

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

Gerald B. White¹ and Michael A. Fargione²

¹ Department of Applied Economics and Management
Cornell University, Ithaca, NY

² Hudson Valley Fruit Program

Ulster County Cooperative Extension, Kingston, NY

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

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.



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

rest of the season and expected receipts for the fruit. The following is a summary of that article.

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 consider-



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

able 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.

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 grow-

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

ers 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."

References

White, J and M. Fargione, 2000. Do I harvest hail damaged apples? An economic perspective. Hudson Valley Tree Fruit Newsletter, 4 August, 2000, p. 2-6.

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.

Gerald White is a professor in the department of applied economics and management at Cornell University. He conducts extension programs and applied research in horticultural crops, primarily apples and grapes. Mike Fargione is a county extension educator who conducts a five-county fruit program in the Hudson Valley. He is based at the Hudson Valley Laboratory.
