

## **Project Report to the NYS IPM Program, Agricultural IPM 2002-2003**

**Title: Using 1-MCP as a replacement for postharvest drenching with diphenylamine, thiabendazole, and captan for control of superficial scald and rots on NY apples**

### **Project Leaders:**

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### **Cooperators:**

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### **Type of grant:**

Cultural methods; sanitation; physical controls

### **Project Locations:**

Orleans County NY, Findings are applicable to Western NY and the Hudson Valley region

### **Abstract:**

Apples were treated with 1-Methylcyclopropene (1-MCP) gas to determine if it could suppress the development of the skin discoloration disorder known as "superficial scald". The present procedure to control scald is to drench fruit with a water solution containing diphenylamine (DPA). Drenching controls scald, but the process itself leads to increased rot problems in storage. The long term availability of DPA is in doubt due to concerns about food safety and cross contamination. Therefore, alternatives need to be explored. Separately, two trials were initiated at harvest in 2002 to determine if 1-MCP treatment affects decay-susceptibility of Empire apples during long-term controlled-atmosphere (CA) storage. Since both projects deal with disorders that develop after extended storage (20+ weeks), the results are not yet available.

### **Background and justification:**

Superficial scald is a skin discoloration on apples that develops after extended periods in storage, and is controlled by drenching bulk fruit in bins upon arrival at the storage destination with a solution containing diphenylamine (DPA). The drenching process requires a fungicide to be added to the water solution, typically thiabendazole (TBZ) or captan to control *Penicillium expansum* (blue mold) and *Botrytis cinerea* (gray mold). However many storage operations in NY have developed resistant strains of *P. expansum*, and postharvest decay can no longer be effectively controlled with fungicides. The fungicide resistant spores are passed from farm to farm on bins, and apples become inoculated with *Penicillium* spores that are washed from bins into the recycling DPA drench solutions. Therefore, while storages have obtained effective control of scald with DPA, they have opened the door to increased problems with rot in long term storage. The best way to avoid this problem would be to eliminate the drenching process altogether. However, this is impractical due to the need for the application of scald controlling materials (DPA).

Recently, a new material called 1-Methylcyclopropene (1-MCP) was registered for use on apples. It is used as a gas in closed storage rooms, and helps maintain fruit quality by blocking ethylene receptors. Other research has shown it to inhibit or delay the onset of scald

development. The use of 1-MCP (trade name SmartFresh) offers several potential advantages: 1) it may eliminate the need for drenching, thereby minimizing the rot problems associated with drenching. 2) Better control of storage rots would help improve pack out and profitability for growers during what has been a very difficult time for the apple industry. 3) There are no disposal issues with 1-MCP since it is a gas. 4) Treatment occurs in closed storage rooms, so there is no hazard associated with worker exposure, nor is there any environmental contamination risk. 5) 1-MCP is used at low concentrations (1.0 ppm) and has a safe toxicity profile. 6) There is no residue left on the fruit after treatment, therefore 1-MCP does not add to the cumulative loading of chemical residue on fruit. 7) If DPA is pulled from the market, storage operators may still have the ability to control scald with 1-MCP.

One possible down side is that 1-MCP treatment could possibly contribute to increased decay in stem-inoculated fruit if 1-MCP interferes with natural resistance mechanisms that impede invasion of stems by *P. expansum*. So far, this has not been researched in NY and more information is needed in this area.

### **Objectives:**

- 1) Test the efficacy of 1-MCP as a scald control measure on NY apple varieties, and determine if 1-MCP gas treatment can be an effective alternative to drenching with DPA and fungicides.
- 2) Project evaluation: determine the potential reductions in DPA and TBZ that may be achieved by switching to 1-MCP, and perform economic analysis comparing the cost/benefit of 1-MCP vs. DPA and TBZ.

### **Procedures:**

#### **Scald Trial with Cortland, Red Delicious, and Law Rome**

Samples of Cortland, Red Delicious, and Law Rome were harvested from commercial orchards in Western NY during the identified harvest window for each variety. At the time of sample collection, 10 fruit were taken for maturity assessment. The following three treatments were replicated three times with fruit from different orchard sources serving as replicates. Each replicate sample contained one bushel of apples.

1. Untreated check
2. Drenched with DPA and TBZ
3. Treated with 1 ppm 1-MCP for 24 hours

All treatments were applied at Lake Ontario Fruit Inc., in Albion NY. Drenching was done with the commercial drencher at the storage using known concentrations of DPA and TBZ. The 1-MCP treatment was applied in a commercial storage room at the rate of 1.0 ppm for 24 hours. Samples are being held in regular air storage (34°F) until adequate time has passed for scald to develop (generally 20 weeks or more). In March, the samples will be evaluated for the presence of superficial scald, rots, and senescent disorders.

#### **1-MCP effect on decay susceptibility of Empire apples**

Trials were initiated at harvest in 2002 to determine if 1-MCP treatment affects decay-susceptibility of Empire apples during long-term controlled-atmosphere (CA) storage. Fruit in these trials were inoculated with *P. expansum*, the pathogen that causes blue mold decay, using two different inoculation methods. We anticipate that 1-MCP is unlikely to affect the incidence or severity of blue mold decay that results from wound inoculations. However, 1-MCP treatment may contribute to increased decay in stem-inoculated fruit if 1-MCP-treatment interferes with natural resistance mechanisms that impede invasion of stems by *P. expansum*.

The following four treatments were replicated four times at Lake Ridge Storage and five times at Dobbins Storage by using fruit from different orchard sources as replications:

1. Stem-inoculation with no 1-MCP treatment
2. Wound-inoculation with no 1-MCP treatment
3. Stem-inoculation plus 1-MCP treatment
4. Wound-inoculation plus 1-MCP treatment

For each orchard source, treatments were applied to bags containing 25 fruit. Wounded fruit were dipped into inoculum suspensions containing 10,000 conidia/ml whereas stem-inoculations were performed by dipping fruit into suspensions containing 50,000 conidia/ml. Inoculations were made on October 8, and 1-MCP treatments were applied later the same day. All of the inoculated fruit, along with comparable non-inoculated fruit that will be used for quality assessments at the end of the experiment, are being held in long-term CA storage.

Wound-inoculated fruit will be evaluated for incidence (% fruit decayed) and severity (diameter of decayed area) in early January. Stem-inoculated fruit will be held in CA storage until at least May of 2003 before they are evaluated.

If 1-MCP treatment contributes to a higher incidence of decay following stem inoculation, then storage operators will need to implement more effective sanitation procedures for fruit destined for 1-MCP treatment so as to reduce risks of decay-related losses during long-term CA storage.