

Mechanics of Drop Control in the orchard: Use of NAA, Retain and Harvista.

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Fruit drop just before harvest is a serious problem for some apple varieties grown in New York. Many commercial apple fruit growers with sensitive varieties lose 5 to 25% of their apple crop due to pre-harvest fruit drop, which occurs just before fruit develop optimum red color, maturity and/or size. This drop can occur very rapidly, often within a few days and before labor can be marshaled to prevent it. Pre-harvest drop must be managed annually for notorious varieties such as McIntosh and Macoun, and more recently Honeycrisp.

The severity of fruit drop is influenced by several factors but plant stress and premature ethylene production is at the basis of true physiological drop. Stress factors such as late season heat, primary and secondary pest infestation, and nutrient imbalance or deficiency, and heavy summer pruning, all can contribute to drop.

There are other physical factors that can cause fruit drop not related to the physiological causes. For example, a large crop of a short stemmed apple variety will “push off” close to harvest simulating the more serious physiological drop. Managing drop is an important aspect of bringing a full crop to market.

Fortunately we have a number of tools available to help us manage fruit drop that can be partially effective if used properly. These tools are not perfect and rarely control the entire drop. When they do not work they can be frustrating and expensive.

To put an effective drop control program together one must plan well in advance. Strategies include either prompt harvest or the use of growth regulating chemicals. The first step is to identify those varieties and blocks that are most at risk based on the variety, intended market, history of the block, and severity of stress factors in the current season. Based on these factors identify the tools that will be required to prevent drop and the timing for the application of these tools.

The dropping history of a block is an important factor to keep in mind when managing fruit drop. Some blocks have a history of drop problems while others do not even if the variety is known to be prone to dropping. Generally, blocks with a history of drop should receive special attention and be monitored frequently.

After you have identified which blocks are most at risk based on variety harvest date and history, a strategy can be constructed based on the intended use of the apples in this block and the reasons for keeping apples on the tree.

Reasons for Applying a Stop Drop

1. *To keep apples on the tree until they reach physiological maturity.* This type of drop is the most serious since a significant portion of the crop fall before they are ready for harvest. Prompt harvest is not an option. McIntosh, Macoun, and Honeycrisp fall into this category since they drop before they are physiologically mature. A chemical strategy must be used because apples must be kept on the tree until they are mature and saleable. Apples picked before maturity are small, under-colored, starchy, have a poor taste without varietal flavor or sweetness and do not store well.
2. *To allow apples extra time on the tree to increase fruit size and yield and to obtain marketable color.* Growers often need to wait for marketable color on apples. Apples may be mature and physiologically ready to pick but lack fruit color demanded by the market. Some varieties such as McIntosh will drop wait for color. Since environmental conditions with warm days combined with cooler nights trigger color development, applying stop drops will delay harvest sometimes

pushing apples into windows of improved weather for coloring. Fruit size and total yield also increase since apple size continues to increase.

3. *To hold apples on the tree for an extended period of time so that they will be available for extended harvest as in U-Pick situations.* U-pick operations rely on the public to harvest the fruit. Often the success of these operations depends on having a wide variety of fruit available for picking at any one time. Most consumers do not realize that the optimum picking window is relatively short and the less experienced expect their favorite variety to be available throughout the fall. Growers try to accommodate these consumers by having the widest variety of fruit available through the harvest window by using a number of tactics. Delaying maturity and preventing fruit drop are two of these strategies.
4. *To survive a predicted storm with a high wind event that will cause apples to drop.* Storms with high winds can occur during the harvest window. A significant number of apples will drop suddenly especially when the abscission layers have already formed and apples are loose on the tree. When growers have enough notice, the application a Stop-Drop prior to the storm can help.
5. *To manage the harvest season when there are too many apples to harvest during the time window available with the labor available.* Drop control can be used to manage harvest on drop prone varieties when harvest must be delayed because of labor shortages.

Strategies for Preventing Drop

Prompt Picking -

Prompt picking is an easy way to maximize the crop yield. As soon as true drop begins have the crop picked immediately. This will require that blocks be monitored frequently and labor can be obtained and moved quickly. This strategy requires that growers be aware of problem blocks and regularly scout them for true drop. It is important that growers not jump the gun and pick before fruit is physiologically mature or color has not reached a marketable level. "Push off" (false drop) usually occurs several days before true physiological drop and premature picking can result in poorer fruit quality and storage.

Growth Regulators

NAA(naphthalene acetic acid) – is an auxin-type growth regulator recommended for use at 10 to 20 ppm. There are now several manufacturers of NAA. AmVac Corporation produces Fruitone N and Fruitone L and Fruit-Fix Concentrate 800 all labeled for drop control. Fruitone N and L are 3.5% ai materials and Fruit-Fix C 800 is a 21% ai material so different rates apply. Be sure you know which material you are using to avoid over or under dosing. Although there are other manufacturers and formulations of NAA labeled for thinning, they are not legally used for Drop Control. NAA is considered a rescue material and should be applied 7 days ahead of anticipated harvest and as the first sound apple drops. Applications are most effective and should be made when temperatures are above 70 degrees F and NAA is only effective for 7-10 days after spraying. A repeat application for stop-drop prevention can be made 7 days after the first if needed. The material will become effective 1-2 days after application. If applied after the orchard has been spot picked it may take longer to take effect. Therefore, apply NAA as soon as the spot pick is finished. Do not apply NAA closer than 5 days before harvest. Refer to the label.

Apply NAA in a dilute spray. A dilute application favours more uniform coverage. This is important because NAA is only locally systemic and high volumes of water take longer to dry and allow increased absorption of NAA. The optimum conditions for maximum absorption are at or near 21°C-24°C and high humidity. Absorption is less on foliage injured by insects, diseases or frost, and at temperatures below 16°C.

The Addition of a non-ionic type spreader sticker improves absorption of NAA under less than ideal weather conditions.

NAA inhibits fruit abscission but the fruit continues to mature at an accelerated rate. The higher the concentration used and the greater the number of applications, the greater the ripening effect. One application of single strength (10 ppm) has little effect on direct ripening but our research has shown that multiple applications of NAA will result in fruit softening.

ReTain (*aminoethoxyvinylglycine*) - This material has proven to be more effective than NAA for stop drop control but has the drawbacks of being harder to time application and more expensive to use. ReTain however, may increase soluble solids, color, fruit size, fruit firmness and reduce the increase of water core. It delays harvest 7-10 days and must be picked when maturity indices indicate. Although the label states that applications need to be made 4 weeks ahead of anticipated harvest practically speaking there is a fairly broad window for application that will still give good results. In NY, our recommendations have taken into account the weather conditions in August for application timing. Applications should be made 4 weeks ahead of anticipated harvest in hot years and closer to harvest on the cooler years. This approach takes into account the increased stresses and earlier ethylene generation in hot years and the delayed ethylene in cooler years. Like NAA, this material needs to directly contact the fruit and is not translocated in the tree so thorough coverage is essential. The addition of a 0.1% v/v organosilicon surfactant such as Silwet L-77 is recommended to improve coverage. Since the use of excess water carrier also has a negative effect the use of TRV applications is encouraged.

The recommended rate is 17oz (of 333 grams)/100 gallons and the material comes in single pouches so it is easy to measure and use. The high rate is used for stop drop control on sensitive high ethylene producing varieties such as McIntosh and Macoun and can be reduced for low ethylene generating varieties such as Gala and for other uses such as spreading the harvest season by delaying maturity.

Retain plus NAA - Recent work in Virginia showed that combinations of Retain plus NAA were more effective than Retain or NAA in most years and did not reduce fruit quality as NAA alone does. This combination has been adopted widely there and has been successfully tested in NY for several years.

Harvista (*1-methylcyclopropene*) – This material is not yet available in NY but is being tested throughout the world and in the Northeast as a stop drop material for McIntosh. It is rapid acting and only need be applied approximately 7 days before harvest and gives comparable results to the best Retain plus NAA treatments we have tested. In addition, this material preserves firmness through storage.

Results

NAA is the only stop-drop material available in NY that can be used just before harvest. It should be used only as a “rescue” material and will provide only marginal drop control. Data from the Hudson Valley repeatedly shows that this material is ineffective as a drop controlling material and in our trials has not differed from the untreated checks. Data from Western NY and the Champlain Valley have not shown a significant difference but there appears to be a numerical difference in drop control of less than 10% in severely dropping blocks. In blocks that do not normally drop badly an application of NAA may not work at all and multiple applications may actually be detrimental resulting in softer fruit and poorer storage.

Retain has proven to be an effective material in most years, significantly better than NAA and is recommended for broad application in drop prone varieties in blocks with historical problems. It does delay harvest and fruit must be picked according to maturity indices.

Retain plus NAA continues to be better than either of the other materials alone especially when Retain is used at the normal rate and NAA is applied in repeated applications shortly before harvest. We have had variable results over the years we have tested these combinations so the best combination has not yet been determined.

Orchard evaluation of Havista has shown excellent activity as a drop control material in NY for McIntosh allowing for applications immediately before harvest.

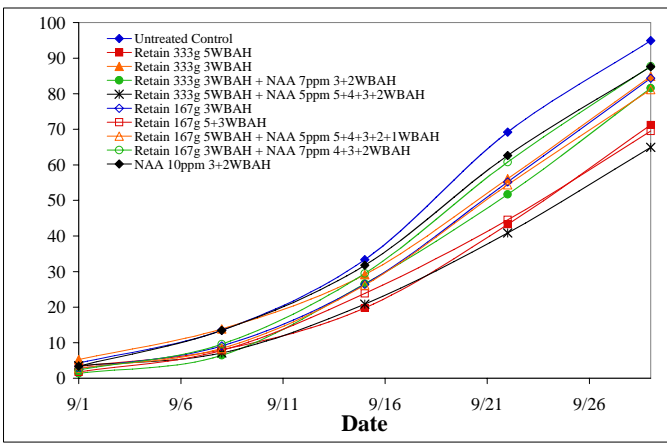


Figure 1. Effect of Retain, NAA, and Retain plus NAA on pre-harvest drop of McIntosh in 2010 in the Hudson Valley, NY (Dressel Farms).

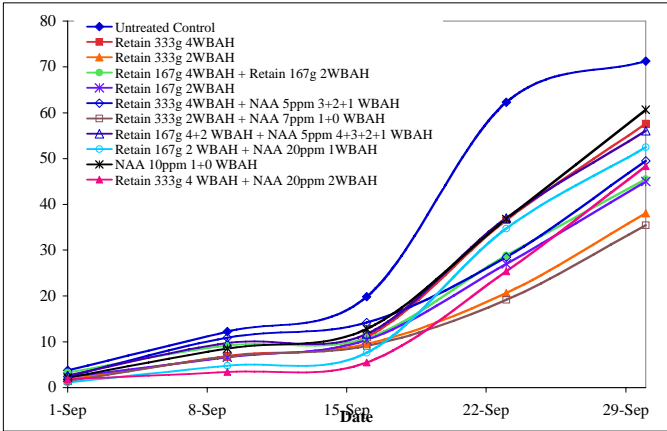


Fig. 2. Effect of Retain, NAA, and Retain plus NAA on pre-harvest drop of McIntosh in 2010 in Western NY (DeBadts Orchards).

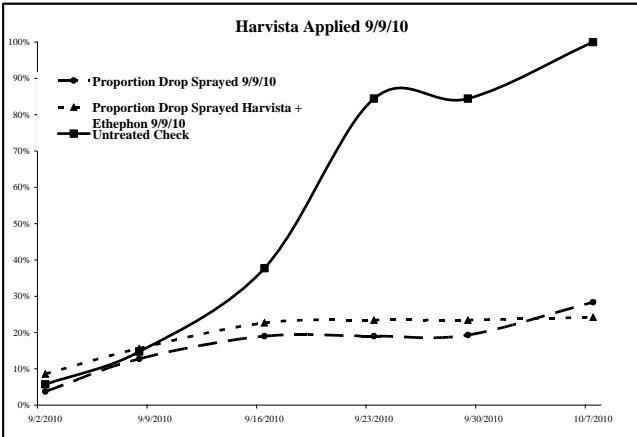


Fig.3. Effect of Harvista on preharvest drop of McIntosh in 2010 in the Hudson Valley (Dressel Orchards).