EDUCATIONAL DIRECTOR
Bruce H. Barritt
1100 N. Western Avenue
Wenatchee, WA 98801
(509) 663-8181 (office)
Ext. 233
(509) 664-0526 (FAX)

BUSINESS DIRECTOR
Charles J. Ax, Jr.
14 South Main Street
Middleburg, PA 17842
(office) (717) 837-1551
(home) (717) 539-8300
(FAX) (717) 837-0090

COMPACT NEWS
A Periodic Newsletter of the International Dwarf Fruit Tree Association
No. 3 December 1996

INFLUENCE OF FRUIT COMPETITION ON SIZE, AND THE IMPORTANCE OF EARLY THINNING

(from New York Fruit Quarterly 4 (1):7-9 (Spring 1996)

A. N. Lakso, T. L. Robinson and M. C. Goffinet
Department of Horticultural Sciences, Cornell University
New York State Agricultural Station, Geneva, NY

The goal of apple growing is to produce large crops of high quality fruit as efficiently as possible. To do this, we need to understand how the apple tree works and therefore how best to make it work for us. One of the best ways to think about fruit production is to think of the balance of supply and demand in the tree and how we can find the optimum for fruit production while still growing a healthy tree for many years. The approach is to grow a tree and orchard of high supply via good cultural practices, then adjust the crop via thinning to best utilize that supply. Although this paper primarily addresses the demand of the fruit, it is critical to consider at least briefly the supply side of the equation.

The supply of energy, dry matter and nutrients needed for a crop depends on:

1. planting and training well-designed orchards that capture a good amount of sunlight energy,
2. distributing that light efficiently into the bearing spurs within the canopy,
3. providing good nutrition to ensure healthy leaves that can convert the energy into the sugars needed for growth,
4. pruning properly to assure a good balance of tree growth and cropping (long shoots compete with young fruits and shade the spur leaves that support early fruit growth),
5. maintaining tree health over the season by avoiding or controlling other stresses that reduce tree function (for example, drought or foliar pests).

We will emphasize in this paper that the practice of thinning is not just removal of fruit but is necessary to balance the supply and demand in the tree.

COMPETITION AMONG FRUITS

Many more fruits initially develop than the tree can mature (only about 5% of flowers are needed to produce a crop that the tree can carry). Therefore, the tree must drop many young fruitlets to set final fruit numbers. This leads to a competition that occurs when the supply is inadequate for all fruits to grow to their potential.

In the first 2-4 weeks after bloom, we have found that fruits are supported primarily by carbohydrates from the spur leaves while shoot leaves support only their own shoot's growth. It appears that the leaves just after bloom can support the many, but small, fruitlets. But, quickly, the rapid growth of the fruits and the strong competition of rapidly growing long shoots lead to competition for the limited resources (we think the competition is mostly for carbohydrates, but it may be for other nutrients).

Again, the key is to just balance the demand of fruits to the supply. Also, it is critical that this balance be established as early as feasible for several key reasons:

1. Competition among fruits reduces the size of all the fruits ➤

until the competition is relieved by thinning to numbers the tree can handle. This competition varies with the numbers of fruits and health of the tree, but typically competition starts by about 7-10 days after bloom.

2. Apple fruit size potential is generally determined by cell numbers, so if cell division is reduced by fruit competition during the early growth, optimum fruit size is not recoverable. Once competition is relieved by thinning, then the fruits can begin to grow at their potential growth rate. Any delay in getting the fruit up to the best growth rate will mean a loss of potential size.
3. Apple fruit cell division is most active in the first 3 weeks after bloom and only lasts for about 4-5 weeks. So, late thinning does not usually give the best fruit size increases since at that late date the remaining fruit cannot make many new cells. The increases in fruit size with late thinning are generally small although average size may go up simply by removing the smaller fruits. Also, singling of fruits may help uniform color development.

HOW IMPORTANT IS THINNING TO SINGLES?

In most varieties, the king fruit is the largest of the fruits on a spur and so you want to thin to singles. The importance of this, however, differs with varieties. Delicious is very king dominant and must be singled for best results since the two largest lateral fruits are only 70 to 80% as big as the king fruit at petal fall. In Empire, however, the king fruit is not much bigger than the two largest laterals (90 and 95% of the king), so there tends to be a more even competition of fruits in the Empire cluster. This can be good and bad.

We have found that the largest two Empire laterals can each produce a good size fruit if thinned to a single early, so losing a king flower or fruit is not as bad as with Delicious. Also, in thinning trials, hand thinning of Empire gave the best size if the fruits were singled, but leaving the same fruit numbers per tree as doubles was not that bad. So, a full crop of Empire doubles is better than thinning to a half crop of singles. However, this uniformity of sizes also means that it is harder to single out Empire with chemical thinners. Perhaps this is why hand thinning to singles has given the best final fruit sizes with Empire compared to chemical thinners that allow more doubles and triples.

IMPORTANCE OF EARLY THINNING AND METHOD OF THINNING

The importance of all this is realized when a tree is thinned to a given number of fruits and the best size will occur if thinning is done early so we eliminate the competition among fruits in time for cell division to be maximized.

We have carried out many thinning trials and the growth of fruits in these trials demonstrates the points just covered. Hand thinning at different times after bloom shows that delaying thinning to late in the cell division growth period limits the size potential even though the trees were thinned to quite low crop levels (Fig. 1).

A second factor seen in fruit growth monitoring is that chemical thinners may hurt the size potential of the fruit that are to remain to harvest. This occurs because these thinners inhibit the growth of all fruits for a while, and therefore shorten the time that the fruits can produce cells (Fig. 2). This is especially true for NAA, but BA (the active ingredient in Accel) is clearly better. Note that, in this trial, the fruits on the NAA-thinned trees did not even catch up to the unthinned fruit until about 45-50 days after bloom. This severely limits the gain in final size by reducing the crop level. This is a major problem for NAA on Empire, but it is also why the Accel product looks promising in this case. Sevin tends to be similar to Accel in effect on fruit development.

The results of these differences in early season growth are seen at harvest when Accel and Sevin tended to cause some reduction in fruit growth compared to hand thinning at same time, but still give much better final size at any crop level than does NAA (Fig. 3). Also, the same treatments all behaved well if applied by 5 days after bloom. It was the later treatments at more normal thinning times that showed the clear problems.

SUMMARY

We need to thin to establish the proper balance of supply and demand in the tree. Cell numbers limit fruit size potential and yet growth by cell division only occurs for about the first month of fruit development. We therefore need to thin as early as feasible to allow the most time for retained fruits to increase the cell numbers needed to obtain large fruit size. Finally, later thinning at more normal times may be effective if done by hand, but the choice of thinner is more important at that time.

ACKNOWLEDGMENT

The authors would like to acknowledge the partial financial support of the NY Apple Research and Development Program and the NY State Department of Agriculture and Markets.

➤

FIGURE 1
AVERAGE EMPIRE APPLE FRUIT DEVELOPMENT CURVES ON TREES HAND THINNED TO A RELATIVELY LIGHT CROP AT PETAL FALL (PF) OR AT 40 DAYS AFTER BLOOM COMPARED TO UNTHINNED CHECKS.

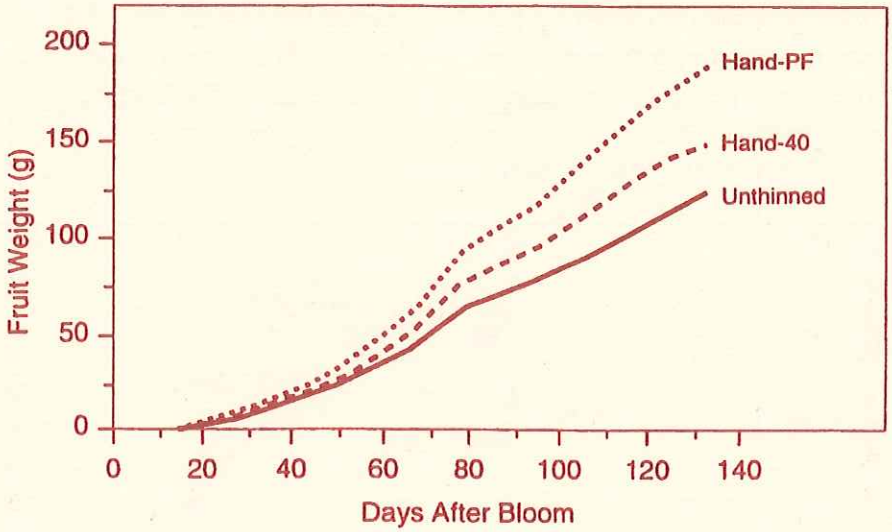


FIGURE 2
AVERAGE EMPIRE APPLE FRUIT DEVELOPMENT CURVES ON TREES THINNED AT ABOUT 2 WEEKS AFTER BLOOM BY HAND, 10 PPM NAA, AND 75 PPM BENZYLADENINE (BA) COMPARED TO UNTHINNED CHECKS.

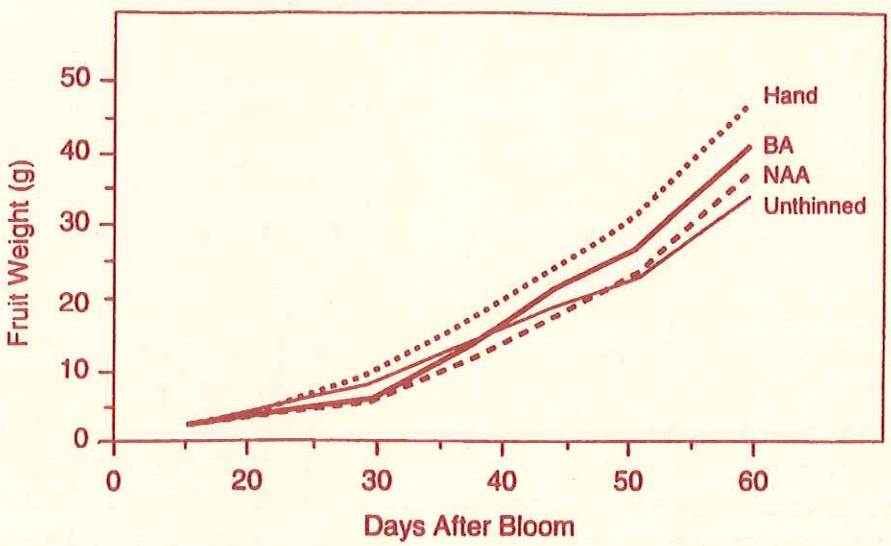
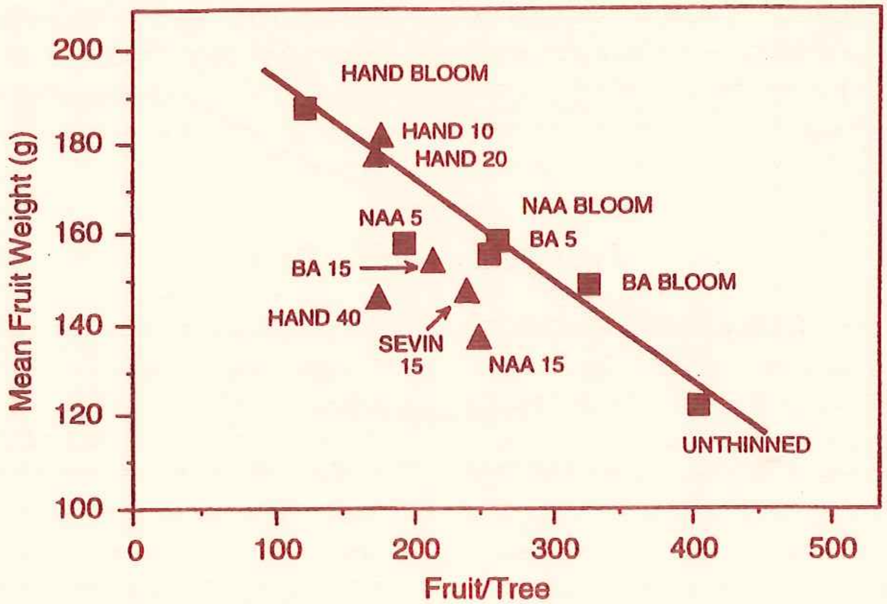


FIGURE 3
AVERAGE EMPIRE APPLE FRUIT WEIGHTS AT HARVEST RELATED TO AMOUNT OF THINNING ON TREES UNTHINNED AND THINNED BY HAND AT BLOOM, 10, 20, AND 40 DAYS AFTER BLOOM (DAB); 10 PPM NAA AND 75 PPM BENZYLADENINE (BA) AT BLOOM, 5 AND 15 DAB; AND SEVIN AT 15 DAB. SQUARE SYMBOLS INDICATE TREATMENTS NEAR OR AT BLOOM; TRIANGLES REPRESENT TREATMENTS 10 DAYS OR MORE AFTER BLOOM.



TERRIFIC GIFT-GIVING IDEA!

APPLE AND GINGER JAM

(Makes 2.5 kg / 5 lb)

Apples 1.5 kg / 3 lb

Peel and core apples. Tie the peel and cores in clean muslin and hang in the pan. Place the apples in preserving pan with:

Water 500 ml / 1 pint, UK / 1.25 pint, US

Ginger ground 2 Tbs

Grated rind & juice of two lemons.

Cook until the fruit is tender. Remove the muslin bag and squeeze out the juice. Allow the bag to cool a little before doing this procedure.

Sugar 1.5 kg / 3 lb

Add to the pan and stir until the sugar dissolves. Boil rapidly until setting point is reached.

ROCHESTER IDFTA CONFERENCE

Rochester, NY, February 23-26, 1997

The 40th IDFTA Conference will be held at the Radison Hotel at Rochester Plaza in downtown Rochester, NY. Registration will begin Sunday afternoon. Monday and Wednesday will be all-day educational sessions. The awards banquet will be Tuesday evening. Orchard tours west of Rochester will be on Tuesday.

An extra pre-conference tour day (with a separate fee) has been arranged for Saturday, February 22. This tour, which will begin and end in Rochester, will feature research trials evaluating orchard systems and rootstocks at the New York State Agricultural Experiment Station, Geneva.

FEATURED SPEAKERS

DR. LUCA CORELLI GRAPPADELLI is Associate Professor at the Dipartimento di Colture Arboree, Bologna University in Bologna, Italy. He earned a master's degree from Clemson University in South Carolina and a Ph.D. from Bologna University. He was a visiting scientist at Cornell University with Dr. Alan Lakso in 1987 and 1992. His area of research interest is tree fruit physiology, particularly photosynthesis, respiration and water use as they influence tree productivity and efficiency. He has also studied pruning, fruit thinning, fruit development, orchard design and training systems with both apple and peach. At the conference in Rochester, his topics will be Apple Orchard Management Systems and The Peach Industry in Italy.

MICHAEL WEBER is horticulturist and technical advisor for the cooperative Marktgemeinschaft Bodenseeobst in Friedrichshafen in the Bodensee region of southern Germany. In addition to his university education in Germany, he has had practical training in tree fruit production in France, Switzerland, South Tyrol, Italy, and New Zealand. As advisor to grower members of the cooperative, he 1) provides information on training methods for intensive orchards of apple, cherry and plum, 2) coordinates the selection and distribution of nursery trees, 3) evaluates new cultivars and 4) evaluates soil mineral analysis and provides fertilizer recommendations. He has been active in the evaluation of new dwarfing rootstocks and intensive management systems for sweet cherry. At the Rochester conference, his topics will be Intensive Apple Orchard Management Systems in the Bodensee Region and Intensive Cherry Production Systems Using Dwarfing Rootstocks.

GUY LIGONNIERE is the second generation owner/manager of the Davodeau Ligonniere Nursery located in Angers, in the Loire Valley of France. The nursery produces tree fruit rootstocks and finished trees. In addition to the nursery, he also oversees the company's extensive apple and pear orchards. As an orchardist, he has been active in the development of new training techniques for high density apple and pear orchards. As a nurseryman, he has been interested in matching nursery tree quality with the requirements of high density orchards. He is continually evaluating new dwarfing rootstocks and new apple and pear varieties. At the Rochester conference, he will speak about New Apple Cultivars.

The Robert F. Carlson Distinguished Lecture will be presented by **DR. HERB ALDWINCKLE**, professor and chairman, Department of Plant Pathology, Cornell University New York State Agricultural Experiment Station, Geneva. His presentation will describe the development of new disease-resistant apple rootstocks through both traditional plant breeding and new genetic engineering approaches. He, along with his plant breeding colleague, Dr. Jim Cummins, has developed through plant breeding techniques the new Cornell-Geneva apple rootstocks G. 65, G.11 and G.30 with resistance to collar rot and fire blight. Dr. Aldwinckle will also describe genetic engineering research in which he and his colleagues have incorporated fire blight resistant genes in susceptible apple rootstocks.

THE WORLD APPLE CONFERENCE

October 28-31, 1997
Nagano, Japan

The World Apple Conference in Nagano, Japan, is being organized by the Young Fruit Farmers' Association of Nagano Prefecture. Nagano is a major apple growing region in central Japan. The city, surrounded by the Japanese Alps, is the host city for the 1998 Winter Olympic games. A part of the three and a half day conference, the Fuji Session sponsored by IDFTA, will feature speakers from around the world discussing the growing and handling of Fuji apples. The conference is being held during the harvest season for Fuji in Japan, one to two weeks later than the harvest season in most northern US states.

The goals of the conference are a) to study apple production practices in commercial orchards in Nagano Prefecture; b) to view research on intensive orchard systems, thinning and crop load adjustment, new apple varieties, and spur and nonspur strains of Fuji at the Nagano Fruit Tree Experiment Station; and c) to see new fruit handling and packing facilities, including nondestructive infrared detection of soluble solids content. Production practices that will be demonstrated in commercial orchards to enhance fruit color will be bagging, the turning of fruit, removal of spur and bourse shoot leaves, and the use of reflective ground covers. On display will be over 50 strains of Fuji, including early season, red color and spur-type strains.

The cost to attend the conference will be approximately $700. This includes three nights' accommodations, all breakfasts, lunches and two dinners, transportation during the conference to orchards, packing houses, and research stations, and conference registration. Not included is round trip airfare to Japan or the cost of transportation from Tokyo to Nagano and return to Tokyo. A home-stay option will be available for one evening.

THE IDFTA WORLD APPLE CONFERENCE STUDY TOUR TO JAPAN

IDFTA has organized a 14-day (October 26-November 8) tree fruit study tour to Japan that will include participation in the World Apple Conference (October 28-31), as well as visits to commercial orchards, research stations, and a fruit auction in the Morioka and Aomori fruit districts in northern Japan. Weekend sightseeing in Kyoto and Tokyo will be included. The fall colors of Japan's deciduous forests are at their spectacular peak in early November. The cost of the study tour, including round trip air transportation to Japan, all transportation and accommodations (12 nights) in Japan and most meals and all costs for the World Apple Conference, will be approximately $4,000 per person (double occupancy). Individual arrangements can also be made for an extended stay in Japan or elsewhere. Tour itinierary is on the back of this sheet.

Upon request an abbreviated one-week (October 26-November 1) IDFTA World Apple Conference tour can be arranged that will include round trip airfare to Japan, round trip transportation Tokyo/Nagano, full participation in the World Apple Conference, all accommodation (5 nights) and most meals. The approximate cost will be $2400 per person (double occupancy).

The tour leader is Dr. Bruce Barritt, IDFTA Education Director and pomologist at Washington State University, whose research emphasis is orchard systems, rootstocks and apple breeding. In October 1996, Dr. Barritt visited the sites that will be included in the study tour and helped with the planning and organization for the World Apple Conference in Nagano. The tour coordinator is Bob Curtis of Curtis-C Travel of Wenatchee, WA. Bob also visited the tour sites in October 1996. This will be the eighth tree fruit study tour Bob and Bruce have led to important fruit growing regions around the world.

If you wish to reserve a place on the tour, would like to be on the mailing list for more information, or have questions, please contact: **Bob Curtis** of Curtis-C Travel, P. O. Box 7188, East Wenatchee, WA 98802, phone (800) 562-2580; FAX (509) 884-5651, or **Dr. Bruce Barritt**, IDFTA Education Director, 1100 N. Western Avenue, Wenatchee, WA 98801, phone (509) 663-8181, ext. 233; FAX (509) 662-8714; e-mail etaplz@wsu.edu.

Start saving now and plan to have your 1997 Fuji crop picked by October 25 so you can join the IDFTA tour to Japan on October 26. ➤

ITINERARY

IDFTA World Apple Conference Study Tour to Japan ▪ October 26-November 8, 1997

SUNDAY, OCTOBER 26

Depart from US.

MONDAY, OCTOBER 27

Arrive late afternoon in Tokyo, Japan. Overnight Tokyo.

TUESDAY, OCTOBER 28

Morning travel by bus to Nagano (4 hrs.); the World Apple Conference begins in the afternoon with visits to 3 orchards featuring bagged and unbagged Fuji and to a warehouse packing bagged Fuji; evening welcoming banquet. Overnight Nagano.

WEDNESDAY, OCTOBER 29

The 'IDFTA World Fuji Session-Challenges of Growing Fuji Apples Around the World' will feature presentations by speakers from around the world. Overnight Nagano.

THURSDAY, OCTOBER 30

Morning visit to Nagano Fruit Tree Experiment Station to see Fuji trials of training systems, rootstocks and interstems and spur and standard strains. Studies of biennial bearing, regulation of fruit set and optimal cropping levels for Fuji will be seen. A display will feature new Japanese varieties, including Shinano Sweet, Nagano 15, Akibae and over 50 strains of spur and nonspur Fuji. Fruit tasting is encouraged. Afternoon visit to intensive hillside Fuji orchards and drive to Matsumoto for evening banquet at a local winery. Overnight choice of home stay with a fruit-growing family or hotel in Matsumoto.

FRIDAY, OCTOBER 31

Morning presentations by Japanese orchardists on Fuji growing and on techniques for sorting and packing fruit. Afternoon visit to JA-azumi warehouse to see Fuji being sorted for fruit size and color as well as soluble solids and maturity using infrared nondestructible sensors. Fruit is packed into boxes using automatic vacuum lifting techniques. Also visit high density orchards of new Fuji strains on M.9 interstems. Conference closing. Overnight Matsumoto.

SATURDAY, NOVEMBER 1

Morning visit to Matsumoto Castle, the oldest in Japan, and travel by bus (3 hrs.) to Kyoto, a living museum of artistic heritage and the imperial capital of Japan for over 1000 years. Overnight Kyoto.

SUNDAY, NOVEMBER 2

Free day to explore the shrines, temples and gardens of Kyoto or visit nearby Nara, an even older capital with the world's oldest wooden structures. Overnight Kyoto.

MONDAY, NOVEMBER 3

Time to see additional sites in Kyoto with afternoon flight to Aomori in northern Japan, the center of apple growing with 50% of Japanese production. Japan Culture Day, a national holiday. Overnight Hirosaki.

TUESDAY, NOVEMBER 4

Early morning visit to the wholesale apple market in Hirosaki to see bagged and unbagged fruit of Fuji, Orin, Jonagold and Mutsu. Next will be a visit to the Aomori Apple Experiment Station to see trials of apple rootstocks and training systems and to taste new apples developed by Japanese breeders. Afternoon visit to commercial orchards to study Fuji color enhancing techniques of bagging, turning of fruit, leaf removal and reflective ground covers. Overnight Hirosaki.

WEDNESDAY, NOVEMBER 5

Morning travel by bus to Morioka (3 hrs.). Afternoon visit to commercial high density orchards during the harvest period of Orin and Fuji. Overnight Morioka.

THURSDAY, NOVEMBER 6

Morning visit to the Apple Research Center of the National Institute of Fruit Tree Science in Morioka where Fuji was bred. See the original Fuji tree, trials of the newly released Morioka series of dwarfing rootstocks and enjoy tasting many of the newly released and promising selections from the apple breeding program. Afternoon travel by Shinkansen (Bullet Train, 3 hrs.) to Tokyo. Overnight in the vibrant Shinjuka district of Tokyo.

FRIDAY, NOVEMBER 7

A day to enjoy the sights of Tokyo, which may include the Imperial Palace and gardens, traditional shrines and temples, museums and art galleries, the Tsukiji fish market, and the Ginza and Shinjuka shopping districts. Overnight Tokyo.

SATURDAY, NOVEMBER 8

Morning free in Tokyo with late afternoon departure from Tokyo's Narita airport for the flight to the US, arriving the same day.

IDFTA CALENDAR

February 23-26, 1997
40th Annual IDFTA Conference, Rochester, New York

June 22-24, 1997
IDFTA Summer Tour, Fitchburg, Massachusetts

July 20-22, 1997
IDFTA Summer Tour, Wenatchee, Washington

October 26-November 8, 1997
IDFTA World Apple Conference Study Tour to Japan

February 22-25, 1998 (tentative date)
41st Annual IDFTA Conference, Pasco, Washington

International Dwarf Fruit Tree Association
COMPACT NEWS
14 South Main Street
Middleburg, PA 17842

FIRST CLASS MAIL

MIDDLEBURG PA. DEC 16'96 U.S. POSTAGE .32 PB.METER 7804787

275
WALLACE E. HEUSER
SUMMIT SALES
55826 60TH AVE
LAWRENCE, MI 49064
USA

Recycled Paper

A9064-9716 01

EDUCATIONAL DIRECTOR
Bruce H. Barritt
1100 N. Western Avenue
Wenatchee, WA 98801
(509) 663-8181 (office)
Ext. 233
(509) 664-0526 (FAX)

BUSINESS DIRECTOR
Charles J. Ax, Jr.
14 South Main Street
Middleburg, PA 17842
(office) (717) 837-1551
(home) (717) 539-8300
(FAX) (717) 837-0090

COMPACT NEWS

A Periodic Newsletter of the International Dwarf Fruit Tree Association

No. 2 June 1996

MAXIMIZING THE PERFORMANCE OF YOUNG APPLE TREES

(reprinted with permission from New York Fruit Quarterly 1995 3(2):10-16)

Terence Robinson and Warren Stiles
Cornell University, New York State Agricultural Experiment Station, Geneva, and
Cornell University, Department of Fruit and Vegetable Science, Ithaca, New York

The success of high-density orchards depends on obtaining significant yields in the third, fourth and fifth years to repay the high establishment costs of these systems. To obtain the expected yields requires excellent tree growth during the first two years after planting. In too many cases, early tree performance is poor, resulting in a negation of the benefits of high tree density and a cost of thousands of dollars per acre. Gerling (1981) has estimated that when cropping of an orchard was delayed due to poor tree growth in the early years, peak investment was increased by 20% and the total profit was reduced by 66% over the 20-year life of the orchard.

To help growers obtain the expected yields, we have been studying the effects of various orchard management practices on tree performance for the last nine years. Our results have shown early tree performance can be significantly improved by following many of our existing Cornell recommendations and with the addition of intensive management practices such as trickle irrigation. We have studied seven major cultural factors which influence the performance of the newly planted tree: 1) preplant soil preparation; 2) tree quality; 3) planting date; 4) irrigation; 5) fertilization; 6) pruning; and 7) cropping level. In interpreting our results it must be remembered that the work was done at Geneva, NY, which has a humid climate and some factors such as irrigation and fertigation will likely have different effects in arid and humid climates.

PLANTING DATE

In 1986, we planted an experiment with 'Redchief Delicious'/MM.106 at the New York State Agricultural Experiment Station in Geneva, NY, where we compared two planting dates (April 14 and June 10).

Early planting resulted in greater shoot growth and trunk cross-sectional area increase (TCA) in the first two years (Table 1). However, in later years the late planted trees had similar shoot growth and TCA increase as the early planted trees so that after six years there were no significant differences in total shoot growth or TCA increase due to planting date. Nevertheless, late planting reduced yield in years 2, 3, 4 and 6 but not in years 5 and 7. The cumulative yield of the late planted trees was 12% less than the early planted trees due to the large effect of planting date on tree performance during the first two years. Based on these results, we suggest that growers plant as early in the spring as soil conditions allow. In most years all trees should be planted before May 1 in NY.

Many growers have successfully planted trees in the fall for additional tree performance benefits. Experience indicates that fall-planted trees have a significant growth advantage over early spring-planted trees which results in additional yield in the early years. However, fall planting carries with it the additional risk of winter damage to newly planted trees. For growers considering fall planting, we suggest three simple rules: 1) Trees should be planted between November 1 and not later than November 15; 2) The leaves must be stripped from the trees prior to digging; and 3) The soil must not be too wet. The soil must be friable at planting and settle around the roots before cold weather arrives for fall planting to be successful. If these rules are followed, fall planting offers an additional option to help maximize tree performance but the risks must be understood and minimized.

TREE QUALITY

Tree Caliper. Our 1986 experiment with 'Redchief Delicious'/ MM.106 rootstock also compared four initial tree caliper classes (1/4"-5/8"). The larger the initial tree caliper, the greater the initial tree growth and early yield. Yield was greater with increasing initial caliper in years 2, 3 and 4 (Table 2). However in years 5-7, there was no difference in yield due to initial tree caliper. Nevertheless, the larger early yields of the larger caliper trees resulted in a significant increase in cumulative yield over the first seven years when compared to smaller caliper trees. These results support our recommendation to plant large caliper trees (>1/2" caliper) for optimum performance.

Feathers. In recent years there has been considerable interest not only in large caliper trees but in branched or feathered nursery trees. In 1987, we planted an experiment comparing trees with different numbers of side branches (feathers) using three varieties ('Empire', 'Mutsu' and 'Redchief Delicious'). The 'Empire' and 'Mutsu' trees were on M.9/MM.106 interstem rootstock while the 'Delicious' trees were on M.7 rootstock. The number of initial feathers on the tree at planting varied from 0 to 6 feathers but all trees had similar initial tree caliper. The 'Mutsu' trees had the longest feathers, the 'Empire' trees had intermediate length feathers, and the 'Delicious' trees the shortest feathers. Feathering had little effect on TCA increase and no effect on total shoot length (Table 3). Although there were no differences in total length of shoots, feathered trees produced greater numbers of shoots with a shorter average length. There were no differences in final tree size as a result of initial feathers. Feathering did have a significant effect on yield in the early years (2-4) but, in the later years (5-7), the trees with no feathers had similar yields as the feathered trees. Nevertheless, cumulative yield after eight years was increased 9% by feathering. Thus, the feathered trees had similar total growth as the unfeathered trees but the initial branches provided fruiting sites in the second year and the shorter average shoot length resulted in more fruitful branches in year 3 and 4. The effect of feathering was greatest with 'Mutsu' and least with 'Empire'. 'Delicious' was intermediate. The additional cumulative yield of the highly feathered trees compared to the unfeathered trees was 0.6 bushels. Assuming a $5.00 price per bushel of fruit, the feathered trees produced a gross additional return of $3.00 over the first 8 years. This improvement would translate into a significant improvement in yield per acre in orchards with high tree densities, consequently, we continue to recommend highly feathered trees for high-density plantings.

PRUNING

In experiments with different orchard systems, we have compared central leader style pruning with its annual heading of the leader and early heading of scaffolds, with more modern systems which use less pruning and more tree training. In general, pruning has reduced early yield compared to unpruned controls. With M.26 or M.9/MM.111 interstems, vertical axis trained trees which had minimal pruning were 12% more efficient than central leader trees of 'Empire' and 3% more efficient with 'Jonagold' over the first five years. Y-trellis trees were 38% and 23% more efficient than central leader trees with 'Empire' and 'Jonagold', respectively. Thus, the vertical axis and Y-trellis training systems enhanced the yield efficiency of M.26 or M.9/MM.111 interstem compared to central leader training. It appears this is due to the tree support and the reduced pruning of those systems. In addition, vertical axis trees were 12% and 8% smaller than central leader trees and Y-trellis trees were 22% and 15% smaller than central leader trees for 'Empire' and 'Jonagold', respectively. The more modern training systems which require less pruning in the early years allow for greater cropping which results in less tree growth and greater efficiency. As a result of the smaller tree size with these two training systems, we estimate that M.26 or M.9/ MM.111 interstems could be planted at 10 to 20% greater tree density with vertical axis or Y-trellis training than central leader training.

We also compared the performance of M.9 rootstock in three training systems (vertical axis, Y-trellis and slender spindle). Tree size was smallest with the slender spindle system but yield efficiency of the slender spindle trees was 13% lower than with the vertical axis system and more than 20% lower than with the Y-trellis system. The lower yield efficiency was probably the result of the greater pruning required to contain tree growth in the slender spindle system compared to the vertical axis and Y-trellis systems. These results indicate that the yield performance of dwarfing rootstocks can be enhanced by using modern training systems that rely primarily on tree training and use minimal pruning.

CROPPING LEVEL

As young trees develop, crop load must be managed to balance the need for early production against the need for continued tree growth. If young trees are cropped too heavily, tree growth is reduced and alternate bearing is induced. Often an excessive third year crop can result in a very small crop in the fourth year, resulting in a significant financial loss. In several of our experiments, we have attempted to determine by trial and error the maximum number of fruits that could be allowed per tree without reducing tree growth or the next year's crop. With large caliper feathered trees which have had excellent tree growth in the first year, we have successfully carried up to 20 apples per tree in the second leaf and up to 70 apples per tree in the third leaf without reducing the fourth year crop or tree growth. Based on these results, we have proposed the following rules of thumb to guide growers in manipulating crop load of young trees. With feathered trees, allow a maximum of 15, 60 and 120 apples per tree in the second, third and fourth years, respectively. For unfeathered trees, allow a maximum of 5, 30 and 100 apples per tree in the second, third and fourth years, respectively. If tree growth was poor in the first year, the second year's crop should be sacrificed. After the second season, if tree size is less than desired, then the third year's crop should be reduced by 50%.

The difficulty in following the above recommendations is that young trees respond very erratically to chemical thinners. In some years, all of the fruits are removed by the chemical thinners. The need for early cropping to pay back the investment in the new orchard and the need to settle the trees into a balance between vegetative growth and cropping makes it essential to have a crop in the third and fourth years. The best way to ensure this crop is to hand thin during years 2 and 3 and then apply only a light dose of chemical thinner in year 4 and follow up with hand thinning to be sure the trees are not overcropped. By the fifth year, the trees should respond more predictably to chemical thinners.

PREPLANT SOIL PREPARATION, IRRIGATION, FERTILIZATION AND FERTIGATION

We have conducted three experiments where we have evaluate combinations of fertilization an trickle irrigation treatments. Experiment 1 was planted in 1986, Experiment 2 in 1987 and Experiment 3 in 1992. In each experiment we compared three fertilization treatments with and without trickle irrigation: 1) preplant fertilization only (lime, N, P, K, B); 2) preplant fertilization plus annual soil applied N, K, B; and 3) preplant fertilization plus annual N, K, Mg, B, Zn applied through the trickle irrigation system. The amount of fertilizer applied varied between years but was kept constant across treatments 2 and 3. The ground fertilizers were applied in 2-3 split applications spaced three weeks apart starting about April 1 while the fertigation nutrients were applied in 10 equal weekly increments starting in late April each year. Ammonium nitrate was the source of Nitrogen, Muriate of Potash was the source of Potassium, Epsom salt was the source of Magnesium, and Solubor was the source of Boron. Trickle irrigation water was applied to irrigation treatments when tensiometers reached 20 centibars. In addition, the 1992 experiment also compared two additional treatments: 1) preplant lime only (3 tons high mag lime/acre); and 2) preplant fertilization plus annual soil applied N, K, B plus annual foliar N, Zn, Mg, B.

The effect of preplant fertilization on tree performance was examined in Experiment 3. In general, the addition of preplant N, P, K, B improved tree growth and yield over the first three years compared to the lime only preplant treatment (Table 4). The improvement was greatest when trickle water was also applied (17% improvement in 3rd year yield). These results strongly support our recommendation to invest in preplant lime and fertilizer since that is the only time it can be plowed down during the life of the orchard.

All three experiments have shown that trickle irrigation increases shoot growth and TCA increase especially in the early years (Tables 4-6). Even after seven or eight years, irrigated trees were up to 36% larger than the unirrigated controls. Ground fertilization did not generally increase tree growth when no irrigation water was applied. In Experiments 1 and 2, the addition of ground applied fertilizers to the unirrigated plots significantly reduced shoot growth in the first and second year; however, with the addition of trickle irrigation water, ground fertilizers significantly improved tree growth compared to either the irrigated trees without fertilization or the unirrigated controls (Tables 5 and 6).

Another practice that had a positive effect on tree growth was fertigation. In most years, the fertigated trees had the greatest growth but often there was little difference between the fertigated trees and the water plus ground fertilizer trees (Tables 4-6). It appears that it was important to have both water and fertilizers to obtaining optimum tree growth but the method of fertilizer delivery was not important. Nevertheless after seven or eight years, the fertigated trees were the largest being 53% and 30% larger than the unirrigated controls in Experiments 1 and 2, respectively.

Trickle irrigation also had a significant effect on yield. In Experiment 1, trickle alone had only a small effect on yield in years 2-4 but since irrigation had increased tree growth during the early years, yields in later years were greater than controls (Table 5). In Experiments 2 and 3, there was a consistent improvement in yield in all years from trickle irrigation (Tables 4 and 6). Cumulative yield of irrigated trees was 18% greater after seven years than the unirrigated controls in Experiment 1 and 16% greater after eight years in Experiment 2. The addition of ground applied fertilizers without trickle irrigation in Experiment 1 increased yield in the second year but, because tree growth was reduced, there was no yield advantage in later years from ground fertilizers. However, if water was applied in conjunction with the ground fertilizer, then yield was improved considerably. Fertigation also tended to increase yield in both the early and later years. Cumulative yield over seven or eight years was increased 25-28% by fertigation compared to the unirrigated controls.

In the early years, fertigation gave slightly improved yield compared to the irrigated treatment with ground applied fertilizers. However, cumulative yield from fertigation in all three experiments was not statistically greater than the irrigation plus ground fertilizer treatment. In Experiment 1, the fertigation treatment had the greatest yield, while in Experiments 2 and 3, the irrigation plus ground fertilizer treatment had the greatest yield. This indicates that trickle irrigation aids in the utilization of applied fertilizers whether the fertilizers are soil applied or dissolved in the irrigation water.

Average fruit size was improved by trickle irrigation. When averaged over the six cropping years of this study, trickle irrigation alone increased fruit size by 3-6%, but when trickle irrigation was combined with ground fertilization or fertigation, fruit size was increased 6-18% (Table 7). Thus, there was little benefit from supplemental irrigation on fruit size unless it was accompanied by ground fertilizer or fertigation. The increases in fruit size from our study were similar to those of an earlier study in New York with sprinkler irrigation (Forshey and Dominick, 1965).

In Experiment 3, we also compared the effect of foliar micronutrient sprays on early tree performance (Table 4). The addition of foliar nutrient sprays of N, Zn, Mg and B did not improve tree growth or yield and in some cases reduced first year growth. A different result might have been obtained if the soil was lower in natural fertility.

PUTTING IT ALL TOGETHER

The combined effects of planting date, irrigation and fertilization showed that little improvement in tree performance could be obtained from added irrigation, fertilization or larger caliper trees when trees were planted late. However, when trees were planted early, the large caliper trees had greater yield in both unirrigated and irrigated treatments. The results also show that fertigation gave the greatest benefit when used in conjunction with early planting. With early planting, even small caliper trees performed well when they received fertigation. With late-planted trees, fertigation did not significantly improve performance. Taken together, the results of these three studies indicate trickle irrigation in the eastern United States can improve tree performance in the first few years after planting. The addition of ground-applied fertilizer or fertigation will improve tree growth even more, resulting in larger trees with a greater bearing capacity. The magnitude of the improvement in yields over the first six or seven years appears to justify the investment in trickle irrigation for humid climates such as New York's, especially in dwarf apple orchards where significant yields are expected in the second through fifth years. However, the economic benefit of fertigation versus ground-applied fertilizer with trickle irrigation is less clear and may not be justified based on the cumulative yields from our experiments to date. It may also be true that our method of fertigation or choice of fertilizers has minimized the potential improvement from fertigation. An interesting additional benefit from fertigation is the increase in fruit size. With small fruited varieties like 'Empire' this could greatly improve the economic benefit from fertigation.

The improvement in tree performance from trickle irrigation or fertigation can be expected to vary with soil type. The soils used in our studies were fine sandy loams with excellent fertility and water holding capacity. With a more droughty soil than ours, a greater difference between unirrigated trees and fertigated trees would be expected, while under heavier soil conditions, additional irrigation may not be beneficial and may in fact result in excess water and poorer tree performance in wet years. The benefit of trickle irrigation may also depend on the amount and frequency of natural rainfall in any given year. Nevertheless, with high density orchards, the improvement in early tree performance will help ensure the financial benefits of planting high tree densities.

PRACTICAL IMPLICATIONS

When considering the use of trickle irrigation in the northeastern United States, the following points can be gleaned from our experiences:

1) To maximize tree growth the first year, the trees should be planted as early as possible in the spring or the previous fall. This is especially true with large caliper trees which do poorly when planted late, even when they are fertigated.
2) The use of ground-applied fertilizers is enhanced with the addition of trickle irrigation. Without supplemental irrigation, we have shown no benefit of soil-applied fertilizers in the first few years if proper preplant land preparation is done. However, with trickle irrigation, ground fertilization increased yield and tree growth.
3) Trickle irrigation and fertigation have their largest impact on tree growth and yield in years 1-4 so should be installed in the first year. If the trickle system is not installed in the first year the loss of potential tree growth will necessarily limit early yields.
4) The application of water should begin about May 1 each year. If the application of water and fertigation is delayed until drought symptoms develop later in the year, much of the potential benefit of trickle irrigation will be lost. In our studies, in some years no irrigation water was applied in July and August due to wet summers, but the early season application of water and fertilizer in late May and June resulted in significantly greater tree growth than control trees.
5) Fertigation has its greatest impact with large caliper feathered trees which can be cropped heavily in the second and third years.

FURTHER QUESTIONS

Our studies have raised new questions and have not addressed other questions. For example, we do not know which specific fertilizers are important to obtain improved tree performance from fertigation. We have used a combination of N, K, Mg, B, and Zn in all of our fertigation treatments. In addition, we do not know what is the effect of timing of fertigation on tree performance or fruit quality. All of our fertigation treatments have been applied in the spring over the first 10 weeks of the season. It is likely that certain elements should be applied at specific times of the year to optimize their use. For example, we are currently studying whether late season applications of potassium will aid in fruit color development. Also, we have not compared microsprinklers to trickle irrigation nor have we studied the optimum frequency of trickle irrigation. We currently have initiated new experiments to address many of these questions. The results from these should help in refining the technology and benefits of trickle irrigation of apples in humid climates. Nevertheless, it does seem clear that performance and early profits can be improved with this technology.

LITERATURE CITED

Forshey, C. G. and B. A. Dominick. 1965. Irrigation of apples in the Hudson valley. *New York State Agricultural Experiment Station Bulletin 809*.

Gerling, W. D. 1981. An analysis of apple orchard replanting costs and potential profitability. *Cornell University Ag. Econ. Ext. Bulletin* 81-26.

Robinson, T. L. and W. C. Stiles. 1993. Fertigation of young apple trees to improve growth and cropping. *Compact Fruit Tree 26*:61-65.

Funding for this research was received from the New York State Apple Research and Development Program.

TABLE 1.
EFFECT OF PLANTING DATE ON TREE GROWTH AND YIELD OF 'REDCHIEF DELICIOUS'/MM.106 APPLE TREES OVER THE FIRST SEVEN YEARS.

	Total shoot length (% of control)							
Planting date	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**Cum.**
April 14 (control)	100 a[z]	100 a	100 a	100 a	100 a	100 a	—	100 a
June 10	53 b	78 b	97 a	97 a	90 a	93 a	—	88 a
	Yield (% of control)							
April 14 (control)	—	100 a	100 a	100 a	100 a	100 a	100 a	100 a
June 10	—	60 b	47 b	79 b	97 a	78 b	99 a	89 b

[z] Means within years followed by the same letter are not significantly different (P=0.05, n=4)

TABLE 2.
EFFECT OF INITIAL TREE CALIPER ON TREE GROWTH AND YIELD OF 'REDCHIEF DELICIOUS'/MM.106 APPLE TREES OVER THE FIRST SEVEN YEARS.

	Total shoot length (% of control)							
Initial tree caliper	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**Cum.**
1/4"	64	74	95	105	116	130	—	96
3/8"	72	83	98	108	105	131	—	99
1/2"	83	89	97	84	83	110	—	91
5/8" (control)	100	100	100	100	100	100	—	100
Regressions[z]	(+)	(+)	(+)	NS	(-)	(-)	—	(+)
	Yield (% of control)							
1/4"	—	59	64	80	96	84	101	91
3/8"	—	74	69	82	99	79	98	92
1/2"	—	72	87	90	96	80	101	94
5/8" (control)	—	100	100	100	100	100	100	100
Regressions[z]	—	(+)	(+)	(+)	NS	NS	NS	(+)

[z] (+), (-) or NS indicate the effect of initial tree caliper was significant with a positive slope, significant with a negative slope or nonsignificant (P=0.05, n=56).

TABLE 3.
EFFECT OF INITIAL FEATHERS ON TREE GROWTH AND YIELD OF 'REDCHIEF DELICIOUS'/M.7, 'MUTSU'/M.9/MM.106 AND 'EMPIRE'/M.9/MM.106 APPLE TREES OVER THE FIRST EIGHT YEARS.

	Total shoot length (% of control)								
Initial feathers	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**Cum.**
0 (Control)	100	100	100	100	100	100	100	100	100
3	98	113	101	101	94	98	105	98	100
6	99	122	106	105	89	100	99	101	103
Regressions[z]	NS	(+)	NS	NS	NS	NS	NS	NS	NS
	Yield (% of control)								
0 (control)	—	100	100	100	100	100	100	100	100
3	—	152	106	110	101	103	100	106	105
6	—	260	113	116	95	108	101	111	109
Regressions[z]	—	(+)	(+)	(+)	NS	NS	NS	(+)	(+)

[z] (+), (-) or NS indicate the effect of initial feathers was significant with a positive slope, significant with a negative slope or nonsignificant (P=0.05, n=106).

TABLE 4.
EFFECT OF IRRIGATION, FERTILIZATION AND FERTIGATION ON TREE GROWTH AND YIELD OF 'EMPIRE' APPLE TREES ON M.9 AND M.7 ROOTSTOCK OVER THE FIRST THREE YEARS.

Fertilization	Irrigation	TCA increase 1992-93	Total shoot yield length (% of control) 1992	1993	Yield efficiency 1994	Fruit size 1994
Preplant lime only (control)	None	100	100	100	100	100
	Trickle	114	117	114	105	106
Preplant lime + NPKB	None	105	103	108	103	106
	Trickle	116	115	117	107	105
Preplant + annual NKB	None	106	108	120	115	111
	Trickle	**128**	**135**	**138**	**117**	112
Preplant + annual NKB + foliar	None	105	94	114	111	110
	Trickle	117	112	116	105	**113**
Preplant + fertigation	Trickle	115	129	116	107	110
LSD[z]		8	16	18	16	5

[z] Least significant difference between means in a column (P=0.05, n=4).

TABLE 5.
EFFECT OF IRRIGATION, FERTILIZATION AND FERTIGATION ON TREE GROWTH AND YIELD OF 'REDCHIEF DELICIOUS'/MM.106 APPLE TREES OVER THE FIRST SEVEN YEARS.

Fertilization	Irrigation	1986	1987	1988	1989	1990	1991	1992	Cum.
		Total shoot length (% of control)							
Preplant NPK (control)	None	100 b[z]	100 bc	100 b	100 b	100 b	100 b	—	100 bc
	Trickle	**127 a**	148 a	132 a	145 a	127 ab	94 b	—	136 ab
Preplant + annual NKB	None	63 c	82 c	90 c	104 b	141 ab	178 b	—	98 c
	Trickle	78 c	116 b	122 ab	152 a	163 ab	239 a	—	136 ab
Preplant + fertigation	Trickle	111 ab	**149 a**	**148 a**	**159 a**	**171 a**	**297 a**	—	**153 a**
		Yield (% of control)							
Preplant NPK (control)	None	—	100 b	100 b	100 ab	100 b	100 ab	100 b	100 b
	Trickle	—	92 b	112 ab	**106 a**	127 a	**103 a**	124 ab	118 ab
Preplant + annual NKB	None	—	**222 a**	74 b	79 ab	109 b	82 ab	112 b	99 b
	Trickle	—	208 a	82 b	74 b	129 a	85 ab	125 ab	110 ab
Preplant + fertigation	Trickle	—	197 a	**140 a**	83 ab	**150 a**	72 b	**147 a**	**125 a**

[z] Means within years followed by the same letter are not significantly different (P=0.05, n=4).

TABLE 6.
EFFECT OF IRRIGATION, FERTILIZATION AND FERTIGATION ON TREE GROWTH AND YIELD OF 'REDCHIEF DELICIOUS'/M.7, 'MUTSU'/M.9/MM.106 AND 'EMPIRE'/M.9/MM.106 APPLE TREES OVER THE FIRST EIGHT YEARS.

Fertilization	Irrigation	1987	1988	1989	1990	1991	1992	1993	1994	Cum.
		Total shoot length (% of control)								
Preplant NPK (control)	None	100 ab[z]	100 bc	100 ab	100 a	100 a	100 b	100 b	100 a	100 ab
	Trickle	**136 a**	139 a	128 a	105 a	82 a	99 b	98 b	105 a	108 ab
Preplant + annual NKB	None	76 c	82 c	88 b	85 a	88 a	115 ab	116 b	87 a	94 b
	Trickle	127 a	**143 a**	128 a	123 a	108 a	153 ab	137 ab	99 a	127 ab
Preplant + fertigation	Trickle	132 a	127 ab	**131 a**	**127 a**	**112 a**	**180 a**	**175 a**	**108 a**	**130 a**
		Yield (% of control)								
Preplant NPK (control)	None	—	100 c	100 b	100 bc	100 b	100 ab	100 b	100 b	100 c
	Trickle	—	178 bc	121 ab	111 ab	131 ab	118 a	102 b	107 b	116 bc
Preplant + annual NKB	None	—	225 bc	105 ab	80 c	100 b	80 b	157 a	106 b	100 c
	Trickle	—	308 ab	136 ab	**126 a**	**154 a**	**128 a**	**168 a**	**134 a**	**138 a**
Preplant + fertigation	Trickle	—	**483 a**	**150 a**	114 ab	153 a	98 ab	151 a	131 a	128 ab

[z] Means within years followed by the same letter are not significantly different (P=0.05, n=4).

TABLE 7.
EFFECT OF IRRIGATION, FERTILIZER AND FERTIGATION ON AVERAGE FRUIT SIZE OF 'REDCHIEF DELICIOUS'/MM.106 APPLE TREES (EXPERIMENT 1) AND 'REDCHIEF DELICIOUS'/M.7, 'MUTSU'/M.9/MM.106 AND 'EMPIRE'/M.9/MM.106 APPLE TREES (EXPERIMENT 2).

		Average fruit size (%) of control	
Fertilization	**Irrigation**	**Experiment 1 (1987-1992)**	**Experiment 2 (1989-1994)**
Preplant NPK (control)	None	100 c[z]	100 bc
	Trickle	106 b	103 ab
Preplant + annual NKB	None	114 a	98 c
	Trickle	114 a	105 a
Preplant + fertigation	Trickle	**118 a**	**106 a**

[z] Means within experiments followed by the same letter are not significantly different ($P=0.05$, $n=4$).

1996 IDFTA BOARD OF DIRECTORS

The 39th annual IDFTA conference in Penticton, B.C., was presided over by President Darrel Oakes, Lyndonville, NY, and Vice President Dennis Courtier, Lake City, MN. In 1996 each is serving the second year of 2-year terms. At the 39th conference, two new members were elected to the Board of Directors: Bennett Saunders, Roseland, VA, and Ken Hall, Poplar Grove, IL. Leaving the board after dedicated service were Tim Mercier, Blue Ridge, GA, and Dennis Courtier, Lake City, MN. Dennis will continue to attend board meetings as vice president.

Tom Auvil
HC 78, Box 13
Orondo, WA 98843
Phone: 509 682-2591
FAX: 509 682-2651

Steve H. Blizzard
Logoluso Farms
7567 Road 28
Madera, CA 93637
Phone: 209 674-8897 office
Phone: 209 227-5834 (Fresno)
FAX: 209 674-5384 FAX

Joseph T. Burnham
Burnham Orchards
8019 State Route 113
Berlin Heights, OH 44814
Phone: 419 588-2138

Dennis Courtier
(Vice President)
Pepin Heights Orchard, Inc
Route 4, Box 18
Lake City, MN 55041
Phone: 612 345-2305
FAX: 612 345-4949

Jim Hughes
Hughes Orchards
R. R. 4
Picton, Ont.
CANADA K0K 2T0
Phone: 613 476-6458

Steve Klackle
Klackle Orchards
11466 W. Carson City Road
Greenville, MI 48838
Phone: 616 754-9223

James J. Lott
1230 Idaville-York Springs Rd.
Gardners, PA 17324
Phone: 717 528-4615

Ken Hall
7061 Centerville Road
Poplar Grove, IL 61065
Phone: 815 765-2234
FAX: 815 765-1072

Gary Mount
330 Cold Soil Rd
Princeton, NJ 08540
Phone: 609 924-2310
FAX: 609 924-8569

Darrel Oakes (President)
Lynoaken Farms
174 S. Main St
Lyndonville, NY 14098
Phone and FAX: 716 765-2046

Robert F. Petch
464 Frontier Street
Hemmingford, Quebec
Canada J0L 1H0
Phone: 514 247-2032

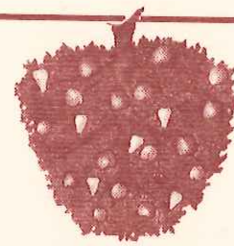
Bennett Saunders
HCR 61, Box 27
Roseland, VA 22967
Phone: 804 277-5199 home
FAX: 804 277-8010

Harold Thome
2137 7-Mile Rd., N.W.
Comstock Park, MI 49321
Phone: 616 784-1009
FAX: 616 785-0724

Jake van Westen
R.R. #1
Naramata, B.C.
CANADA V0H 1N0
Phone: 604 496-5434 home
FAX: 604 496-5434

Fritz Wafler
Wafler Nurseries
RD-2, 10662 Slaght Road
Wolcott, NY 14590
Phone: 315 594-2649
FAX: 315 594-8829

Kent Waliser
Wells and Wade Fruit co.
P.O. Box 259
Wenatchee, WA 98807-0259
Phone: 509 886-0440
FAX: 509 884-6690



IDFTA CALENDAR

February 23-26, 1997

40th Annual IDFTA Conference, Rochester, New York

October 28 - November 12, 1997

IDFTA Japan Tree Fruit Study Tour and the World Fuji Summit, Nagano, Japan

February 22-26, 1998

41st Annual IDFTA Conference, Pasco, Washington

International Dwarf Fruit Tree Association

COMPACT NEWS
14 South Main Street
Middleburg, PA 17842

MIDDLEBURG PA.
JUN 24'96
U.S. POSTAGE
.32
P.B. METER
7604787

275
WALLACE E. HEUSER
SUMMIT SALES
55826 60TH AVE
LAWRENCE, MI 49064
USA