2013 grant report to NARBA:

Postharvest Kit, Produce Cooling, and Training for Small Acreage Raspberry and Blackberry Growers: Phase 2: Training, Web Access and Grower Demonstration

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Category: Production research

Update:

A postharvest kit was developed and presented at the Virginia Berry Conference, February, 2013 and again at the Virginia extension agents in service training day in July of 2013. It was displayed most recently at the NC Strawberry Association and NASGA combined meeting. Kits were given to Dr. Rafie and Dr. Jayesh Santani, Virginia. A description of the kit, photo, and supplies price list for those who want to make their own is attached.

The Pack N Cool trailer has proven to be a big success, especially when people see it in person. It has been to Virginia, Raleigh, Durham, and New Bern, North Carolina. We have used what we have learned about its limitations to start a larger unit that will be able to hold a generator on its tongue, and is slightly taller and wider to accommodate a pallet of fruit. The current Pack N Cool was retrofitted with a generator and deflection plate on the AC fins to offset damage when driving down the road. The Pack N Cool was also taken to local farmers markets by a grower to test its effectiveness and potential weaknesses. Overall the grower was highly pleased, using it to haul sweet corn and melons and able to keep them cool after reaching markets. Selling cold watermelons was not a point I had considered as a marketing strategy. Additionally, the grower reported that picking and packing for Saturday markets could be wrapped up Friday afternoon, allowing for a later start on Saturday and far less labor in the field Saturday. He calculated that this savings alone would pay for a Pack N Cool in a month.

We fitted ibuttons in the Pack N Cool then added a large load of strawberries harvested from the Piedmont Research Station, NC. These were in bins as solid masses of about 15 to 20 lbs per bin

(a total of about 100 lbs fruit). Bins were stacked in the unit, with starting field heat at 90 F. Cooler temperature was at 50 F within 2 hours, and reached the 7/8 temperature at 7 hours. Humidity was not as high as would want, running at about 60%, and rotating fans within the unit might help move cold air more quickly through a more solid mass.

Setbacks:

Two major goals were not met in 2013. One was the completion of the postharvest portal. I ran into snags when trying to set up the portal early in the year, then ran out of time to get the job finished once summer began. The other was to build a fan small enough to be portable yet strong enough to generate sufficient air flow through a ½ or full pallet of fruit. The fan did not get done before our mechanically talented assistant left to take another job. While the postharvest kit and Pack N Cool got to some grower demonstrations and was presented at several meetings, I underestimated the amount of time it would take to attend the various grower and field meetings.

For these reasons, I am asking for a no cost extension for 2014. Goals are to get a video of the kits (and how to use each piece) onto the postharvest portal, to get the portal launched, to get the kits demonstrated at more grower events, and to get a functional fan built.

POSTHARVEST KITS FOR FRUIT QUALITY TESTING

Postharvest experts generally follow fruit and vegetables from field to consumer. The general guidelines are cleanliness, cold chain management, adherence to packaging guidelines and weights, and reduced mold/decay of the product. Extensive postharvest research, along with the boom in technology and relatively cheap tools, has made it possible for small acreage growers to better monitor their commodities for quality control.

I developed this kit with the idea that extension specialists and county extension agents could use the kits for on farm visits and grower demonstrations at meetings. After putting several together, it was also clear that anyone could do this themselves, if a short list of items and how they are used, was put together. The key to the kit is that most items can be found at Walmart, Harbor Freight, or Amazon. Some items can be purchased directly from the vendor, and some items can be obtained on sale. Outlined below are the lists of items, what their uses are, sources, and relative costs. NCSU will sell the kits for $300 if you don't want to be bothered to put your own together (contact Penelope_perkins@ncsu.edu for details). Or, you may want to tailor a kit to your specific needs.

Category:

Weight and diameter

Scale (600 g or 1.3 lb): used to check individual weights of clamshells to make sure 1 lb weight is met. Can be used as a training device for new pickers. Also good for the 'biggest berry' competition.

Calipers give a quick gauge of diameter or thickness, depending on the fruit. It may be that you want to call attention to your large blueberries (over 1 inch across!) or determine if standards will be met for berry size. Also can be used to size onions, apples, peaches.

Sweetness

Refractometers are used as a quick means to determine the sugar level of fruits. This model uses infrared light beamed through a sample and reads out the result digitally (easier on the eyes than the stick model). Refractometer readings (in brix or % soluble solids) are capturing sugars, acids, and other water soluble components. For some fruit, the reading will reflect the sugars to 90%. For other types, the sugars may only represent 60 to 70% of the brix reading. It is a good instrument to check fruit quality, especially after heavy rain or irrigation, when the brix often falls as water moves into the fruit, to see if those blackberries are really ripe enough, or to see if your fertilizer regime (more potassium for sweetness) is working for strawberries. Note: if you just want the refractometer, Milwaukee (in Rocky Mount, NC, milwaukeeinstruments.com) sells the refractometer plus the box (an extra $12 or so); I recommend getting the box-it won't fit in the insulated bag we use but if you just want the refractometer, the box protects it nicely. Also, the range on these refractometers is 0 to 85 Brix, which means they can be used to monitor jelly (Brix should be 50 and above for jams and jellies to suppress bacterial growth).

Slurpee straws are added to transfer puree to the refractometer sampling dimple (or you can squeeze the fruit directly onto the sampling stage). Lens wipes are added to clean the surface. Avoid paper towels as these will scratch the lens coating of the refractometer.

Temperature management

This is the heart of maintaining shelf life for fruits and vegetables. Usually it's a matter of keeping fruit cold enough; sometimes some commodities want to be warmer (like tomatoes).

Anemometer:

Thanks to balloonists, these units now come in handy pocket sizes. Anemometers measure wind speed, and can be used to check your cooler fans to see how much movement you're getting, and if the air movement is uniform.

Thermometers:

a. Digital Shelf thermometer. Gives a quick glance when you open the cooler door as to the status of the cooler. The humidity measurement is not very accurate but will distinguish 10% from 60%.
b. Digital Stick-in thermometer. This is needed to comply with food standards where an actual destructive measurement is taken of produce (stick it into the fruit and read the temperature)
c. Non contact thermometer. My personal favorite. The beauty of this little thermometer is that you can aim it at the center pack of fruit and get an idea of what the temperature is relative to the cooler temperature, without having to stick a fruit or even walk inside. A great way to isolate hot spots in your truck or cooler too-check corners, floor, roof areas for relative temperatures of solid surfaces.

   While not included in this kit, check out ibutton loggers at QA supplies.com. These come as temperature or temperature plus humidity buttons ($28 to $85 plus $15 software) that can be placed anywhere in your cooler or produce load, and changes in temperature followed by computer by increments of minutes or hours. You can follow the cooling curve from anywhere using this system.

Other parts:

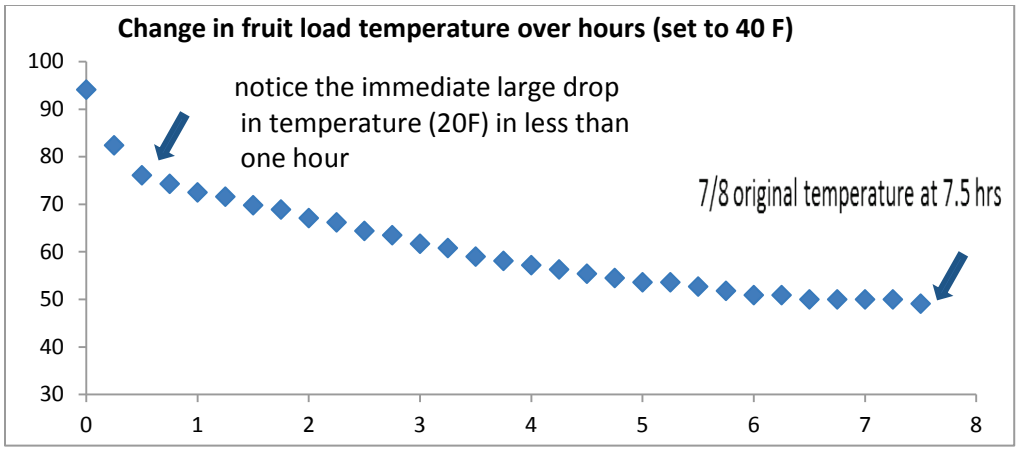
pH paper: useful for checking acidity of fruits and also for pH where cleaning of produce is being done. If chlorine is used as a wash step, check the pH of wash water to make sure it is 6 to 7 so chlorine will remain active. A useful hint: fruit pH is usually between 3 and 6. So if you want to check fruit pH, get pH paper that covers these ranges and has ½ point increments (3, 3.5 etc). If you want to check chlorine levels, use pH paper that covers 0 to 14 range in 1 unit intervals.

Chlorine test strips: used to see if free chlorine levels are correct. Usually not done with small fruits, but chlorination of wash water is done with peach, apple. Free chlorine should be 100-200 ppm. The chlorine level of tap water should be 1-2 ppm if city chlorinated.

Container: this is a 9-can insulated cooler bag. The idea is to offer insulation and protection to the instruments inside without adding excessive bulk or weight.

1. INSULATED BAG (HOLDS AND PROTECTS CONTENTS)
2. REFRACTOMETER (MEASURES SUGARS)
3. SCALE (MEASURE CLAMSHELL OR FRUIT TO 1.5 LB)
4. ANEMOMETER (MEASURE FAN WIND SPEED)
5. CALIPERS (MEASURE DIAMETER, LENGTH, THICKNESS)
6. LASER THERMOMETER (NON CONTACT TO CHECK FRUIT TEMPERATURES IN STORAGE)
7. pH PAPER (CHECK ACID LEVEL OF FRUIT)
8. SHELF THERMOMETER (QUICK LOOK IN COOLER TO SEE IF TEMPERATURE AND HUMIDITY ARE IN RANGE)
9. CHLORINE WIPES TO CLEAN HANDS, SURFACES WHEN TESTING
10. COLD PACK (CAN REFREEZE IF NEED TO KEEP SAMPLES COLD)
11. STICK THERMOMETER (TO CHECK INTERNAL FRUIT TEMPERATURE)
12. LENS WIPES FOR REFRACTOMETER LENS
13. WATER AND SUGAR (SUCROSE) TO CALIBRATE REFRACTOMETER

Description of item	Source	cost
digital refractometer (Milwaukee)	Amazon	$ 120.00
laser (no contact) thermometer	Harbor Freight	$ 30.00
digital penetrating (stick) thermometer	Walmart	$ 10.00
pH strips (0 to 14 units by 1 or 0.5 units)	Amazon	$3.00-10.00
anemometer	Amazon	$ 36.00
Digital shelf thermometer	Amazon	$ 12.00
Digital calipers	Harbor Freight	$ 4.00
Scale (600 g)	Amazon	$ 10.00
500 g wt	Amazon	$ 10.00
wet wipes	Walmart	$ 1.00
small insulated cooler/9 can size	Amazon	$ 20.00
lens cloths to clean refractometer (bulk)	Walmart	$ 10.00
slurpy straws (disposable) (bulk)	Amazon	$ 24.00



Change in strawberry fruit temperature (about 100 lbs packed as loose berries in lugs) using

Pack N Cool trailer set at 40 F final temperature

Conversion of a 5 x 8 cargo trailer, barn door style, 3800 lb load capacity, to the Pack N Cool refrigerated trailer by adding an AC unit, a cool bot to make it run cold (storeitcold.com), insulation, and a 110 volt receptacle with a 14 gauge 50 foot extension cord.