsletter 22(2):2.
21. Way, R. D. 1971. Apple cultivars introduced by the New York State Agricultural Experiment Station 1914-1968. Search – Agriculture, Pomology, No. 1, N.Y. State Agr. Expt. Sta., Geneva.
22. Way, R. D. and J. Einset. 1966. Introducing Empire – a new dessert apple. Farm Res. 32(2):8.

New York Apple Planting System Trials — Early Yields

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In 1989, we established large-scale Apple Planting System Trials on two commercial farms in western New York (Lynoaken Block is 3.2 acres, Cahoon block is 2.4 acres). These plantings were established in cooperation with two of our leading commercial growers to compare five promising apple planting systems. The five planting systems in the trial are slender spindle, Y-trellis and 4-wire vertical trellis, each at 605 trees/acre, and a 3-row slender spindle and V-slender spindle, each at 908 trees/acre. Each system was established with McIntosh and Empire on M.9. Our objective was to collect sound research data on a commercial scale and at the same time give commercial fruit producers the opportunity to observe and compare apple planting systems firsthand. There are many factors that go into the choice of a planting system, some of which are available labor, soil resource, varieties to be grown, available capital for investment, and horticultural skills. These demonstrations allowed growers to sort out some of these factors for themselves.

The plantings have been maintained by the owners, however most of the critical early pruning and training has been done by us using recipes we developed early in the project. We have collected economic and horticultural data on all aspects in these plantings and will eventually have a solid comparison of costs and returns for the five systems. We have also used these plantings as sites for field workshops and applied research. Last season we used them to compare differences between spray coverage among the various planting systems.

Tables 1 and 2 show annual and cumulative yield for the various planting systems. For the three systems at 605 trees/acre total production (years two to four) was not significantly different with either variety at both sites. In addition, for two systems at 908 trees/acre total production per acre was not significantly different. At a common tree density differences in production between systems were small. The data clearly show that it really does not matter which planting system the grower chooses as long as he is committed to it and comfortable with it.

The second point that is clearly shown is that early yield is strictly a function of tree density. The triple row system and our V-slender spindle both have 908 trees per acre, 50% more trees than the other three systems. At both sites and with both varieties the two systems with 50% more trees resulted in 50% more yield/acre. If your goal is early high production, then the more trees the better.

TABLE 1
Marshall McIntosh/M.9 and Empire/M.9 Production for the First Four Years (Cahoon Block)

System	Tree Spacing (Ft.)	Tree Density (Trees/Acre)	McIntosh Yield* (Bu/Acre)				Empire Yield* (Bu/Acre)			
			1990	1991	1992	Total	1990	1991	1992	Total
Slender Spindle	6 X 12	605	8a	149a	289bc	445bc	18a	232c	300b	550b
Y-Trellis	6 X 12	605	3b	137a	275bc	416bc	6a	270c	296b	572b
4-Wire Vertical	6 X 12	605	7a	127a	262c	397c	6a	285c	300b	591b
3-Row Slender Spindle	6 X (6+6+12)	908	11a	208a	367a	586a	16a	500a	370a	886a
V-Slender Spindle	4 X 12	908	7a	154a	346b	506ab	17a	371b	438a	826a

*Means followed by the same letter within each year are not significantly different.

►

TABLE 2
Marshall McIntosh/M.9 and Empire/M.9 Production for the First Four Years (Oakes Block)

System	Tree Spacing (Ft.)	Tree Density (Trees/Acre)	McIntosh Yield* (Bu/Acre) 1990	1991	1992	Total	Empire Yield* (Bu/Acre) 1990	1991	1992	Total
Slender Spindle	6 X 12	605	3a	105b	419b	527b	8b	135b	342ab	485b
Y-Trellis	6 X 12	605	1a	126b	519b	646b	11b	141b	368ab	549ab
4-Wire Vertical	6 X 12	605	3a	103b	467b	573b	12b	170ab	265b	447b
3-Row Slender Spindle	6 X (6+6+12)	908	4a	166ab	691a	861a	11b	198ab	428a	637a
V-Slender Spindle	4 X 12	908	8a	206a	709a	922a	27a	217a	390ab	634a

*Means followed by the same letter within each year are not significantly different.

Four High Density Apple Trial Plantings in Vermont

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In 1988 in the Lake Champlain region of Vermont, 200 foot rows of trees on virus-free M.9 were planted using the 4-wire trellis (Penn State Low Trellis), the Cornell Y-trellis, the slender spindle and the Guttinger (V-slender spindle) systems. The two trellis systems were planted at 8′ x 12′ (454 trees/acre) and the two spindle systems at 4′ x 12′ (908 trees/acre). Trickle irrigtion was installed. The 4-wire trellis has wires spaced 18″ apart to a height of 6′. The Y-trellis has two sets of four parallel wires at an angle of 30° from vertical. Slender spindle trees were supported by 1/2″ conduit held vertically by a single overhead wire. The V-slender spindle system has trees alternating to each side of the V 15° from vertical and supported by 1/2″ conduit attached to two overhead wires.

Table 1 (fifth leaf and cumulative production) shows that McIntosh outproduced Empire in the fifth leaf. This is a function of McIntosh being more vigorous and filling in the allotted tree space more quickly, resulting in more fruiting area. Also, McIntosh fruit size was greater. I am concerned that Empire on 4-wire trellis and Y-trellis planted 8′ in the row will not attain adequate tree size to take advantage of the system's potential. Significant runting out in lighter soils on a replant site has occurred.

The higher cumulative production in the slender spindle-type systems is the result of twice the number of trees per acre. Of interest, the McIntosh trellis systems are no more than 20% lower in production than the spindle systems with twice as many trees. Closely planted trees (four foot spacings) are in themselves dwarfing, as can be visually observed in lower vigor compared to the trellis trees.

Considering the inherently higher risks associated with dwarfing systems (management changes, rootstock idiosyncrasies, higher capitalization costs), can a profit be reasonably quickly realized? The McIntosh and Empire 4-wire trellis systems paid for themselves by the fifth leaf, while having reached less than 50% of their estimated production potential (Table 2). All other systems should be profitable by the sixth leaf. Whether the higher initial costs of the spindle system will be justified is yet to be known. The difference between the Empire- and V-slender spindle is explained by increased production (about 20%) of the former and higher system cost of the latter. I can conclude that within the limitations of my management and other considerations, these systems can be profitable, and relatively earlier, than on lower density plantings. Particularly impressive has been fruit size and general quality. ►

Certainly such grower-based data can be helpful in judging the feasibility of imitating a full-scale high-density planting. However, nothing compares with having your own trial planting. I would appeal to you to consider your own small planting. A few rows are adequate. I feel we have no other alternative but to grow fruit under intensive management in high density plantings if we wish to remain profitable in the north country. I would enjoy discussing any and all aspects of the above opinion and sharing my data and limited experience with these systems. □

TABLE 1
Production in Bushels/Acre of Five-Year-Old McIntosh and Empire on M.9 Rootstock

System:	4-Wire Trellis	Y-Trellis	Slender Spindle	V-Slender Spindle
Density (Trees/Acre)	454	454	907	907
McIntosh:				
Fourth Leaf	346	317	358	458
Fifth Leaf	358	442	500	500
Cumulative	890	909	1,050	1,183
Empire:				
Fourth Leaf	242	242	392	342
Fifth Leaf	298	275	442	425
Cumulative	772	717	1,205	1,042

TABLE 2
Cumulative Orchard Run Return/Costs Analysis Through Fifth Leaf McIntosh and Empires in $/Acre

System:	4-Wire Trellis	Y-Trellis	Slender Spindle	V-Slender Spindle
McIntosh:				
Return	7,424	7,434	8,508	9,551
Costs	7,389	8,607	11,841	12,495
Profit (Loss)	35	(1,173)	(3,333)	(2,944)
Empire:				
Return	7,489	6,992	11,833	10,014
Costs	7,281	8,563	11,991	12,443
Profit (Loss)	208	(1,571)	(158)	(2,429)

Washington Apples – How Do They Do That?

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For those of us growing apples in the Northeast, the monolithic Washington apple industry sometimes appears as a distant and dark force. Subtly, they adopt innovative horticultural practices and combine aggressive selling in the apple market to influence the way we grow and sell apples on the East coast. Upon touring Washington's Wenatchee Valley apple growing region while attending the International Dwarf Fruit Tree Association's annual meeting, we gained some insight into how they have become such a dominant player and innovator in the fruit growing industry.

The Washington apple industry has been monumentally successful in producing and in creating a demand for their number one product: Red Delicious apples. The industry's marketing and promotion arm, the Washington Apple Commission, funded through a per-box surcharge on all apples packed in Washington, has been instrumental in creating a year-round demand for their product. Through advertising panache and aggressive marketing, the commission has nearly guaranteed a market for a crop worth over one billion dollars annually. A second commission, the Washington Tree Fruit Research Commission, also funded by a surcharge on production, promotes research on the production and handling of tree fruits.

The ability to effectively supply this demand is handled by an extensive infrastructure developed over the last 50 years. Over 160 warehouse entities pack and ship an average of 70 million fresh boxes annually. We had the opportunity to tour a large, modern packing house: Trout Inc. of Lake Chelan. It is an impressive operation that handles three million boxes of apples a year. A huge investment in state-of-the-art apple storage and packing facilities was displayed, including electronic color scanners, hydrofillers (refills bins with graded and sized apples in a water flume), and individual apple labeling machines. On the packing line, people rotate to the next position every half hour to reduce fatigue. With facilities like this, it is quite apparent why their industry is in a position to supply the market with high quality fruit year-round.

In addition to all this high-tech equipment, each packing house supports its member growers with trained field personnel (fieldmen) who provide information on varieties, rootstocks, and planting systems and cultural advice on pruning, fertilizing, harvest maturity, and pest monitoring and control recommendations. Finally, growers are advised on quality control during fruit harvest by the field staff. In north central Washington these advisers formed the Northcentral Washington Fieldmen's Association which holds monthly educational meetings.

This system of advisors fills the niche that county extension agents occupy in other states. The cooperative extension agents in Washington State are top notch, but spend their time providing information to the fieldmen (who, in turn, pass it on to the growers) as well as conducting applied research projects. In Washington, we saw these field personnel as the critical link between the growers and their marketing outlet, the co-op packing house.

The infrastructure we have been talking about involves the successful integration of both growing and marketing the largest apple crop in the United States. Growers were forced to go to co-ops to market their crops because of the great distance to the major U.S. population centers. This structure has enabled the Washington State apple growers to build an infrastructure that is second to none.

Now, what about all these glitzy new varieties like Fuji and Braeburn and the innovative high density plantings we have all been hearing so much about? How do they parlay into the Washington game of apple growing?

Super high density plantings and the newer cultivars are being successfully employed in relatively small blocks to capitalize on the exorbitant wholesale prices growers have been getting for fruit from these novel varieties, often destined for the Asian overseas market. For example, we viewed a planting of Golden Delicious on M.26 rootstock that was planted in 1989. The trees were trained to a slender spindle and planted at 518 trees/acre. This was a very progressive high density planting at the time. Establishment cost then was \$6,700/acre, and after three years of yield (1990, 1991 and 1992) a \$10,800/acre return had been realized – not too bad for an orchard coming into full production. We must point out, however, that these prices reflected less than five percent of the Washington crop.

Nowadays those densities are not nearly intense enough! We gawked at a Fuji planting on M.26 rootstock established in 1991 at 1,300 trees/acre. Tree spacing was 13.5 x 2.5 feet, and the trees were trained to a mini-tatura type trellis, basically an 8-wire V-trellis. The year after planting, in 1992, they picked 16 bins/acre, and packed out 366 boxes which returned $16,470. That is a phenomenal $45/box! Their establishment cost was substantial at $10,895/acre, but they've already realized a net return of $5,575/acre in the first crop. Now you know why high density plantings are so fashionable. However, do not be fooled. These glamorous orchards are clearly the exceptions to the rule. Medium density plantings of modest sized trees (including Reds, Goldens, and Granny Smith) remain the backbone of the Washington industry.

Much interest and many research dollars have been invested in cultivar testing in the Pacific Northwest. Clearly, most growers have begun to diversify their Red Delicious plantings with Granny Smith, Gala, Braeburn and Fuji, and are looking closely at newer cultivars in research trials for the hottest new money maker. Deciding what strain to plant of these cultivars is the question most often sought by growers. It is a message east coast growers should heed: diversity with newer high quality cultivars if you wish to remain competitive in the U.S. apple market.

So what's the take-home message? Certainly, the infrastructure the industry has developed to produce and market all their fruit is impressive and makes good economic sense.

Unfortunately, the eastern growing and marketing infrastructure is not as well developed because our industry is more diverse and spread over a much wider geographic range, including across state boundaries. If possible, growers would be wise to follow Washington's lead and pull together a more unified marketing structure that carries more weight on the national scene. We need to continue implementing innovative high density plantings with newer, improved cultivars in an aggressive manner. We may not see a completely analogous situation here in the east, but if we are not willing to innovate, Washington state apple growers will probably continue to be the horticultural innovators in apple production in the United States. □

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