STABY - OSU

Blanpied 80

CORNELL FRUIT HANDLING AND STORAGE NEWSLETTER

G. D. Blanpied, F. W. Liu, and R. M. Smock

Pomology Department, Cornell University, Ithaca, NY

July 1980

BLANPIED 180

Oxygen Concentrations in CA. The increasing demand for hard apples and the research data that shows better firmness with lower oxygen have motivated some operators to use oxygen concentrations below the recommended range of 2.5 to 3.0 percent. Two New York operators suffered losses from low oxygen injury last winter. The injury would not have occurred if these operators had the margin-for-error that is available when rooms are held in the recommended range. At some future date we may lower the recommended range of concentrations for oxygen, but that recommendation will be accompanied by additional harvesting and handling recommendations and also recommendations for atmosphere analytical and control equipment that is not presently used in our commercial CA rooms. Until then, play it safe.....2.5-3.0% O_2.

Carbon Dioxide Concentrations in CA. Our research data indicates the very low CO_2 (below 1.0%) associated with placing large quantities of lime (.75 to 1.0 pounds per bushel) directly into the CA room does not adversely affect the condition of apples normally held in 32° CA rooms. However, research data and observations at one commercial CA establishment last winter strongly indicated that low CO_2 may dramatically increase McIntosh breakdown (soft McIntosh). Use 3% CO_2 for the first 4-6 weeks after sealing and then use 5% CO_2 for the remainder of the McIntosh CA storage season.

Fast Fill CA. In recent years there has been an increasing tendency for operators with several CA rooms to fill the rooms one-at-a-time, rather than spreading each day's load into two or more rooms. If the room is loaded in one or two days and there is poor air circulation due to improper, tight stacking of the bins (which is usually the case), the thermometer will indicate only slightly elevated air temperatures but the center of the room will be hot. If the room is loaded in one or two days with properly aligned air channels to facilitate rapid cooling, the air temperatures in the room will be high because the coil was probably sized for a ten percent fill rate. The ten day loading rate may be exceeded if incoming core temperatures are low (below 50°), but one and two day fillings can be tolerated only if apples have been precooled to core temperatures of 35° or less. Remember that good fruit condition after CA is more dependent upon rapid cooling than on quick sealing and rapid oxygen reduction.

Explosion in CA Room. An explosion occurred last fall less than one hour after a propane burner was disconnected from a CA room. It is thought that the defrost timer-relay provided an electrical spark that ignited propane gas inside the CA room. The take-home lesson from this incident is to locate electrical relays outside the CA room.

Carbon Monoxide Poisoning. A CA operator was moving apples from a newly opened CA room into a holding room across the corridor. A fan was used to ventilate the corridor outside the CA room. The operator passed back and forth through a plastic strip curtain door, which was hung in the doorway of the holding room, as he transferred bins from the CA room to the holding room. The free movement of the forklift through the plastic strip curtain door fooled him into ignoring the plastic strips as a barrier to the carbon monoxide emitted from the forklift motor. After 1½ hours of restacking bins in the holding room he became dizzy and nauseous. The carbon monoxide poisoning hospitalized him for a few days. PLASTIC STRIP CURTAIN DOORS ARE BARRIERS TO CARBON MONOXIDE GAS.

Disinfect Cull Bins. Fungus spores in the bins you used for cull apples last season can be a rich source of inoculum to infect the current crop of apples when they are treated with a scald inhibitor after harvest. A fungicide with the scald inhibitor will reduce but not completely eliminate the hazard of rot. Therefore, Dave Rosenberger (Highland Lab) has suggested using a 10 percent chlorox spray to disinfect empty cull bins.

Ethoxyquin. We have recently heard from Monsanto Agricultural Products Company that they are still making StopScald for sale in Great Britain, France, Spain, and Israel, but not in the U.S.A. because they estimate the cost of compliance with the new EPA regulations for registration would exceed 5 million dollars. Sales and profit from StopScald would not justify the cost. Fortunately, ethoxyquin is still available from PennWalt and from Chemley Products Company. Chemley reports the occasional bitter taste of apples treated with ethoxyquin was imparted by material that was a year or more old. Consequently they will manufacture only enough of their ethoxyquin formulation for each season. Orders should be placed with Chemley before the end of June each season.

Thermometers. Many storage operators foolishly use uncalibrated thermometers to set their thermostat(s). It is not at all unusual for thermometers to be inaccurate by 1 or 2 degrees. Consequently, rooms are sometimes run at 30° or 34° instead of a desired 32°. Occasionally, thermometers are highly inaccurate. Last winter an operator set the thermostat in a CA McIntosh room with a thermometer that was reading 7° low. He loaded the room at 39° (the thermometer read 32°) and operated the room all winter at 43° (the thermometer read 36°). The room was a complete loss.....the worst case of McIntosh breakdown we've seen.

Don't entrust your valuable stored apple crop to an uncalibrated, 3 dollar thermometer with 2° subdivisions on the scale. See the last page of this Newsletter for sources of good thermometers. But, remember that all thermometers except primary reference thermometers should be calibrated with a primary reference thermometer or by placing the thermometer into a container of melting ice and ice water, which will be 32°. All thermometers should be checked for correctness of reading at the beginning of each storage season.

Idared Breakdown. The 3 factors that most often aggravate storage breakdown of Idared are young tree age, large fruit size, and late harvest. Breakdown is usually not severe after trees reach 10 to 12 years of age. However, large fruit size due to light cropping and late harvest may result in excessive breakdown of apples from older trees. The best control measures include: patience until the trees pass out of their adolescence; avoidance of overthinning the crop; pick the apples within one week after the bitter flavor disappears from the skin; postharvest dip treatment of 3% calcium chloride (24 pounds/100 gallons) plus 1000 ppm liquid DPA. The liquid DPA contains a good wetting agent for the calcium chloride and provides protection against storage scald.

McIntosh Breakdown (Soft Macs). For a number of seasons we have been studying orchard, harvest and storage factors that might influence McIntosh breakdown. Many of these factors have been eliminated as contributors to the problem. In the paragraphs below we discuss the factors that do appear to significantly influence the development of McIntosh breakdown in storage.

Some Orchard blocks are notorious offenders. You probably know which ones they are by now. We do not know why some blocks always yield apples with high incidences of breakdown and others never have the problem.

NAA thinning sprays greatly increased breakdown in one Ithaca orchard block in 1978 and again in 1979. In 1979 parallel studies in Sodus and Peru did not verify this effect. This indicates NAA thinning sprays may be a contributing factor to

breakdown in some orchard blocks. Further observations will be made this season.

We have looked at Alar effects in several seasons and have observed that Alar may reduce breakdown in early harvested fruit and frequently increases breakdown in apples picked in the second half of the harvest season. Pick all of your CA McIntosh before the optimum harvest (centering) date for your area.

Harvest date is also important when Alar is not used. Avoid late picked McIntosh in CA. CA apples not sprayed with Alar should also be picked before the optimum (centering) date.

Treatments with several calcium tree sprays in the growing season have not looked promising. We have tried many different calcium compounds and none have given consistantly good results. In 1979 calcium chloride tree sprays significantly increased breakdown in an Ithaca and also in a Sodus block of trees. Calcium chloride postharvest treatments have usually reduced breakdown when a good wetting agent was present in the water. Therefore, we are suggesting the following recipe for commercial use. However, do not use the recipe if the apples have open calyces or split lenticels because the calcium chloride will burn if it comes into direct contact with the apple flesh.

calcium chloride (food grade, such as DowFlakes)	25 lbs/100 gallons
Benlate	0.5 lbs/100 gallons
Captan	1.0 lbs/100 gallons
DPA	1000 ppm
*Chevron X-77 or Tween 20	1 pint/100 gallons

*If DPA is used at 2000 ppm, no additional wetting agent is required.

Lowering the relative humidity to about 80% in 32° air storage has significantly reduced breakdown in 2 seasons. We have not made relative humidity studies in CA. Postharvest calcium chloride dips may have the same effect as the lower relative humidity and the two effects may not be additive. Calcium chloride postharvest treatment would be easier to implement than lowering the relative humidity. We'll investigate the possibility of substituting lower storage humidity with calcium chloride postharvest treatment this season.

Observations in the field and research data indicate breakdown is aggravated by high temperatures in storage. In air storage the temperature should be maintained at 30-32°. Although we recommend 36-38° for CA McIntosh, a few operators are using 32°. We cannot make a blanket recommendation of 32° because this low temperature can induce brown core, lack of flavor, and sometimes off flavor. However, we cannot ignore the few Hudson Valley operators who have been successfully using 32° for CA McIntosh for a number of seasons. If you want to try temperatures

below 36°, we suggest you maintain the oxygen at 3.5-4.0% to minimize the danger of off-flavor development.

We have experimentally observed that breakdown at 1.5% oxygen was significantly lower than at 3% oxygen. However, we strongly recommend that commercial operators maintain 2.5-3.0% oxygen...see comments under the section Oxygen Concentrations in CA.

One field and one research study in 1979-80 indicated carbon dioxide may significantly influence breakdown in CA. Experimentally there was no breakdown at 3% carbon dioxide and 100% breakdown when the carbon dioxide was held below 1% in CA. In the field we observed tragically high incidences of breakdown in a room that had very low concentrations of carbon dioxide because 1 pound, instead of 0.1 pound, of lime per bushel had been added to the room to control carbon dioxide.

Ethylene scrubbing in CA continues to be a very promising way to control breakdown. In 1979-80 we ran adjacent 1400 bushel capacity CA rooms at low and normal concentrations of ethylene. In the control (normal ethylene concentrations) room the ethylene quickly rose to concentrations of several hundred ppm. In the ethylene scrubbed room Purafil was used to hold the ethylene below 1 ppm until January. After January the ethylene concentrations increased rapidly because the apples produced ethylene faster than the scrubber could remove it from the atmosphere. The test was therefore not a complete success, but it demonstrated the feasibility of scrubbing ethylene in CA rooms and in spite of the higher-than-desired concentrations of ethylene late in the storage season the apples held for 6 and 8 months in the ethylene scrubbed CA room were firmer than apples held in the normal CA room and ethylene scrubbing reduced breakdown from 1-75% to only 0-3%. In 1980-81 we will concentrate on developing methods to reduce the rate of ethylene production by apples late in the storage season and also testing more cost-efficient ways to scrub ethylene from CA rooms.

In summary, keep the following points in mind. (1) Avoid long storage of blocks with a poor track record. (2) Do not CA store McIntosh picked after the optimum harvest (centering) date. (3) Add calcium chloride (see recipe) to your scald inhibitor tank. (4) Use 30-32° for air storage and 36° for CA. (5) Hold the oxygen concentrations at 2.5-3.0%. (6) Use the maximum recommended concentration of carbon dioxide - 3% for the first 4 to 6 weeks and then 5% for the rest of the season.

Thermometers for Commercial Apple Storages*

Taylor wall thermometer #1106
-50° to +70°F in 1° subdivisions
hang near window of CA room or on wall of air storage room

Chippewa Instrument Co.
30 Pannell St.
Buffalo, NY 14214
716-232-4088

Joseph H. Bertram Co.
4 Britton Drive
Bloomfield, CT 06002
800-243-2340

Primary reference thermometer
ASTM No. 63F
+18° to +89°F with 0.2° subdivisions
Catalog No. 15-142B
can be used to replace ice bath for calibration of storage room thermometers

Sling psychrometer
Catalog No. 11-666
to measure relative humidity

Fisher Scientific Co.
15 Jet View Drive
POB 8740
Rochester, NY 14624
716-464-8900

Fruit testing thermometer
+20° to +80°F with plastic case
Catalog No. 21862-1
to measure apple core temperatures

Analog Instruments
600 W. Manlius
POB 219
East Syracuse, NY 13057
315-437-8413

The most commonly seen remote temperature sensing equipment is manufactured by the Yellow Springs Instrument Company, Yellow Springs, OH 45387 (513-767-7241). Instruments must be purchased through franchised dealers such as VWR Scientific, 39 Russel St., POB 1050, Rochester, NY 14603 (716-288-5881). YSI Model 44 Telethermometer can be used to read 12 remote temperatures. Specify the instrument must have the TH temperature range (25 to 100°F). Order #401 general purpose probes and specify the length of the wire needed to reach from the temperature sensing location in the storage room to the location where the instrument will be used (usually the table for the Orsat gas analyzer).

*Mentioning of specific trade names and vendors does not imply our endorsement.