NEW YORK FRUIT QUARTERLY
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Editorial
Strategic Planning Initiative

As part of the strategic planning initiative approved at the statewide grower meeting held in Syracuse in January, a committee was formed to address the current and future status of new varieties in New York State. The committee was charged, "to aid the development and testing of new varieties of apples and to publish a list of recommended varieties." An initial meeting was held in March in Little Falls to start organizing this committee. Several issues were discussed: the need to find varieties adapted to our production regions, the need for consumer and market feedback early in a variety's development, the proper role of strains and their selection, the ability to achieve sufficient production to provide for proper marketing, and methods for assisting the Cornell breeding program with future introductions.

It is clear that new varieties will continue to drive the marketing of apples worldwide. The group felt that the New York State apple industry needs to find ways to stay on the cutting edge of new variety identification and introduction. Producers and marketers also need an organized effort to introduce new, exciting and, hopefully, profitable varieties to the end consumer.

We envision several strategies to accomplish these goals: (1) By identifying existing grower trials and evaluating fruit from these trials not only for its horticultural characteristics but also for its potential viability in the market place, (2) by using existing grower trials to quickly identify strains that may have distinct advantages for the various fruit regions in New York, (3) by gleaning the data from existing organized testing through the Northeast Apple Variety program (NE183) in which Cornell University participates with three locations in the state, (4) by establishing a similar effort in at least three new geographically and climatically distinct apple producing regions, and (5) by publishing the results of these trials so the entire industry can make planting decisions about those varieties that make the most sense for their regions and our markets.

In the near future, the Horticultural Society Variety Committee will be sending out a survey that attempts to identify new varieties and strains that growers have under test. This effort will attempt to gather as much information as quickly and efficiently as possible. We heartily encourage every grower's participation by returning these surveys as soon as possible. Additionally, we welcome your suggestions for improvement and the identification of other needs that can be met by this program. If you would like to discuss this further, please call me at 716 765-2046.

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ABOUT THE COVERS

Front cover: Fruit samples of two new, freestone, Cornell-bred processing plum selections that will be named and released in the autumn of 2001. The tree in the background close-up is NY 6, which is spreading and medium in vigor.

Back cover: The health benefits of apples are well known but just beginning to be explored. See inside for the exciting details! PHOTO CREDIT: M. Weller, Agricultural Research Service, USDA.

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This publication is a joint effort of the New York State Horticultural Society, Cornell University's New York State Agricultural Experiment Station at Geneva, and the New York State Apple Research and Development Program.

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Plum Variety Picks for New York

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These plum varieties are recommended for planting in New York. Field evaluation and pilot processing tests were done at Geneva. Many other selection that failed these tests are not listed. These recommended varieties are available from commercial nursery sources or the Geneva Station's stone fruit program.

The recommended European and Japanese type plum cultivars for New York conditions are listed in order of maturity in 4 categories: (1) JAPANESE, (2) BLUE EUROPEAN, (3) GAGE, and (4) DAMSONS, MIRABELLES, and BULLACES. This article gives a brief characterization of the general attributes of each broad category. Cornell Cooperative Extension and the New York State Agricultural Experiment Station have conducted field evaluations and pilot processing tests on nearly all of these along with hundreds of other less desirable ones that are not listed. Most of the recommended varieties are available from commercial nursery sources. If you can't find a nursery source, the stone fruit program at the Geneva Station will provide the nursery of your choice with a limited supply of virus indexed budwood so that you can contract with the nursery to grow trees specifically for your needs. Contact the program at 315-787-2235 for more information.

Japanese Plum Types

Japanese plums bloom earlier than any other stone fruit crop making them more frost susceptible, and their trees are generally less tolerant to dormant cold than most European plums. This list spans a harvest period of 7- 8 weeks from mid-July to mid-September.

Ohishi Wasi – the earliest ripening plum at Geneva and one with a long history of success in Japan and Korea. Fruit is larger than that of Early Golden. Tree is hardy enough to be grown in New York if peach trees flourish on the site. It has a blushed red cheek over golden ground color and good eating quality for this early season. Self-incompatible.

Early Golden – a mid-July plum in Geneva. It is well known in the Great Lakes region as one of hardiest trees and will produce regularly in cold climates and with harvest starting before Methley or Shiro. It needs multiple pickings and gets very little blush. It has a bland flavor if overset. Biennial fruiting pattern is common if over-cropped. It requires pollination and Burbank, Ozark Premier, Shiro, and Vanier all pollinate it well.

Methley – This round purple plum with red flesh and small to medium size fruit ripens between Early Golden and Shiro. Quality is mediocre and some people find the flavor objectionable, particularly the bitterness in the skin. It is self-fertile and is hardy. It needs multiple pickings. *It is of doubtful value for farmstands that wish to emphasize high quality.*

Early Magic™ – This new sport, possibly of Santa Rosa, was found in Niagara County, NY and is offered for trial by Hilltop Nursery, Hartford, MI. It has outstanding fruit color (bright red/purple with golden flesh), taste and texture are both very good for an early plum, and handling characteristics are good. We do not know if the tree is hardier than the Santa Rosa (which is marginal for many sites in New York). Although we know cross pollination is necessary we do not know which specific pollinators will work. It has set crops very well when Ozark Premier, NY 1502, and Fortune are its closest neighbors in trials in Geneva.

Shiro – ripens 10 to 12 days after Early Golden in Geneva. It is well known as a hardy all-yellow fruited type. It is self-incompatible. Burbank, Methley, Vanier, and probably Obilinaya will pollinate this variety.

Obilinaya – We have limited experience with this hybrid from the former USSR. It has outstanding fruit size, a beautiful red-purple appearance with bright red flesh under the skin and golden flesh around the pit. The tree is very hardy and an extremely heavy cropper. It will mature fruit that are uniformly nearly 2 inches with good flavor. It ripens between Methley and Shiro. We have no pollination data for it yet.

Ozark Premier – This hardy, spreading tree is often biennial in its cropping pattern. Its fruit is very large and well colored with good flavor when it is thinned. It requires pollination, and Early Golden will not pollinate it. Vanier and Myrobolan rootstock are both excellent pollinators for it. Obilinaya probably is, too, because of its parentage being one-half Myrobolan.

Burbank – This hardy, dependably cropping old variety is valuable as a pollenizer in any Japanese-type plum orchard. It needs careful hand thinning in most seasons to make adequate fruit size. This red skinned variety with yellow flesh has good flavor if not too heavily cropped. The fruit ripens in late August in Geneva. It is self-incompatible, but is good pollenizer for many other varieties.

Vanier – This hardy, upright growing tree sets an adequate crop of firm, bright

Violette, recently released from the Vineland breeding program, is very attractive, crops regularly and appears to be frost tolerant.

red over golden ground color fruit with yellow flesh. It is medium sized, similar to Shiro. It is self-incompatible and ripens with Burbank between Ozark Premier and Fortune. It hangs on the tree and stores very well. It is pollinated readily by Burbank and Ozark Premier.

Fortune – This variety produces the largest fruit of varieties listed here. It has red/purple skin with yellow flesh and ripens about Labor Day in Geneva. The tree is vigorous and somewhat upright similar to Ohishi Wasi in hardiness. It should not be tried in regions that do not have success growing most peach varieties. It is self-incompatible and is pollinated well by Burbank.

European Blue Plum Types

This group of blue and purple/blue plums formerly known as "prunes" spans a 10-week ripening period from mid-July to late September. Many shapes, flavors, and textures are represented. Good eating quality, regular cropping, and good tree longevity were the primary traits used as a basis for their recommendation.

Ruth Gerstetter – This variety is popular in some parts of Europe as one of the first high quality blue plums of the season.

Ersinger – This "German Prune" style of fruit (meaning that it is oblong to oblong-pointed and has blue skin) has excellent flavor! It ripens in July at Geneva with Earliblue and Ruth Gerstetter. It crops heavily and retains its flavor very well but is not firm enough to ship.

Earliblue – is similar to Ersinger in size and shape but has a darker blue color and a slightly blander flavor. It is not firm enough to ship.

California Blue – is a round, medium large, unevenly shaped blue plum that sizes well but tends to drop. It ripens 3 days after Shiro. Flavor is satisfactory, but uneven maturity and drop may make it troublesome to grow.

Valorie – was recently released from the Vineland, Ontario program. It ripens with California Blue and is about 3 days after Shiro. It is self-incompatible and pollenized by Vanette and Valor. This variety is firm enough to pack and ship to wholesale markets.

Vanette – was recently released from the Vineland, Ontario program. It ripens in early August in Geneva. This blue plum with a nice flavor can over-set and be small. It requires pollination; both Stanley and Valor are suitable. This variety does not drop. Vanette will pollinate Valorie but Valorie won't pollinate Vanette.

NY 9 plum selection's tree is pictured in a fourth leaf, semi-commercial trial in Michigan. Its tree is more vigorous and less spreading than that of NY 6, making it somewhat less precocious in early cropping but higher yielding in mature orchards and well suited to shake-and-catch mechanical harvesting

Voyageur – This round-oblong shaped fruited variety with sky-blue color (due to heavy covering of waxy bloom that gives fruit a distinctive appearance). It ripens shortly before Early Italian and Caslteton™. It crops abundantly and regularly but has some tendency to drop, and it softens more quickly than Castleton™ and Early Italian. It is self-compatible and is a good pollenizer for Early Italian. It has good eating quality. It is firm enough to pack and ship to wholesale markets.

Early Italian – This well-known variety of blue plum is also known as "Early Fellenberg" and has outstanding fruit quality. It is not self-fertile and sets lighter crops than Castleton™. This variety is firm enough to pack and ship to wholesale markets.

Castleton™ – This new release from Cornell sets exceptionally heavy crops of dark blue-purple plums that are very uniform in size and appearance. They are excellent for fresh use but color early and are often picked before really ready. This variety should replace Early Italian. It is self-fertile and heavier yielding. The tree is moderately vigorous and should be grafted on full vigor rootstock like Myrobolan or one of the Marianna stocks. This variety is firm enough to pack and ship to wholesale markets.

Violette – This recently released selection from Vineland, Ontario, has a very attractive sky-blue fruit with a long oval shape. Tree crops regularly, yields well, and is proving to be frost tolerant. Fruit ripens the last days of August at Geneva, ahead of Seneca and about with NY6. Eating quality is mediocre, but the fruit is firm and well-suited for packing and shipping.

Seneca – This variety was released by Cornell in 1972. The fruit has a maroon/purple skin color, oblong shape with size often one and a half inches thick and two inches long. Its eating quality is unsurpassed! Pollination is required. This variety is firm enough to pack and ship to wholesale markets.

NY 6 – This Cornell breeding selection is currently being tested for possible release. It is dual purpose ripening before Stanley and Italian Prune and crops regularly and heavily. Fruit size is larger than its sister, Castleton™, but can be bland when it crops most heavily. Infant food trials have been exceptionally favorable compared to Stanley because of better color retention in the processed products. It is partially self-fertile.

Longjohn – This 1993 Cornell release is now gaining a reputation for regular crops of very oblong, blue fruit that have very good quality and texture. The tree is more vigorous than Stanley and tends to self-thin and achieves uniform fruit size. A pollinator is required. Longjohn's fruit is firm and well-suited for packing and shipping.

NY 9 – This Cornell selection is being tested as a possible Stanley replacement for dual purpose uses. Its pit is free and non-shattering. Fruit quality is exceptionally good for both fresh and processing. Yield, size, and ripening times are all similar to Stanley. The tree is more upright and more vigorous than Stanley or NY 6 and it is self-fertile. This variety is firm enough to pack and ship to wholesale markets.

Autumn Sweet – This variety, recently released by Washington State University, easily surpasses the yield and fruit quality of Italian Prune. It is partially self-fer

tile and always sets well in Geneva in the company of Stanley and NY 9. Autumn Sweet's fruit is firm and well-suited for packing and shipping.

Italian Prune – This very well established variety is also known as Fellenberg. It has been an important variety with diverse uses including fresh, canning, and drying. Light fruit set in New York limits its value in New York. Autumn Sweet seems much better. This variety's fruit is firm and well-suited for packing and shipping.

Valor – is a large, blue skinned variety with amber flesh of good eating quality. It ripens early in the third week of September in Geneva. The tree crops regularly, is somewhat thorny, and has moderate vigor with a spreading habit. It is self-incompatible but is effectively pollinized by Stanley and Italian Prune. This variety's fruit is firm and well suited for packing and shipping.

Empress – Fruit is large, oval to pointed, and oblong with dark blue skin. It is free to partially freestone and non-shattering. The neck shrinks in droughty seasons and can prematurely break down. In most seasons, it is the best fresh market packing plum in Geneva's trials. The tree is vigorous, somewhat upright, and regularly productive if pollinized well. It is self-incompatible and can be pollenized by Stanley, Victory, Moyer, and French Prune. Undoubtedly, there are many other blue plums that are also suitable pollenizers. Empress blooms mid to late and ripens in late September in Geneva. This variety's fruit is firm and well suited for packing and shipping.

Greengage Plums Types

These are also known as **Reine Claude**-types and date back to their introduction from Armenia into France about 1500 A.D. Usually they have small, round, generally green, yellow, or blushed fruit with special flavors/aromas that are highly prized by connoisseurs. Usually, they have softer flesh texture than most other European-type plums. It is their distinct Gage-flavor that sets them apart as a category of unique plums.

Oullins Gage – These 1-1/2 inch fruit have yellow skin and flesh. The flavor is very good yet not as aromatic as Greengage. Trees are highly productive and not prone to biennial bearing. It is more vigorous than Greengage, Stanley or Italian Prune. It blooms later than most Gage plums and is self-fertile. Brown rot can be a serious problem if multiple pickings are not strictly made to keep ripe clusters open.

Greengage – This variety originally called Reine Claude, which dates back to the 1500s in France, was renamed Greengage after the Englishman Mr. Gage who imported it from France. It is partially self-fertile and well pollinated by Oullins Gage. The fruit has green skin that turns slightly yellow when tree ripe. Its flavor is considered outstanding by fresh plum connoisseurs. Brown rot can be a serious problem if multiple pickings are not strictly made to keep ripe clusters open.

NY 101 – This Cornell selection is being tested for possible release. This green-yellow plum has exceptionally high sugar content and flavor. It ripens just after Oullins and has a pink/rosy colored blush in most seasons. The tree crops very heavily and retains high quality even with enormous fruit loads. Fruits tend to hide in the foliage, which is abundant on this spreading, but vigorous tree. The tree is brown rot and black knot susceptible. We believe that the fruit quality of this variety is worthy of grower-cooperator trials to see how much of a limitation these susceptibilities are. It is self-incompatible and is readily pollinized by Vanette, Rhine Claude Conducta, Oullins, Polly, and Demontfort.

Reine Claude Conducta – This pink/purple skinned plum with high quality amber flesh is somewhat crisp and very sweet. It ripens with Early Italian and Castleton™ and sets lighter crops than the other gage-types listed above. This plum is so unusual in quality and color that every farm stand should have it. It is self-incompatible and is pollinized by Oullins.

Mirabelles, Damsons, and Bullace

This category of plums includes varieties that are increasingly of interest on two marketing fronts: wine/brandy and fresh snack-foods. While these two uses may seem unusually different to be utilizing the same varieties, the common factor is a very high sugar content with unique aroma or "nose" in wine/brandy terms. An additional common factor is that the Old World names of varieties may increase the marketability of these fruit. For example Herrenhausen Mirabelle has a definite Germanic origin.

French Damson – This processing plum is used for its intense purple pigments and strong flavor that is too astringent for fresh market use. It is usually blended into processed products. Fruit is small and round with blue skin and green flesh. It ripens in early September in Geneva. There are over a dozen other varieties of blue damson plums and another whole group of yellow and green skinned kinds that have generally been called "Bullace Plums" in the European literature. All have the strong flavor and none are self-compatible. Other Mirablelle varieties and other blue skinned plums from European ancestry will pollinate them.

Herrenhausen Mirabelle – This maroon/purple skinned plum has green/amber flesh that often exceeds 25 percent soluble solids when tree ripe. The round-oblong fruit averages about 1 inch in diameter. Its texture is somewhat crisp when eaten at best fresh market maturity level. It stores very well with sugar increasing in storage. The fruit ripens in mid-September in Geneva. It is self-incompatible and pollinized effectively by French Damson and Castleton™.

Gras Ameliorat – This round-oblong fruit averages about 1 inch in diameter and is red over a golden ground color. The texture is somewhat more coarse than that of Herrenhausen Mirabelle but is still very pleasing with excellent flavor and high sugar levels. Pollenization requirements are not clear, but it is not self-compatible. This variety is firm enough to store and ship to commercial markets.

American Mirabelle – This variety has golden skin with a 20 percent pink blush. Fruit is very slightly necked. The tree crops very heavily and will become biennial. Primary uses are for jam and wine/brandy. It ripens in early September in Geneva. It is self-incompatible and is pollenized well by French Damson and Castleton™.

NY 858 – This Cornell breeding selection is being tested for possible release. It is similar to American Mirabelle except it is round and somewhat later in maturity season. It is self-incompatible and pollinized well by French Damson and Castleton™.

Mirabelle de Metz – This variety is extensively used in Europe for production of high value brandy. It is not currently available as budwood from the Geneva Station.

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Managing Risk: What Did We Learn in 2000 Regarding the Decision to Harvest Hail Damaged Apples?

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Making decisions about handling a crop that has incurred major hail damage is difficult at best. Be sure to make a damage assessment on a block by block basis, consider marketing alternatives available to the individual grower, and re-evaluate insurance options as a means of reducing risk.

Hail damage affected an estimated 7,453 acres in Ulster, Columbia, Dutchess, and Orange Counties in 2000. Major hail events occurred in May, June, and again in August with some orchards being affected twice. Many growers faced the decision as to whether to harvest these blocks for fresh utilization, harvest for juice, or to leave the fruit unharvested.

Cornell Cooperative Extension conducted damage assessments for the region following the May storm. Initial estimates from a grower survey indicated a loss of more than 2 million bushels of fruit, valued at $19.8 million.

The purpose of this article is to conduct a retrospective analysis of the decisions that growers made this past crop year regarding harvesting hail damaged fruit. The emphasis of the article is to analyze what lessons were learned from the 2000 experience that will help growers make a better decision in the future when faced with the decision about how to handle a crop that has experienced significant hail damage.

The economic decision rule in the case of crop damage from hail or other natural disasters is simple. The grower needs to attempt to minimize subsequent losses. Thus, the economic decision is to harvest only if the expected receipts from sale of the fruit exceeds the direct expenses for the remainder of the season. Fixed costs, such as depreciation, interest, and property taxes are irrelevant to the decision, as are "sunk costs" such as fertilizer, sprays, and pruning and tree training that occurred prior to the storm. Even harvesting labor costs, such as housing and transportation of workers, would have been irrelevant to the decision—unless damage on a particular farm was so widespread that the appropriate decision after the first storm was to "walk away" from the total crop so that no labor would be brought to the farm for the 2000 season. As long as some labor was necessary for the farm, only the direct harvesting costs for labor were relevant to the decision for a particular block.

By the time most growers got around to considering the harvest decision, many spray applications and other orchard operations had already occurred. It was still necessary to apply 1 or 2 additional late season sprays for maggot. Summer pruning often needed to be done where harvestable fruit was still present. This practice helped reduce dormant pruning next season. By far the greatest remaining expense that growers faced was the cost of harvesting to include direct labor expenses as well as bin placement, and loading and hauling to the storage, packing house, or processor.

In early August 2000, we published a newsletter designed to help growers make the economic decision about whether to harvest hail-damaged fruit for fresh marketing, for juice, or whether to abandon the orchard. There were two components to the decision: (1) sampling blocks to estimate damaged fruit, and (2) calculating expenses remaining for the rest of the season and expected receipts for the fruit. The following is a summary of that article.

Figure 1. Hail damage to Empire fruitlets that occurred in mid-May 2000.

Sampling to Estimate Hail Damage

The most difficult part in applying the economic decision rule is an estimation of the expected revenue of the crop. We suggested that growers start with an estimation of hail damage in each block. The economic decision had to be made on a block-by-block basis. A "windshield survey" is not sufficient. We recommended that growers sample at least 10 trees in each block by imagining an X running diagonally from the corners of the block. Five representative trees from each axis of the X were sampled by choosing 2 limbs on each tree (one on the east and one on the west side) and inspecting all the apples on each of these limbs.

Limbs were alternated with some limbs sampled from the bottom of the tree, some from the middle, and some from near the top. The number of damaged apples divided by the total multiplied by 100 gave the percentage of crop loss from the entire block.

Harvesting for Fresh Utilization

In the newsletter, we suggested that if the sampling procedure indicated that 30 percent or less of the fruit had hail damage, the grower might consider spot picking for fresh fruit utilization. It was necessary to estimate how many bushels would be picked and what price the spot picked apples would bring in order to estimate expected revenue.

We prepared an example that illustrated how to apply the decision criterion for harvesting blocks that were damaged by hail when sampling indicated that 30 percent of the fruit was damaged (White and Fargione). This example indicated a $1,123 per acre advantage from harvesting. This amount of money helps to offset fixed costs (depreciation, interest, insurance, and property taxes), orchard operations (dormant pruning, spraying, etc.) and labor costs (transportation and housing) that had already been incurred for the season. The example suggested that the 30 percent criterion may have been too conservative—that there were situations where higher damage levels would still return greater expected receipts than expenses.

However, we noted in the article that some cautions were in order before adopting a higher threshold for damage. The example, with 35 percent packed into the highest grade (cell pack, extra fancy), may not always be realized. Prices of $16 for cell packs, $10 for bagged apples, and 3.5 cents for juice could easily be above the market, given the low prices of recent years. (In fact, some growers reported that prices for apples received for the 2000 season were indeed below their before-harvest estimates due to unanticipated marketing conditions.) Finally, we noted a tendency, based upon a very limited number of observations in previous seasons in Western New York, for growers to over-estimate the packout from blocks that had been hit by hail. Most of the hail-damaged fruit is on the exterior of the canopy where the highest quality fruit is normally produced. Fruit from the interior of the tree is often lower quality. With even the best spot picking, some damaged fruit will make it to the packing line. Some blocks are likely to pack out at only 50 percent. This low packout would turn the positive net return into a negative one in the example that we constructed.

Harvesting for Juice

In the newsletter, we suggested that growers consider selling the whole block for juice if more than 30 percent of the apples were hail damaged. If a grower did not have an immediate juice market in mind, we warned that storing juice apples would be extremely risky given the potential oversupply of juice apples in the Hudson Valley, as well as hail-damaged fruit from Western New York.

We also constructed a second example based on bulk loading of apples into transportation provided by a juice processor (White and Fargione).

This example, with a juice price of 3.5 cents per pound, yielded a net return of $353 to apply against fixed and operating costs already incurred. In this scenario, there were not enough net receipts to pay for storage given the assumed yield of 700 bushels and usual commercial storage rates.

Although the general recommendation is not to store fruit marketed for juice, growers with their own storage asked about the economics of storing in their own facility. The decision to store fruit from hail damaged orchards should not be made lightly. We suggested that growers with storage facilities would probably be better off leaving their storage rooms empty because the operating costs for storage (estimated at about 53 cents per bushel) would cost more than the $353 net return derived in the above example. Fruit needed to be sold or processed immediately to give the positive net return at a juice price of 3.5 cents.

Figure 2. Stonefruit and pears were also affected by hail in the Hudson Valley. Early damage resulted in lost crop, and scarred and dented fruit at harvest. Late season hail resulted in cut fruit that rapidly rotted.

Other Considerations

These examples also assumed that juice apples could be picked for a lower rate than spot picked fresh fruit (we used labor rates of 60 cents for juice and 89 cents for spot picked fresh fruit). These differential rates may have been a problem for some labor crews.

Growers could easily end up making the wrong decision regarding harvesting for fresh utilization—storing fruit that does not grade high enough to justify the storage costs of off-farm storage—because of the difficulty involved in accurately estimating the packout of hail damaged fruit.

Follow-up Survey

In January 2001, we surveyed growers that suffered hail damage. The survey was designed to determine how growers used the information published in the Hudson Valley Tree Fruit Newsletter (White and Fargione) to make decisions about hail-damaged fruit. We also asked questions about how they marketed hail-damaged fruit, prices received for hail-damaged

TABLE 1

Effect of hail damage on the utilization of fruit in the Hudson Valley in 2000 – survey response from 28 growers.

	28 Farms	% of Crop	Average per Farm
Estimated marketable crop if no hail damage (1,000 Bu.)	2,251.3	100.0	80.4
Utilization of crop hit by hail (1,000 Bu)			
Unharvested	574.4	25.5	20.5
Harvested for peelers	18.5	0.8	0.7
Harvested for juice	435.9	19.4	15.6
Dumped	58.4	2.6	2.1
Total bu. affected by hail	**1,087.2**	**48.3**	**38.8**

fruit, and how growers handled pest management and cultural practices in abandoned blocks. Finally, we asked growers what they learned from the 2000 experience with hail, and what decisions they would make differently if they faced the same situation again. The survey was mailed to 62 growers. We received 30 returned surveys, for a 48 percent response rate. Twenty-three of the respondents stored their own fruit. Twenty-one had their own packing lines.

Twenty-eight of the respondents provided usable estimates of their production and utilization for the 2000 season. Table 1 indicates that the 28 respondents who provided usable figures estimated that their total marketable crop would have been 2.251 million bushels if no hail had occurred. The total utilization that was affected by hail was estimated at 1.087 million bushels, or 48 percent of the estimated marketable crop. One quarter of the estimated marketable crop was not harvested, less than 1 percent was sold for peelers, 19 percent was sold for juice, and nearly 3 percent was dumped.

Assuming the same level of damage occurred for other farms known to have been hit by hail in the four-county region, and assuming a total harvest of about 6.5 million bushels (average production for the four-county region over the past 3 years), hail damage would have resulted in 1.8 million bushels either not harvested or dumped, a figure that is remarkably close to the 2.1 million bushel yield loss which was initially estimated by Cornell Cooperative Extension following the May storm.

Growers used a variety of markets for hail-damaged fruit. The most frequently cited markets were New York juice processors (used by 15 respondents); out of state juice processors (11 respondents); and local cider mills (11 respondents). Probably fortunately from a marketing standpoint, no growers indicated that a hail grade pack was used to market fruit. The price received for hail damaged juice apples averaged about 3.8 cents per pound, with a range from 3-6 cents/pound.

Growers were asked under what circumstances they would harvest hail damaged fruit in the future. Since this was an open-ended question, a variety of responses was received. A typical response (mentioned by 13 respondents) was that they would harvest for juice if juice prices were relatively high (4-6 cents and above). Five respondents indicated they would never harvest hail-damaged fruit for juice. On the other hand, one grower indicated he would always harvest hail-damaged fruit to reduce vole damage.

Table 2 indicates the practices used by growers to mitigate damage or economic losses from hail. Eighty percent of growers conducted some type of damage assessment. Clearly, respondents rated this as an effective practice. Comments included that the practice helped them to walk away from damaged blocks (3 responses), let them learn the extent of damage (5 responses), and helped to decide whether to thin or harvest specific blocks.

Half of the growers tried to estimate remaining costs and receipts in order to make decisions, and only 3 thought it was effective. Growers noted that they could only make rough estimates, and that they did not have a good estimate of prices early enough to make a decision about harvesting.

Slightly over half of respondents abandoned blocks before harvesting, and about half of those thought this was an effective practice. Comments indicated that money was saved on sprays and labor and other items. Another indicated (as other growers indicated in other parts of the survey) that having crop insurance dictated the decision for them because proceeds from sale of the crop would be deducted from the insurance proceeds. (Note: New crop insurance options for 2001 do not penalize growers for salvaging their crop.) Two respondents indicated that they were concerned that if they abandoned blocks this year, there was greater potential for pests next year.

Another effective practice was hand thinning of hail-damaged fruit. Two-thirds of growers used this practice, and about two-thirds of those who used it rated it as an effective practice. Four respondents commented it was very effective; however 3 others who were hit with hail a second time found out in retrospect that hand thinning did not work to their advantage.

Nineteen of the respondents used reduced pesticide programs with some effectiveness. However, 2 growers commented that there were subsequent problems with scab, mites, and other pests. Only 8 growers chemically defruited trees, and the result was judged to be limited in effectiveness. In general, when growers abandoned blocks, they were satisfied with a reduced pesticide program, but those who harvested for fresh utilization were dissatisfied with a minimal pesticide program.

Thirteen respondents used field sorting of damaged fruit, but there was considerable dissatisfaction with the result as it was time consuming and not worth the effort. Eleven growers harvested hail damaged blocks for juice. Given the prices received in most cases, growers felt it was not effective. In one special case it worked satisfactorily for a farm that had an established outlet for orchard run fruit for cider at a good price.

Figure 3. Late season hail damage that occurred in August resulted in fruit cuts that rapidly rotted making fruit unsaleable.

Most of the growers indicated that they had made major plans for changes in the business as a result of hail damage. Most frequently mentioned was cutting back on capital purchases and investments such as tree planting and machinery. One cited going out of business and eight mentioned cutting back on acreage farmed. Some mentioned sub-dividing land and listing land for sale (5 responses). However 4 growers indicated no changes, and others mentioned "full speed ahead" and "continue farming and hope for the best." Numerous variables such as age of the grower, debt situation, and psychological outlook could explain these different responses to adversity.

We asked growers what they would do differently if they had another chance to make decisions about the past year's hail damaged crop. Seven indicated they would do nothing differently. Several others mentioned using a different level of damage threshold for harvesting fruit. Two indicated picking no hail-damaged fruit while other damage threshold such as 50 percent and 25 percent were mentioned. There were 3 mentions of errors made in trying to salvage blocks that should have been abandoned.

Lessons Learned

It should be obvious from the responses to the survey that making decisions about handling a crop that has incurred major hail damage is difficult at best. We hope that this article will be helpful to growers in the future should they face the decision about what to do in a situation such as occurred in the Hudson Valley in 2000. We asked survey respondents to comment on what was the most important lesson they learned from their experience with last year's hail damaged crop. While there were obviously different approaches as to what is the best course of action, we believe there are certain recommendations that all growers should consider.

A damage assessment on a block by block basis is essential. Some blocks were damaged so severely that abandonment was the obvious decision. However, where an initial assessment indicated a percentage of damaged fruit, a sampling routine is necessary. We suggested one such procedure at the beginning of this article. Other systematic procedures can be used. The important point is that arriving at an estimate of what percentage of the fruit suffered hail damage on a block-by-block basis is the starting point to making a correct decision about harvesting. Four comments about lessons learned pertained to the fact that damage is most often worse than it looks initially. "Hail never gets better, look very close at your damage, be honest." Another comment indicated that, "Hail damage packout was worse than expected, a dirty crop gets dirtier as you pack it out." These comments reinforce the importance of a careful, systematic damage assessment prior to making decisions about what to do with the crop.

The optimal decision will be affected by marketing alternatives available to the individual grower. We believe that the damage threshold we suggested in August (that if damage is greater than 30 percent, do not harvest for fresh fruit) is still valid. However, growers with their own storage facilities and packing houses, or with retail farm markets, often will decide upon a less stringent damage threshold. This results from the fact that more of their costs are fixed (and thus unavoidable) than a grower who takes his fruit to another firm for storage and/or packing. In the latter case, growers would incur higher variable costs for packing and storage.

Harvesting for juice or cider was marginal this year. More than half of the growers who harvested for juice felt it was not effective. In general, the growers responding felt that juice prices received this year (generally in the 3 to 4.5 cents per pound range, and averaging about 3.8 cents) did not make for an economical practice. However, having an on-site cider mill, markets with other local cider mills, or an existing relationship with a juice buyer who would offer a higher price, would make harvesting for juice a more attractive option. A few growers were able to realize higher prices under these circumstances. In most situations, we believe that 4 cents per pound is the minimum expected price that would justify harvesting for juice.

Growers need to re-evaluate insurance options as a means of reducing risk. Six growers mentioned the need for crop and hail insurance as the most important lesson they learned from the 2000 season. Growers need to carefully consider the various insurance programs (hail insurance, buy-up crop insurance, and Adjusted Gross Revenue (AGR) insurance) to tailor a program that meets their needs. As one grower commented, "...over 20 years…you lose money buying insurance. The idea is to be there after 20 years." This comment reflects recognition that crop insurance (and other insurance instruments) should not be regarded as an investment tool, but rather as putting a safety net under farm income so that a year like 2000 does not lead to catastrophic losses that would threaten the survival of the business. Legislation in 2001 provided for additional subsidies to encourage growers to purchase buy-up crop insurance over the next 5 years. At a minimum, growers should sign up for catastrophic (CAT) coverage. In the event of a disaster, Congress may insist on participation in some insurance program as a condition for receiving disaster payments. The cost of CAT coverage is minimal, and it keeps growers "in the ball game."

TABLE 2

Practices used to manage hail damaged blocks, Hudson Valley, 2000 crop year, 30 survey respondents.

Practice	No of growers using:		Effective Practice?		
	YES	NO	YES	NO	NOT SURE
Conducted damage counts	24	6	16	0	2
Calculated remaining costs	15	15	3	2	2
Abandoned blocks prior to harvest	17	12	8	2	0
Hand-thin hail hit fruit	20	9	14	2	0
Chemically defruit trees	8	21	2	2	0
Reduced pesticide program	19	8	7	3	1
Pick hail-damaged blocks for juice	11	18	4	5	0
Field sort hail-damaged fruit	13	15	2	5	1

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Acknowledgements

The authors express appreciation to Alison Demarree and Steve Hoying of the Lake Ontario Fruit Team for their contributions to this article. Alison provided a spreadsheet for estimating costs of growing, harvesting, and packing. Steve suggested the sampling procedure and made other helpful suggestions based on the recent experience of western New York growers who incurred hail damage.

David Rosenberger, Jim Schupp, and Richard Straub provided growers with recommendations on cultural and pest management practices that we evaluated in the January survey.

We express our appreciation to the 30 growers who returned their completed surveys.

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Antioxidant and Antiproliferative Activities of Selected New York Apple Cultivars

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No single antioxidant can replace the combination of natural phytochemicals in apples to achieve health benefits. The benefit of a diet rich in fruits and vegetables is attributed to the complex mixture of phytochemicals present in fruits and vegetables. Consumers should obtain their antioxidants from fruits and vegetables for health improvement and disease prevention.

Cancer is the second leading cause of death in the United States. Dietary factors were thought to contribute to about one-third of those cancer deaths. Diets rich in fruits and vegetables have been associated with lower incidences in cancer and lower mortality from coronary heart disease. In addition to the presence of Vitamins C and E, fruits and vegetables are a rich source of phenolic acids and flavonoids, called phytochemicals, which also serve as antioxidants to counteract the prooxidant load of the body. These phytochemicals can have complementary and overlapping mechanisms of action, including modulation of detoxification enzymes, stimulation of the immune system, regulation of cellular signal transduction pathway, reduction of platelet aggregation, modulation of cholesterol synthesis and hormone metabolism, reduction of blood pressure, and antioxidant, antibacterial, and antiviral effects. The specific mechanisms of action of most phytochemicals in cancer prevention, although not yet fully comprehended, seem to be diverse. It has been reported that phytochemicals can inhibit carcinogenesis by induction of phase II enzymes, and inhibiting phase I enzymes, scavenging free radicals, protecting DNA from oxidized damages, regulating expression of tumor genes and tumor suppressor genes, suppressing the abnormal proliferation of early, preneoplastic lesions and by inhibiting certain properties of the cancer cell. It was estimated that 32 percent of cancer deaths might be avoidable by changes in the diet. Thus, the National Research Council (NRC) recommends eating 5 or more servings of a combination of vegetables and fruits. The purpose of this article is to report the results of ongoing research on antioxidant and antiproliferative activities of phytochemical extracts from selected New York apples. This research provides evidence that consumption of fruits and vegetables may play a significant role in reducing the risk of chronic diseases such as cancer.

Phytochemical Content

Total phenolic content of 10 different apple varieties both with and without skin are shown in Table 1. Fuji apples with skin had the highest total phenolic content (230.49 ± 4.4 mg/100 g apple) followed by Red Delicious, Gala, Liberty, Northern Spy, Golden Delicious, Fortune, Jonagold, Empire, and NY674. The total phenolic content in apples without skin was highest for Red Delicious (167.82 ± 1.7 mg/100g apple) followed by Northern Spy, Fortune, Gala, Fuji, Liberty, Golden Delicious, NY674, Jonagold, and Empire. Total phenolic content was higher in all varieties for apples with skin when com

TABLE 1

Total phenolic content of apples

	Total Phenolics (mg gallic acid eq./100g)	
	With skin	Without skin
Fuji	230.49 ± 4.4	131.39 ± 1.0
Red Delicious	204.49 ± 2.1	167.82 ± 1.7
Gala	200.39 ± 2.6	133.78 ± 1.7
Liberty	196.75 ± 0.32	127.95 ± 3.2
Northern Spy	191.50 ± 0.84	142.34 ± 0.83
Golden Delicious	179.19 ± 5.9	124.14 ± 3.6
Fortune	152.04 ± 1.5	137.60 ± 1.8
Jonagold	126.49 ± 0.88	102.49 ± 3.7
Empire	115.07 ± 1.1	71.61 ± 1.4
NY647	110.68 ± 1.5	117.42 ± 3.8

pared to apples without skin with the exception of NY674.

The total flavonoid content was highest for Fuji apples with skin (108.22 ± 4.4 mg/100 g apple) followed by Red Delicious, Northern Spy, Fortune, Gala, Liberty, Golden Delicious, Jonagold, NY674, and Empire (Table 2). For apple varieties without skin, Liberty had the highest flavonoid content (81.67 ± 3.8 mg/100 g apple), whereas Empire apples had the lowest value (25.25 ± 0.86 mg/100 g apple). Apples with skins had a higher total flavonoid content when compared to apples without skins for all 10 varieties analyzed.

TABLE 2

Total Flavonoids content of apples

	Total Flavonoids (mg catechin eq./100g)	
	With skin	Without skin
Fuji	108.22 ± 4.4	59.62 ± 2.9
Red Delicious	99.51 ± 1.2	67.60 ± 0.8
Northern Spy	95.62 ± 0.16	72.28 ± 0.47
Fortune	93.97 ± 3.9	55.03 ± 1.7
Gala	92.66 ± 1.6	60.93 ± 1.0
Liberty	86.86 ± 3.1	81.67 ± 3.8
Golden Delicious	73.13 ± 4.9	50.10 ± 0.55
Jonagold	62.13 ± 3.4	42.41 ± 3.2
NY647	61.16 ± 2.3	39.40 ± 3.9
Empire	48.36 ± 1.2	25.25 ± 0.86

Total Antioxidant Activity

The total antioxidant activity of apples was measured by Total Oxyradical Scavenging Capacity (TOSC) expressed as mmol Vitamin C equivalents per gram. TOSC values (mmol Vitamin C equivalents/g apple) of the different apple varieties both with and without skin were determined (Fig. 1). All of the apples tested exhibited a great antioxidant activity. For apples with skin, Northern Spy and Red Delicious had the highest TOSC value at 83.34 and 83.3 followed by Fuji, Gala, Liberty, NY674, Golden Delicious, Fortune, Jonagold, and Empire. Northern Spy apples without skin had the highest antioxidant activity (48.54) followed by Fuji, Red Delicious, Golden Delicious, Liberty, Gala, NY674, Fortune and Jonagold, whereas Empire apples without skin had the lowest antioxidant activity (19.66 TOSC). Overall, apples with skin had greater antioxidant activities (as indicated by TOSC values) than apples without skin for all varieties. There was a significant difference ($p < 0.05$) for TOSC values between apples with skin and apples without skin for Northern Spy, Red Delicious, Fuji, Gala, Liberty, NY674, Fortune, and Empire. Apple skins are known to contain higher amounts of phenolic compounds than the flesh. It was reported that the amount of phenolics in the skin of apples was several times higher than that of the flesh and that the quercetin glycosides (the most predominate flavonoid in apples) were only found in the skin. The higher phenolic and flavonoid content found in the apple with skins may have contributed to its higher antioxidant activity over the apples without skin.

Vitamin C is a powerful antioxidant and it is present in high concentrations in fruits. The Vitamin C content of raw Red Delicious apples with skin is 5.7 mg/100g.

The antioxidant activity of 1 g of Red Delicious apple with skin and without skin was 83.3 and 46.07 TOSC (mmol vitamin C equivalents/g, Fig. 2), respectively. The calculated antioxidant activity of Vitamin C in 1 gram of Red Delicious apple with skin was only 0.32 TOSC (mmol vitamin C equivalents/g). The Vitamin C in apple with skin accounts for only 0.4 percent of total antioxidant activity. Therefore, the majority of antioxidant activity of apple is not from Vitamin C but from other phytochemicals in apples. The combinations of different phytochemicals in apples may function additively or synergistically to be responsible for this potent antioxidant activity.

Relationship Between Total Phenolic/flavonoid Contents and Antioxidant Activity

The relationship between total phenolic, and flavonoid content and antioxidant activity (TOSC values expressed as µmol vitamin C eq./g) of apples is shown in Figure 3. There was a positive ($r^2 = 0.7298$) relationship between total phenolic content and total antioxidant activity of apples with a statistical significance ($p<0.001$, Fig. 3A). The relationship between flavonoid content and total antioxidant activity of apples was also positive ($r^2 = 0.7403$) with statistical significance ($p < 0.001$, Fig. 3B). This indicates that total phenolic and flavonoid contents have a significant contribution to the antioxidant activity of apples. The different mixtures of antioxidants in apples may have had different additive or synergistic effects to enhance the total antioxidant activity.

Effect of Apple Extracts on Cancer Cell Proliferation

Apple extracts from selected apple varieties were added to human liver cancer HepG2 cells to determine if the extracts could inhibit tumor cell proliferation. HepG2 cells were treated with extracts equivalent to 0, 1, 5, 10, 20, 30, 40, and 50 mg of apple for 96 hours. These levels were chosen based on preliminary experiments indicating doses that were not cytotoxic to cells and resulted in the inhibition of cell proliferation. Fuji apples with skin inhibited cell proliferation by 39.03 percent and 15.94 peercent for apples without skin at a dose of 50 mg/ml (Fig. 4). Red Delicious apples with skin reduced cell proliferation by 57.14 percent and 39.54 percent for

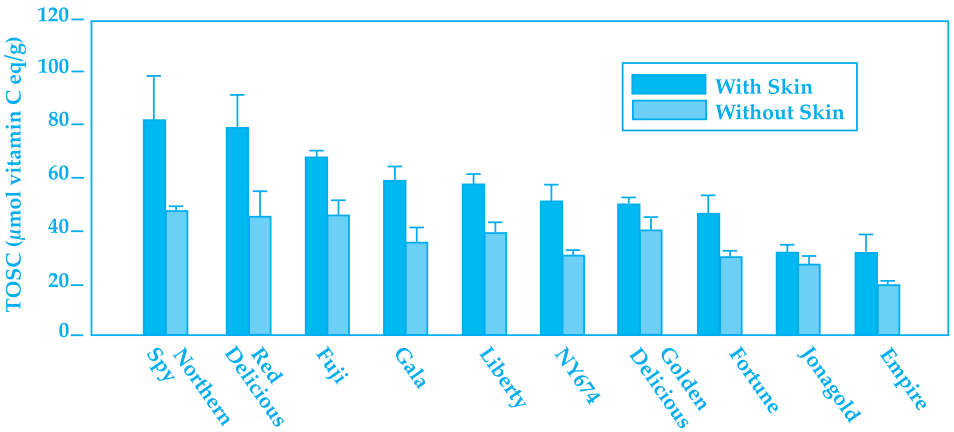
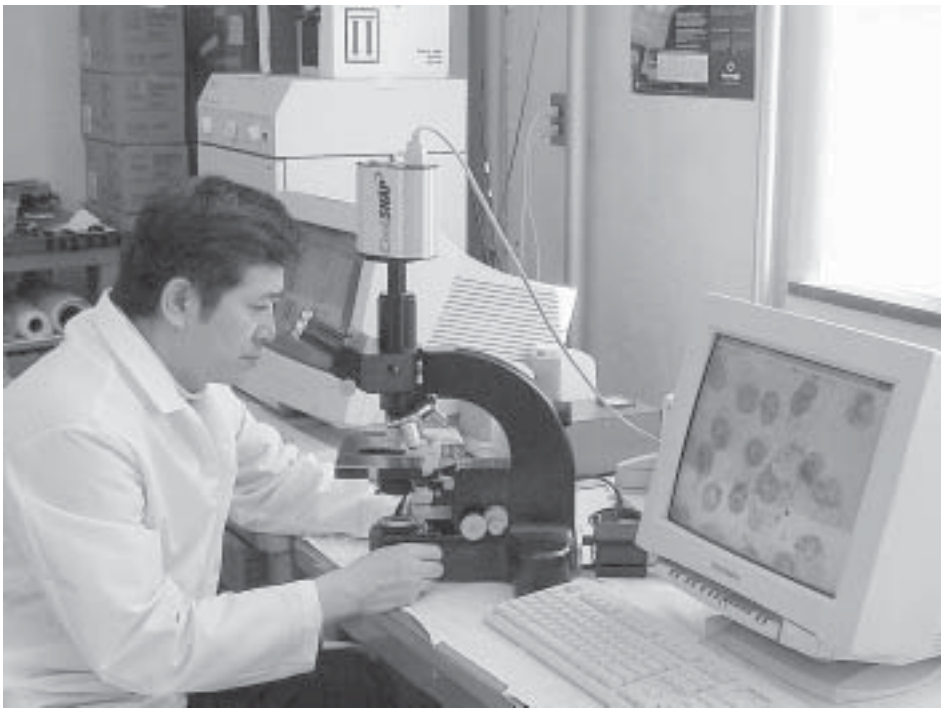


Figure 1. Total antioxidant activities of selected apple varieties (mean ± SD; n=3)



Dr. Rui Hai Lui examines human liver cancer Hep G2 cells.

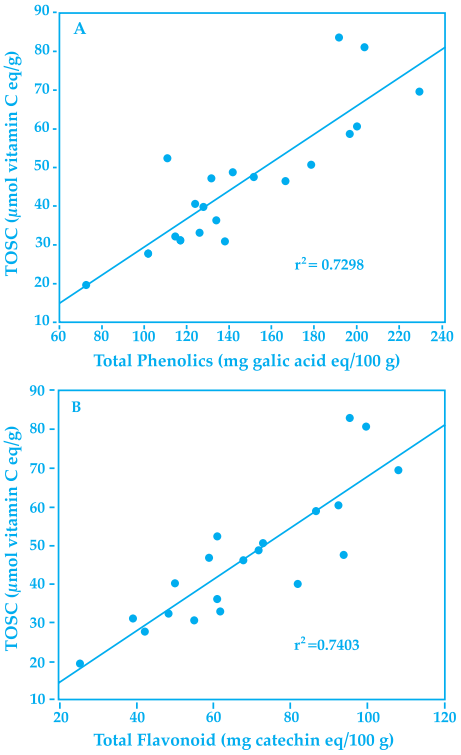


Figure 3. Relationship between (A) total phenolic, (B) flavonid content and antioxidant activity of selected apple varieties

apples without skin at a dose of 50 mg/ml. Gala without skin did not inhibit cell proliferation when compared to the control whereas Gala with skin inhibited cell proliferation 34.65 percent at 50 mg/ml. Northern Spy apples with skin and without skin did not inhibit cell proliferation when compared to the control.

The EC_{50} values for Red Delicious, Fuji, and Gala apple were calculated. A lower EC_{50} translates a higher activity to inhibit cancer cell proliferation. Red Delicious apples with skin had the lowest EC_{50} value at 86.90 mg/ml followed closely by Gala (92 mg/mL) and Fuji apples with skin (116 mg/mL).

There was a large variation in the effects of the different apple varieties on the inhibition of cell proliferation. Apples without skin were less potent in inhibiting HepG2 cell proliferation whereas apples with skins exerted greater inhibitions of cell proliferation.

In summary, our results demonstrated the combination of phytochemicals in apples is critical to its potent antioxidant activity and antiproliferative activity. Apple with skin displayed higher antioxidant and antiproliferative activities than apple without skin. The total phenolic and flavonoid content was positively related to antioxidant activity and inhibition of cell proliferation. Additionally, the minimal contribution of Vitamin C to the antioxidant activity of apples further supports the proposal that other phytochemicals, such as phenolic acids and flavonoids, significantly contribute to the *in vitro* antioxidant activity of apples. The benefit of a diet rich in fruits and vegetables is attributed to the complex mixture of phytochemicals present in fruits and vegetables. Therefore, no single antioxidant can replace the combination of natural phytochemicals in fruits and vegetables to achieve the health benefits. These data provide direct supportive evidence for the Five-a-Day program and suggests that consumers obtain their antioxidants from fruits and vegetables for health improvement and disease prevention.

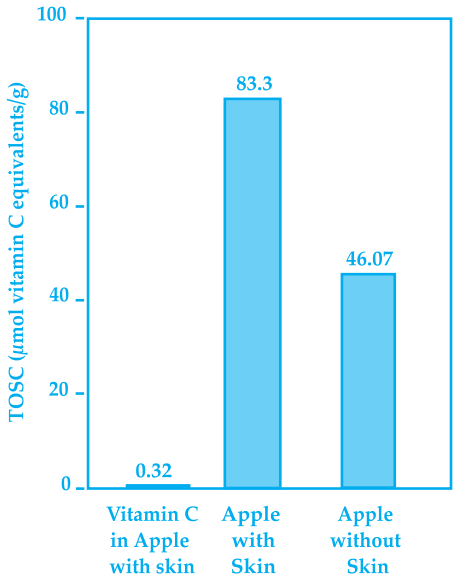


Figure 2. Total antioxidant activity of Red Delicious Apple (mean ± SD; n=3)

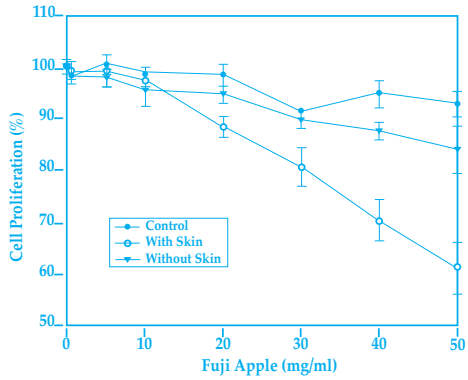


Figure 4. Inhibition of HepG2 cell proliferation by Fuji apple extracts (mean ± SD; n=3)

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Apogee: A New Plant Growth Regulator for Apples.

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Apple trees that are treated with Apogee produce shorter shoots with shortened internodes and dark green leaves. Treating apple trees produces a number of horticultural and pest management benefits including better light penetration into the canopy, reduced tree row volume, better spray penetration, reduced fire blight susceptibility and less dormant and summer pruning.

Apogee, a new plant growth regulator for use on apples, received a label from EPA in 2000 and registration was received in New York in time for use in 2001. Apogee was registered by EPA as a "reduced risk" chemical because it presents negligible risks to human health or the environment. The preharvest interval (PHI) for Apogee is 45 days and the restricted entry interval (REI) is 12 hours. The active ingredient, prohexadione-calcium, has low mammalian toxicity and is not mutagenic, carcinogenic, or teratogenic. It is practically non-toxic to birds and aquatic life and will not harm honeybees. Prohexadione-calcium degrades rapidly in the environment and is rapidly metabolized by the tree, leaving no lasting or adverse effects.

The objective of this article is to report on the results of recent trials with Apogee in New York and to give growers some preliminary suggestions for getting good results.

What It Does

Apogee reduces vegetative growth by blocking the synthesis of gibberellins; naturally occurring plant growth substances that promote cell elongation. The active ingredient in Apogee is prohexadione-calcium, a molecule that is similar in structure to a chemical substrate in the synthesis of gibberellins. When prohexadione-calcium is applied, the production of growth-promoting gibberellins is blocked and forms of gibberellins with no growth promoting activity accumulate. Apple trees that are treated with Apogee produce shorter shoots with shortened internodes and dark green leaves. This reduction in growth provides a number of horticultural and pest management benefits (Table 1).

TABLE 1

Potential benefits from growth reduction as a result of Apogee applications.

Horticultural Benefits:	Pest Management Benefits:
Better light penetration in the canopy	Reduced tree row volume
More light = increased red fruit color	Better spray penetration
Less summer pruning	Better air circulation
Less dormant pruning	Reduced fire blight susceptibility

The results of several trials across New York suggest that Apogee will reduce shoot growth by about 40 percent (Table 2). This level of growth control can result in some very significant benefits. A study in Geneva in 1997 showed that a single spray of 250 ppm (12 oz / 100 gal.) Apogee, or a double application of 125 ppm (6 oz / 100 gal.) to 20-year-old McIntosh / M. 9 trees increased red fruit color by 53 and 32 percent, respectively. In 1999, 2 Apogee sprays of 125 ppm reduced dormant pruning time of 10-year-old Northern Spy trees in Granville, NY by 42 percent.

Effect on Fire Blight, NY

TREATMENT	BLIGHTED SHOOT LENGTH (%)	% CONTROL
Control	87a	--
Apogee 250 ppm X 2	45b	49

Figure 1. Disease severity of Apogee treated Gingergold trees that were inoculated with fire blight bacteria was dramtically reduced compared to untreated trees.

We have also shown in field trials that Apogee limits fire blight development in apple shoots if applied at the same time or shortly after blight infections occur. Apogee has no pesticidal activity on the fire blight bacteria itself. It affects the development of the disease by causing a cessation of shoot growth, which in turn makes the shoots less susceptible to fire blight development. Disease severity of Apogee treated Gingergold trees that were inoculated with fire blight bacteria was dramatically reduced compared to untreated trees (Fig. 1).

Apogee did not reduce fire blight severity when applied to young Gala / M.9 trees after fire blight infections were already visible. Tree mortality was the

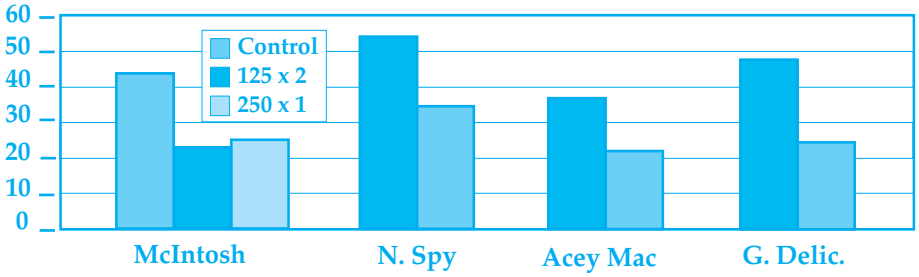

TABLE 2. The effect of one or two Apogee applications on shoot growth of 4 apple varieties.

Figure 2. Fruit cracking and checking caused by lenticel spotting and subsequent fruit growth after Apogee applications during dry seasons.

same in treated and untreated rows. Since Apogee affects the fire blight bacteria indirectly, it does not immediately make a treated tree resistant to infection.

How to Use It

In order to get the maximum benefit in growth reduction, it is important to make the first application when shoots are 1-3 inches long. This means Apogee must be applied at petal fall or soon thereafter to have a large effect on shoot growth. Later applications provide some benefit, but the level of control is reduced because a considerable amount of growth can take place before the Apogee takes effect.

This timing is also best with regard to fire blight protection. Apogee will not protect against blossom blight infection, and the onset of resistance against shoot infections develops within 10 to 14 days after treatment. Thus, apple trees have to be treated in a protective manner before shoot blight symptoms develop. After resistance is acquired it should last from 4-6 weeks. To maintain fire blight protection, a second spray is required if shoots begin to grow again.

Apogee begins to affect shoot growth about 10-14 days after application, and the duration of the effect depends on dose. A low dose controls growth for only about 3-4 weeks. It is likely that 2 applications of 6 to 12 ounces of Apogee per 100 gallons of water will be needed to achieve season-long growth control in most New York orchards. Three applications may be required for vigorous cultivars growing on vigorous soils.

One strategy is to apply the second spray by the calendar, 2 weeks after the first. Another strategy would be to monitor shoot growth after the first spray and apply the second spray as soon as the shoot terminals resume growth. This second strategy may extend the time interval between Apogee sprays, and in some cases, eliminate the need for a third spray. This strategy will require careful monitoring to ensure that the resumed growth doesn't go on so long as to diminish the benefits. Also, once growth resumes, it may require a higher concentration of Apogee to arrest it than is needed to maintain growth control in shoots that are not growing.

The effectiveness of Apogee isn't greatly affected by how many gallons of water are used in the spray, so long as it is applied with enough water to obtain good coverage. A surfactant is recommended, but which one is used doesn't matter. A number of non-ionic and organosilicone surfactants have been used in research trials with good success.

If spray water comes from a source with high concentrations of dissolved calcium carbonates (hard water), a water conditioner is recommended. If you are uncertain, have your water tested for hardness. Water conditioners will provide some benefit when the hardness exceeds 200 ppm. Spray grade ammonium sulfate (AMS) has proven to be effective for this purpose. Use an equal weight of ammonium sulfate to the weight of Apogee used as a starting point. Retest for hardness to be sure that you have lowered it below the 200 ppm threshold. Commercially available water conditioning products may be more convenient to use and may provide additional benefits over ammonium sulfate. A cost/benefit comparison should be done to decide which conditioner is best in your situation.

Do not apply Apogee with calcium sprays, as calcium reduces the uptake and effectiveness of Apogee. Apogee has worked well when tank-mixed with most commonly used fungicides and insecticides. How Apogee-treated trees will react to sprays of plant growth regulators that contain gibberellins, such as Pro-Vide, Promalin, Accel, and similar generic products, is not known and under study. The label will contain a precaution stating that use of GA materials on Apogee-treated trees may reduce the efficacy of the Apogee and/or the GA product. For this reason, it may be best to avoid using GA products on Apogee treated trees, until more is known.

Apple trees treated with Apogee often set more fruit than untreated trees, so it will be important to adjust thinning strategies to remove more fruit. This may mean increasing the dosage of a chemical thinner or making multiple applications of chemical thinners to achieve desired crop load and fruit size.

Research on this side effect of Apogee is still in progress, but our initial estimate is that the strength of the thinner needs to be increased by 30-50 percent. For example, if you determine that untreated trees in a given block would require a thinning spray of 5 ppm NAA, then Apogee treated trees in that block may require 7.5 ppm NAA or 5 ppm NAA plus Sevin to get the same degree of thinning. Apogee has no direct effect upon return bloom, but excessive fruit set could reduce return bloom.

Apogee has apparently caused lenticel spots on Empire apples in several trials in the Northeast. The lenticel spots often result in fruit cracking as the fruits continue to grow (Fig. 2). The damage has been observed in New York in wet, cloudy years (1998 and 2000), but not in a dry, sunny year (1999). Because of this fruit finish problem, the Apogee label contains a cautionary statement about its use on Empire. Other than this concern about fruit finish of Empire, Apogee has no direct effects on fruit quality. Increased red color from improved light penetration, and the possibility of smaller fruit if the increase in fruit set is not corrected by thinning, are the important indirect effects.

Summary

Apogee is a new growth regulator for apples that can reduce shoot growth by

about 40 percent resulting in increased light and spray penetration that improves fruit color and quality with less pruning. For maximum growth control, make the first application as soon as shoot growth begins and apply a second spray 2 to 3 weeks after the first. Apogee should be applied with sufficient water to ensure thorough coverage. Use a surfactant and a water conditioner such as ammonium sulfate if the spray water source has high amounts of dissolved calcium carbonate, (i.e. "hard water"). Never tank-mix Apogee with sprays containing calcium. Use of Apogee often increases fruit set, which may require the grower to thin Apogee treated trees more aggressively.

Apogee applied at bloom can reduce susceptibility of trees to the shoot blight phase of fire blight. Where Apogee is used to control fire blight during summer, inoculum levels in orchards may be lower the following year, thereby resulting in reduced selection pressure to development of resistance to streptomycin. Fire blight suppression is a result of growth control, so Apogee must be applied well in advance of the appearance of fire blight symptoms to be effective for fire blight suppression.

James R. Schupp is an assistant professor of pomology at the Hudson Valley Laboratory who leads the state program in growth regulators. Terence Robinson is an associate professor of horticulture at the New York State Agricultural Experiment Station in Geneva specializing in orchard management. Jay Norelli, formerly a senior research associate in plant pathology is now at the USDA - ARS Appalachian Fruit Research Station working on fire blight. David Rosenberger is director of the Hudson Valley Laboratory and a professor of plant pathology. Herb Aldwinckle is a professor of plant pathology and leads the fire blight team at Cornell.

What it Will Take to Survive in Today's World Apple Market

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If you want to survive in the world apple market today you must have clear objectives. You must understand your resources and the external environment you face. You must make realistic plans to achieve your objectives. Keep your ears perked for new ideas and work smarter, not harder. Contribute to the common good of other producers so that you will become more informed and build a stronger industry that will benefit you in return.

There has been a spate of books recently on the general topic of the millionaire next door. As I prepared this talk a review of one of these books, *The Millionaire Mind*, by Dr. Thomas J. Stanley, arrived in my mail. Dr. Stanley surveyed 700 millionaires to see how they made their money. He found that few inherited wealth; few were shining academics or class leaders in their youth. They were not workaholics, but led balanced lives. They believed in working smarter, not harder. They avoided debt. They were accumulators, not spenders. They saw discipline and hard work as the keys to financial success. They did not depend on luck, but had a plan, patience, and self-discipline.

If you just want to survive in the world apple market, or if you want to make a million in the next few years, many of these same lessons are applicable to your fruit business. The United States apple industry each year generates $1.5 billion in sales at the grower level, 4 to 5 times that at the retail level. That market will not go away. Your challenge is how to get your fair share of that $1.5 billion.

Start with Your Objectives

First of all, you have to have clear objectives. I firmly believe that there will be many ways to make money in the apple business in the next decade. No one model will fit all growers or packers or processors. Your most important decision will be choosing what business model you want to follow.

Each operator needs an income objective and an asset objective. Your income objective may be couched either in terms of dollars or as a proportion of your family income. A full-time orchardist might have a net income goal of $50,000 per year. A part-time orchardist might have a goal of deriving a specific proportion of total net income from the orchard.

Equally important is to have an asset objective. In addition to seeking a specific current return on each asset employed in the business, an orchardist needs to have a target value for each asset. In many cases, the orchard, facilities, and equipment are the orchardist's accumulated nest egg, insurance, and/or retirement source. It is critical that the value of those assets are maintained or enhanced.

Have a Business Plan

Very few millionaires, or part millionaires can reach their objectives without a clear plan. In contrast, few farmers that I know have a business plan. They ride the ups and downs of the market, hoping that the good years compensate for the bad years. For most commodities, the long-term price trend has been downward so the troughs go lower and the recovery peaks are smaller. Riding the market is less likely to be an effective strategy in the future.

A good business plan must be based on the three factors identified by Nigel Poole (2000):

1. The grower's resource set. This includes the quantity and quality of land, labor, and capital available, the price and availability of inputs, natural and climatic conditions, and production systems.
2. The external environment. This includes research and extension support, product flexibility, government regulation, and industry organizations and associations, and
3. Personal attitudes, aptitudes, and attributes. This includes personal wealth, level of management skills, cooperative tendencies, accumulated knowledge, and ability to learn.

A realistic self-assessment is an absolute necessity for developing a feasible plan to carry out your objectives. You have to decide whether you want to be a passive operator, an active, but isolated, operator, or an active, group-oriented operator. You also have to be able to honestly answer the question, "Can I meet my objectives with the current hand I have been dealt?" If the answer is no, you can achieve or you must adapt your plans in ways that will generate more revenue. Adapting your plans will require extra cost, time, and expertise. If these are not available, your smartest strategy may be to retreat with as much of your assets as you still have intact.

Critical Points in Your Operation

Both in the short-run and in the long-run, the most critical aspects of your operation, and the ones needing your greatest attention will be the productivity of your current variety and crop mix, the market demand for what you produce, and the amount of debt, both current and long-term, that your business carries. If your acreage does not generate above av

erage yields of marketable fruit, your product mix does not generate above average prices, or debt repayments are eating up a substantial part of your revenue per acre, you probably will have difficulty surviving a continued shakeout in the industry.

The successful orchardists in the next decade will be able to increase the output per acre of marketable fruit. That means having an increasing share of the packout in the most desirable grades and sizes. The successful orchardists will also find ways to earn above average returns for the products produced, either by creating their own market niche with organic consumers, community-based activists, restaurants, or direct marketing outlets, or by participating in successful market alliances, like the Pink Lady® Alliance, that can deliver price premiums.

Unfortunately, gains made in either productivity or market price may require a temporary increase in borrowing, so the debt burden may rise in the short-run. The hope is that progressive investments will eventually increase net profits and permit a reduction in the debt burden. However, during the adaptation phase, the orchardist will have to take on greater risk that the added investments will not pay off and that profit or asset objectives will be missed. Again, realistic self-assessment will be a vital ingredient in minimizing that risk.

Critical External Factors

Among the external factors that will affect each orchardist differently are the increasing regulatory burdens associated with chemicals, labor, water, food safety, etc. Each orchardist will need to assess how much his resource set will be affected by changing regulations. For example, an orchard that is subject to specific insect pressures may be hurt more by the cancellation of a popular insecticide.

A second key external factor will be the availability of alternative market outlets for your products. In the most obvious case, if you are dependent on one local processor to take your product, the closure of that processor could be devastating. Given the consolidation that is going on in every sector of the food distribution system, producers need to have a realistic assessment of the potential longevity of their main market outlets and have contingency plans in place should those outlets disappear.

A third key external factor is the provision of support services such as research, extension, inspection, marketing research, and promotion to producers in the region. There is little doubt that these collective services are under attack from many quarters. However, there is also little doubt that they will continue to be crucial to keeping United States growers competitive in a world where many international suppliers have an advantage in lower costs of land and labor. You need to build a core group of knowledgeable bankers, accountants, extension agents, industry executives, and others on whose wisdom you can draw.

Most of the successful growers that I know are very group-oriented. They are willing to work with neighbors informally. They are willing to participate in area IPM programs or educational programs. And, when called upon, they are willing to serve and support industry organizations. The astute grower can learn so much from listening to others. He or she does not have to make all the same mistakes to learn from them, or try each new idea himself to find out what worked. In addition, participating in broader district, state or national organizations opens up new ideas and new opportunities that none of us alone could uncover. Even if you do not have time to attend regional or national meetings, you can learn so much about what is going on in the apple world by surfing the internet for key industry sites. Almost all the major state and national fruit organizations now have excellent, informative sites.

The Successful Apple Grower Next Door

Being a successful apple grower requires the same skills as being the millionaire next door. You have clear objectives. You understand your resources and the external environment you face. You make realistic plans to achieve your objectives. You keep your ears perked for new ideas from whatever source they come. You avoid the flashy solutions, or those that promise too much. You rely on working smarter, not harder. And, by contributing to the common good of other producers, you become more informed and build a stronger industry that helps you in return.

As the margin for error in the apple industry shrinks, the successful growers will be those that continually improve every aspect of their operations while allowing themselves some breathing room to experiment with new ideas. The formula is not glamorous. However, it has worked for the millionaire next door, it can work for you.

References

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Corrections for the previous article by Merwin et al. on "Integrated Diagnosis and Control of Apple Replant Problems": The farm identification abbreviations in Figures 3-B, 3-C and 4-A were mistakenly altered in printing, and should have been as follows:
Figure 3-B: (from left to right) CV-2, ON-4, HV-3, LI-1, HV-4, and ON-6.
Figure 3-C: (left to right) CV-3, HV-5, ON-8, and ON-9.
Figure 4-A: (left to right) CV-2, ON-4, HV-3, LI-1, ON-5, and ON-6.
We regret any confusion this may have caused our readers.