The Scourge of Bitter Pit

Looking like a difficult storage year for Hudson Valley Honeycrisp Producers

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Reports are starting to filter in of excessive Honeycrisp cullage out of storage this season. The predominant defect reported is bitter pit, a surprise to some following observations that this season's crop appeared relatively clean at harvest. Our ENYCHP tree fruit team is currently in the 3rd year of our comprehensive Honeycrisp/Bitter Pit survey study, and our results to date shed some light on how 2018 compares to '16 and '17.

What is BP, and do we understand the cause?

BP is a dark sunken lesion on the surface of the apple, usually at the calyx end, that is a result of the desiccation and death of cells just under the peel. The condition is a physical disorder associated with low calcium in fruit tissue and is known to be influenced by soil and weather conditions, nutrient availability, tree age, vigor, crop load and fruit size (Ferguson and Watkins 1989, Rosenberger 2004, Freitas 2010). There is variation in the expression of the disorder by NYS region, by year, and from orchard to orchard. Unfortunately, science has not yet provided a clear understanding of causation, much less how to effectively mitigate the damage. Producers and researchers tend to view bitter pit the same way you and I might treat a vitamin deficiency. If your doctor says that you're deficient in a mineral, or vitamin, lets say magnesium as an example, the practitioner's recommendation might be to take a daily supplement and all will eventually come back into balance. Foliar calcium sprays applied throughout the summer follow the same logic, sort of like saying to the trees: "Take your vitamins!". Unfortunately, this strategy has been shown to produce inconsistent results in both research trials and commercial orchards. The problem may have something to do with calcium distribution and timing. The relatively immobile calcium ion can't reach the deficient tissue to help, and it may be too late anyway, the damage may well have been done much earlier in the growing season than we currently understand.

Honeycrisp, bitter pit, and real-world experience

The profitability of the Honeycrisp (HC) variety is critical to the continued growth of the New York apple industry. Current acreage has been estimated to be as high as 2000 acres, with many of those acres in the newly planted and early bearing stages (unfortunately, reliable survey data doesn't exist). As volume continues to grow, the need to successfully store and market the crop while maintaining currently strong pricing will become more critical. This is the crux of the problem for NYS producers, storing HC from our orchards is financially risky due to several potential storage disorders, the most devastating being bitter pit (BP).

Of the 700 apple producers in NYS, the majority grow some Honeycrisp, and most have trouble obtaining a 60% or better packout. In general, our team has found BP incidence is highest in the Hudson Valley, approximately 25% less in the Champlain Valley, with reports of WNY falling somewhere in between. With HC being one of the highest value varieties we produce in NYS, growers can expect an orchard run crop value of 20-30K per acre. With losses to BP running 6-47% by block, on average over the last three seasons (Donahue et. all unpublished), the cost to producers attributed to BP is enormous, potentially $1,200 to $14,100 per acre, or at minimum 2.4 million dollars a year (likely much higher) for the entire NYS apple industry.

A single spot is all that is required to cull an otherwise great quality fresh market apple into the juice bin with a value loss of 80%. Bitter pit symptoms observed at harvest, on the tree or in the bin, do not reliably reflect the incidence of the defect after two months of storage (see photo below).

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Hudson Valley, NY 2018: Example of bitter pit of Honeycrisp after 60 days refrigerated storage at 36F. At harvest, the apples in this tray did not exhibit any symptoms. Photo credit: D. J. Donahue

As shown in Figure 1, year is a significant variable in trying to predict how HC will behave in storage. In 2016, Hudson Valley HC BP was generally terrible at harvest, but didn't worsen appreciably after 60 days of refrigerated storage at 36F. The same blocks in 2017 behaved differently with a much lower incidence of BP observed at harvest, and a modest increase found after storage. Overall, producers considered the losses much more tolerable than those of the prior season. Data from the same blocks in 2018 tell a very different story. HC appeared clean at harvest, but in storage the "hammer fell" and fruit coming out looked as bad as the 2016 crop did when it was going in.

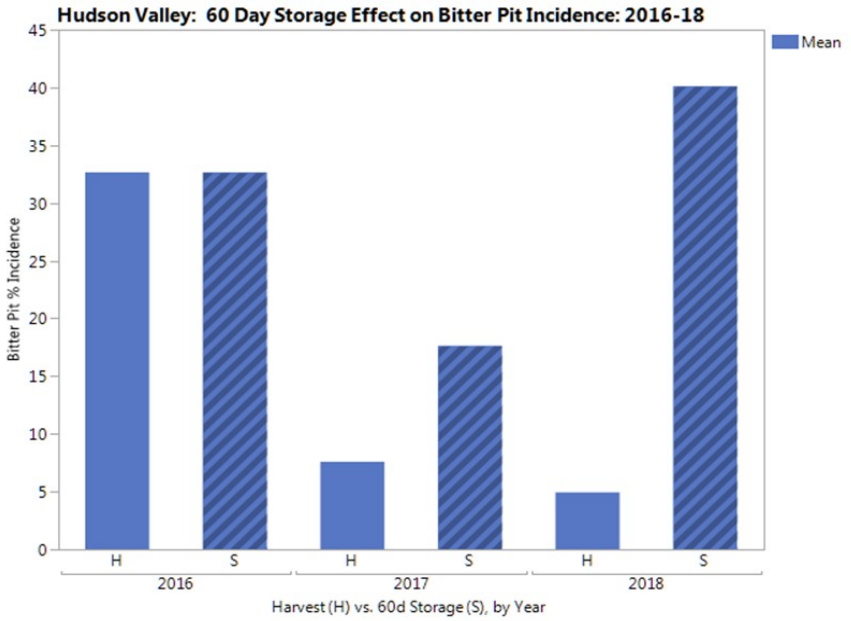

Figure 1. When bitter pit symptoms express, and how much the expression worsens in refrigerated storage, varies from season to season. In 2018, fruit going into storage appeared clean, even better than 2017. After 60 days, the data tells a much bleaker story.

Our conclusion is that we cannot predict BP based on prior season observations. Variation between blocks, as represented below in Figure 2, is a well-recognized phenomenon with producers recognizing certain blocks as historically poor BP performers. However, our data indicates (not shown) that even blocks will vary substantially from year to year.

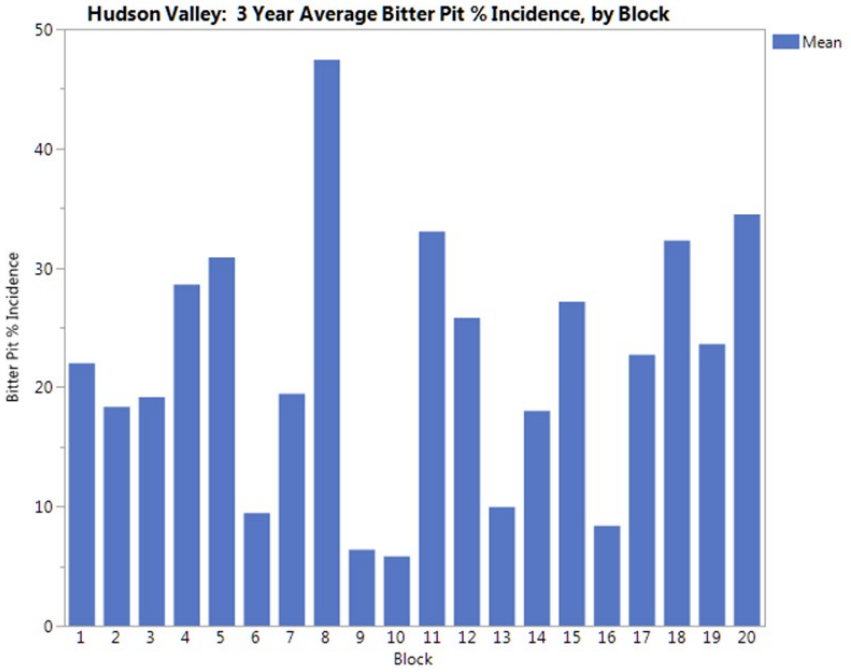

Figure 2. Bitter pit incidence in Honeycrisp varies substantially between blocks, 5.8 – 47.4% in the case of the 20 blocks followed in this three-year study.

What we've recently learned through research:

Separate research groups at Cornell, Donahue et. al. and Watkins et. al. have been funded over the last three years by the NYS Apple Research and Development Program to pursue HC BP prediction strategies. Donahue et. al. has developed a pre-harvest peel mineral analysis model based on our 2016/2017 survey data with an R-square predictive value of 0.53 when tested against an independent validation data set. Work is currently underway to analyze the 2018 data set and further improve the accuracy of the model, incorporating factors for Prohex-pink application, regionality, and rootstock classification. This prediction protocol requires the producer to sample 12 apples per block five weeks prior to expected first harvest, peel them using a spiral peeler (same as you would use to peel apples for baking), and send the calyx half of the sample to the Cornell Nutrition Analysis Laboratory for mineral content testing.

An easy-to-use spreadsheet interface is under development that would calculate a BP prediction in terms of a recommendation: Ok to store, risky to store, do not store.

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The Watkins et. al. group has successfully built a BP prediction model based on a simple "passive" method where the producer picks 100 apples 3 weeks pre-harvest, allows them to sit at room temperature, then rates BP incidence just prior to first harvest. The model does not require the producer to spend money on lab analysis, but it does require a significant labor commitment to pick, store, and evaluate the boxes of fruit sampled. The R-square of the model after 3 years of development is 0.66.

What's next?

Bitter pit prediction technology in NYS as reached a point in development where it should be introduced for testing by commercial producers. Plan on attending the 2019 Cornell Cooperative Extension Eastern New York Commercial Horticulture Fruit and Vegetable Conference, February 19-21 at the Desmond Hotel and Conference Center in Colonie, NY to learn more about our plans to introduce these two new HC BP prediction protocols. Considering the high potential for big $$$ losses, spending a little time and money to identify problem blocks and keep them out of storage will pay off by improving your bottom line.

Recent references: All NYS apple producers receive a copy of the Fruit Quarterly. Please take the time to review three recent articles:

Bitter Pit Mitigation and the Honeycrisp Apple: Prohexadione-calcium and Bourse Pinching Effects on Bitter Pit, Shoot Extension, and Fruit Size. Donahue, D. J. et. al. 2018. Fruit Quarterly 26-3, pp. 23-28.

Non-Mineral Prediction of Bitter Pit in Honeycrisp Apples. Al Shoffe, Y. et. al. 2018. Fruit Quarterly 26-2, pp. 21-23.

Why is Honeycrisp so Susceptible to Bitter Pit? Cheng, L. and M. Miranda Sazo. 2018. Fruit Quarterly 26-1, pp. 19-23.

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New Farmers Grant Fund Accepting Applications from Early-Stage Farmers

Empire State Development (ESD) and the New York State Department of Agriculture and Markets today announced $1 million in funding is available to assist early-stage farmers through the New York State New Farmers Grant Fund. The program, now in its fifth year, promotes growth and development in the state's agriculture industry. To date, $3.27 million has been awarded to nearly 90 farms throughout New York State to expand their operations and improve their profitability.

The $1 million New Farmers Grant Fund will provide grants of up to $50,000 to assist with up to 50 percent of eligible project costs. To qualify, all farm business owners must be within the first ten years of having an ownership interest in any farm business, and the farm must have a minimum of $10,000 in income from sales of products grown or raised on the farm. Eligible project costs include the purchase of machinery, equipment, supplies, and the construction or improvement of agricultural structures.

Applications and guidelines for the New Farmers Grant Fund are available at https://esd.ny.gov/new-farmers-grant-fund-program. The deadline for submission is January 25, 2019.

Questions should be sent to Bonnie Devine at: nyfarmfund@esd.ny.gov.

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