

Report for 2022-R12

Proposal Category: ☒ Research ☐ Outreach

Proposal Status: ☒ New Proposal ☐ Previously funded by SRSFC; has been previously funded for years

Title: **Testing a rapid screening method for blueberry postharvest quality**

Name, Mailing and Email Address of Principal Investigator(s):

Penelope Perkins-Veazie
NCSU, Plants for Human Health Institute, 600 Laureate Way, Kannapolis NC, 28081
Penelope_perkins@ncsu.edu

Massimo Iorizzo
NCSU, Plants for Human Health Institute, 600 Laureate Way, Kannapolis NC, 28081

Mike Mainland
NCSU, Emeritus Professor
mainland@sprynet.com

Objectives:

The purpose of this study is to determine if the postharvest quality of blueberries using a warm temperature and short storage regime will provide effective screening as an alternative to longer storage at a low temperature.

Changes in approach:

Originally, the plan was to hold blueberries at room temperature for 7-8 days and at 2 °C for 14 days. The high weight loss at room temperature noticed after 3 days shortened the evaluation time down to 5 days. Then fruit at 2 C were held longer to see how long it would take to reach a similar weight loss (as weight loss often affects wrinkle).

After the third harvest date, it was clear that anthracnose (*Collectotrichum gloeosporioides*) was skewing mold growth and resulting weight loss at room temperature (storage at 2 C greatly slows anthracnose growth). A small experiment was set up to compare 3, 4, and 5 days storage at room temperature. In this trial, rabbiteye cultivars were used. Mold started to appear at day 4 and reached excessive levels at 5 days.

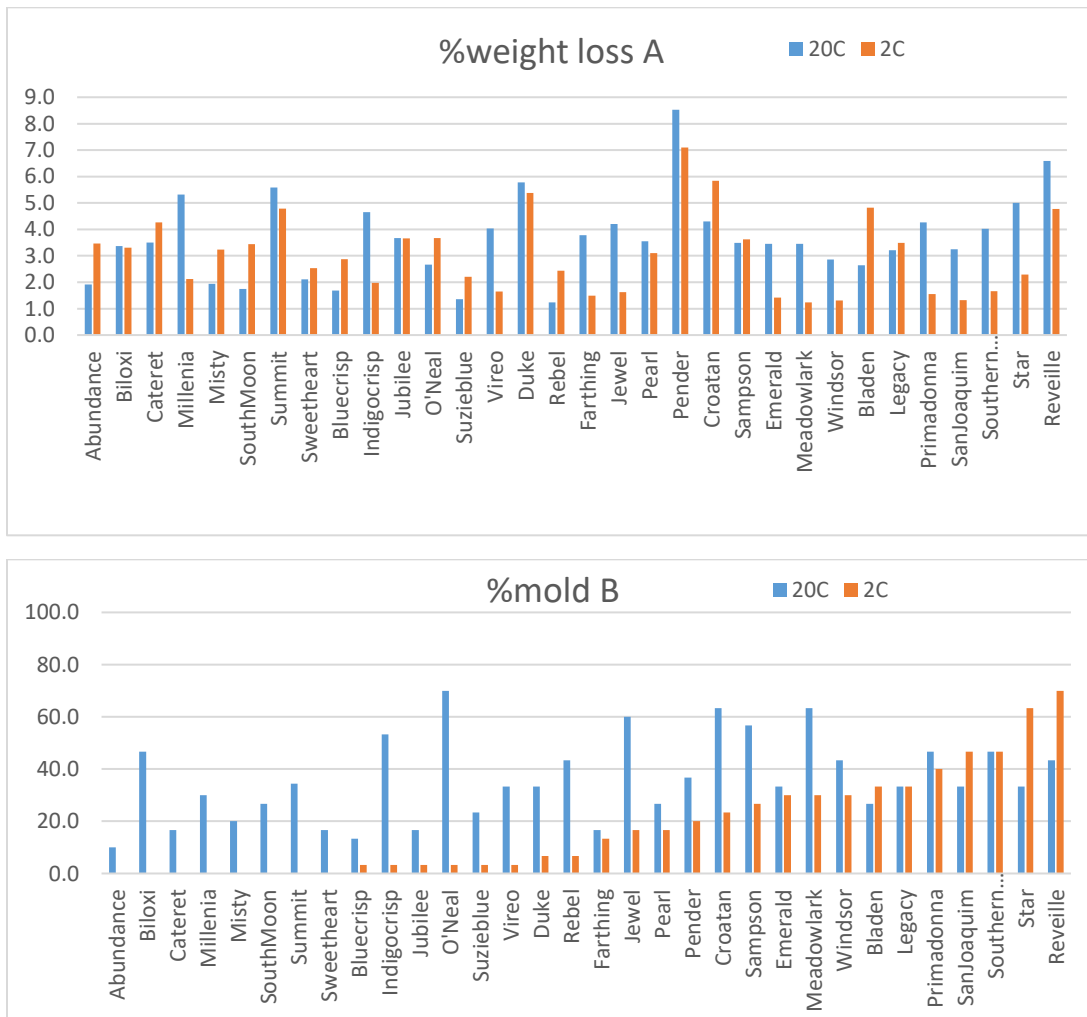
Summary of results:*Ratings and weight loss*

Blueberries (southern highbush genotype) were held for 5 days at room temperature had significantly more weight loss, mold, and wrinkle than those held at 2 C for 20 days (Table 1).

Temperature	%mold	% wrinkle	%weight loss
21	32.1	32.8	3.7
2	18.1 *	43.9*	3.3*

Table 1. Statistical differences between storage temperatures for mold, wrinkle, and weight loss.

Percent weight loss was similar for nine cultivars at both temperatures, and 14 cultivars had 1 to 2% more weight loss at 20 °C than at 2 °C (Figure 1 A). Percent moldy berries were much higher at room temperature than at 20 °C (Fig 1 B). In contrast to mold, percent wrinkled berries were much higher at 2 °C than at 20 °C (Fig 1 C). The cultivars ‘Snowchaser’ and ‘Draper’ were unavailable for this study.



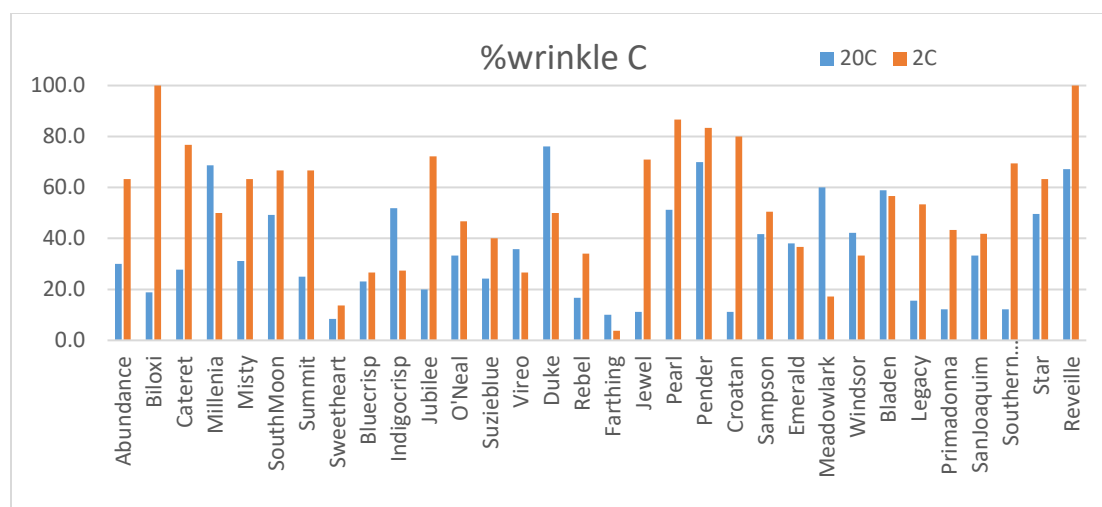


Figure 1. Comparison of blueberry cultivar performance when stored at room temperature for 5 days vs 2 C for 16 days.

Comparison of storage days at room temperature on ratings

Sday	%wt loss	%mold	%shrivel
3	3.8b	2.5a	10.3a
4	3.9ab	5.8a	16.1a
5	4.2a	14.4a	23.8a

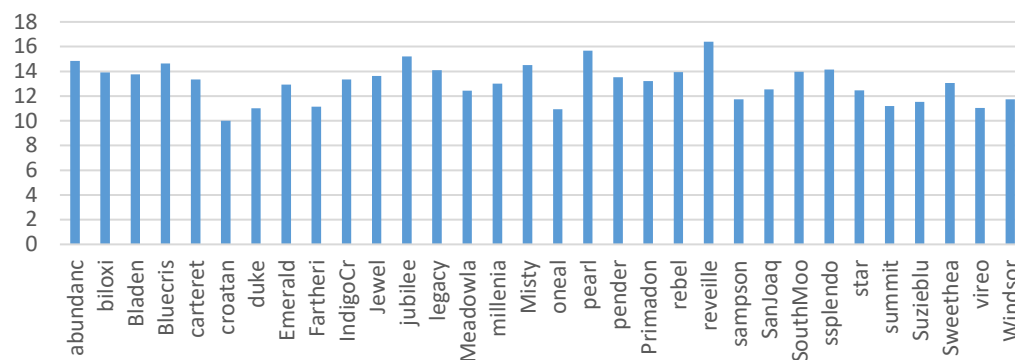
Table 2. Comparison of 3 to 5 days storage at room temperature, averaged for 'Titan', 'Montgomery', 'Premier', and 'Alapaha' rabbiteye cultivars.

As there was substantial development of mold in later harvests, fruit from a late harvest (all rabbiteye) was used to see if the number of storage days should be reduced from five. Fruit from four cultivars, using 3 reps of 10 berries per cup, were followed. Weight loss, mold, and shrivel all increased between days 3 and 5, although not always statistically significant. We also noted that if weight loss on day 3 was unusually high, anthracnose was present by day 5.

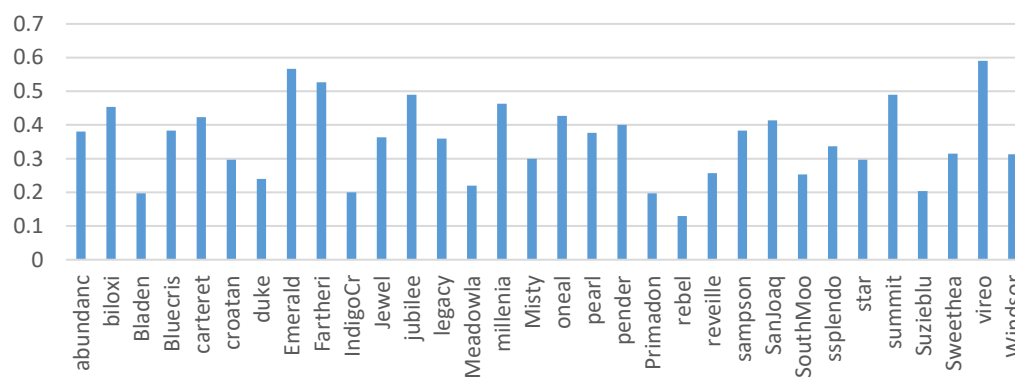
Fruit composition

Presented here are results from fruit held for 20 days at 2 C (Fig 2). Soluble solids content ranged from 10 to 17% and titratable acidity (citric acid equivalents) from 0.15 to 0.55%. These values are within the range reported for southern highbush genotypes. Puree pH was generally 3.5 to 4.0 as is typical in stored berries. Total anthocyanin content showed the most variation, ranging from 500 to 1600 mg/100 g dwt among cultivars. 'Bladen', 'Carteret', and 'San Joaquin' were highest in anthocyanin content while 'Jubilee', 'Sweetheart', and 'Reveille' were lowest in anthocyanin content. The relatively high pH and SSC of these cultivars indicates that they were fully ripe.

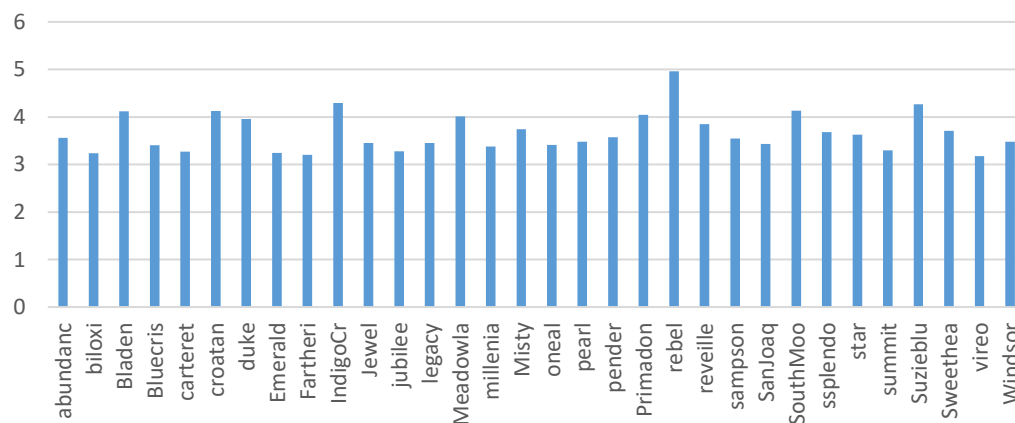
A. ssc after 20 days at 2 C

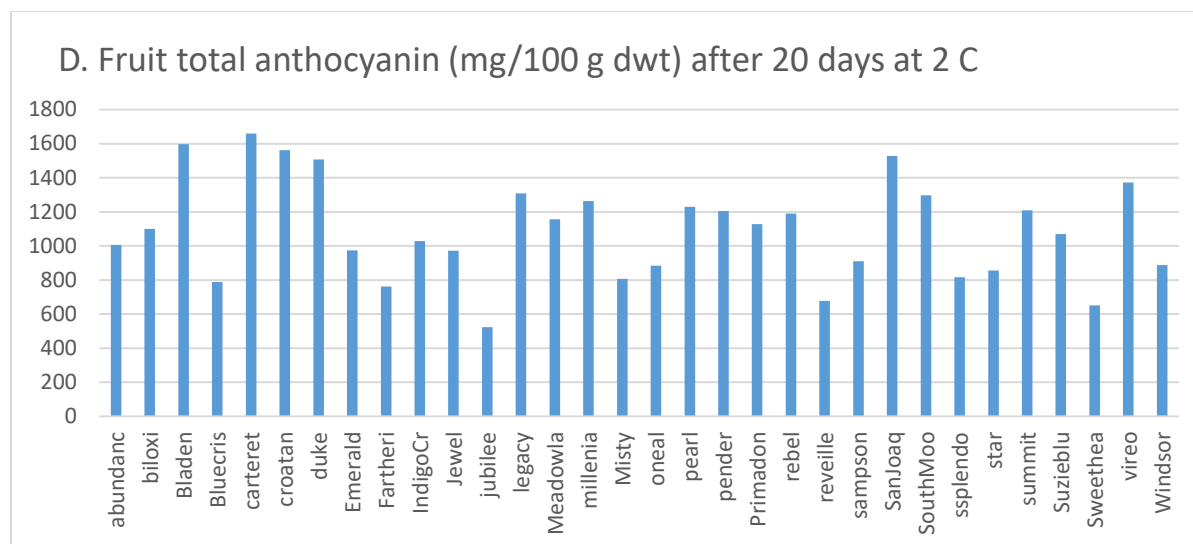


B. titratable acidity after 20 days at 2 C



C. puree pH after 20 days at 2 C





Conclusions:

Using room temperature storage for rapid blueberry genotype evaluation needs to be tweaked for the relative conditions. For instance, if room temperature is higher than 21 C and relative humidity is above 60%, consider reducing storage time to 4 days, especially if anthracnose is an issue in your location. Also consider including at least three indicator cultivars per harvest date in case of high mold incidence.

This system utilizes small portion cups and multiple replicates in order to reduce the number of berries needed while still accounting for environmental effects. If the thrust of the breeding program is to release new material for long storage intervals, screening at low temperature/high humidity (2 C, 90% RH) for longer time periods (3 to 6 weeks) may be of more use to growers and shippers. If labor bottlenecks are a problem when screening lines of interest, the shorter warm temperature system may be of more use.

We were unable to collect firmness data for these 2022 berries due to lack of time available on the texture meter. Presented are data from 2021 from another study for the respective cultivars. Using a 2 mm flat probe and texture analyzer (TAX2 plus), the parameters maximum force and force at 1 mm were effective at differentiating among cultivars and at showing a loss of force after storage (Fig 3,4). ‘Indigocrisp’ and ‘Keecrisp’ are cultivars with a crisp, almost hard texture and this was reflected in readings at day 1. Soft cultivars, such as ‘Pender’, ‘Jubilee’, and ‘South Moon’, had low values at both day 1 and day 16.

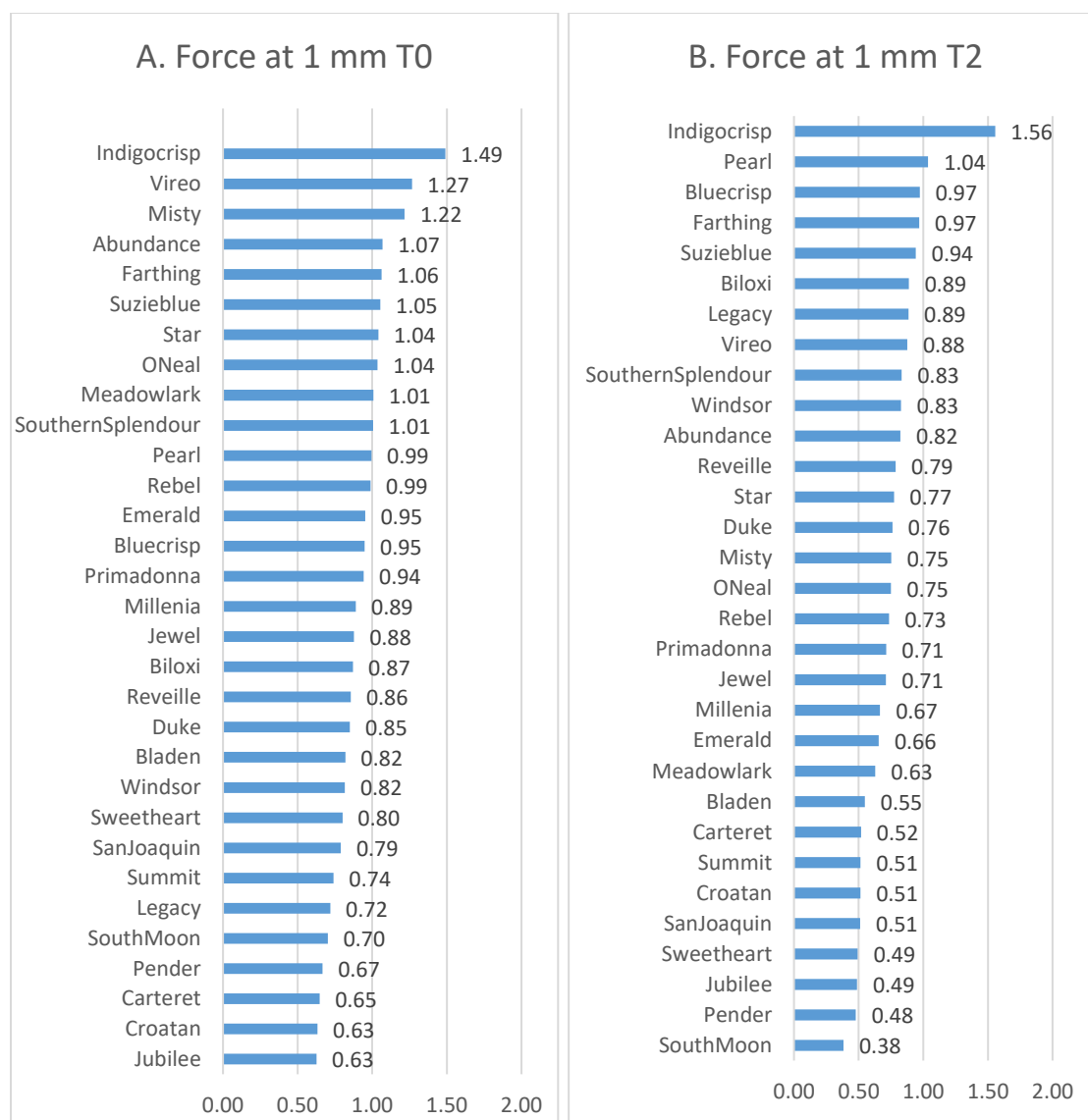


Figure 3. Firmness values (N) (at 1 mm penetration) of a 2 mm flat probe on SHB blueberries after 1 (A) and 14 days (B) storage at 2 °C. Note the lower values after 14 days storage; ‘Croatan’, ‘Carteret’, ‘Pender’, ‘Jubilee’, ‘South Moon’ are considered to be types soft at harvest and after storage. ‘Indigocrisp’ and ‘Bluecrisp’ are crisp-type textures. ‘Suzieblue’, ‘Meadowlark’, ‘Pearl’ and ‘Farthing’ are considered firm types; these gave somewhat mixed results.

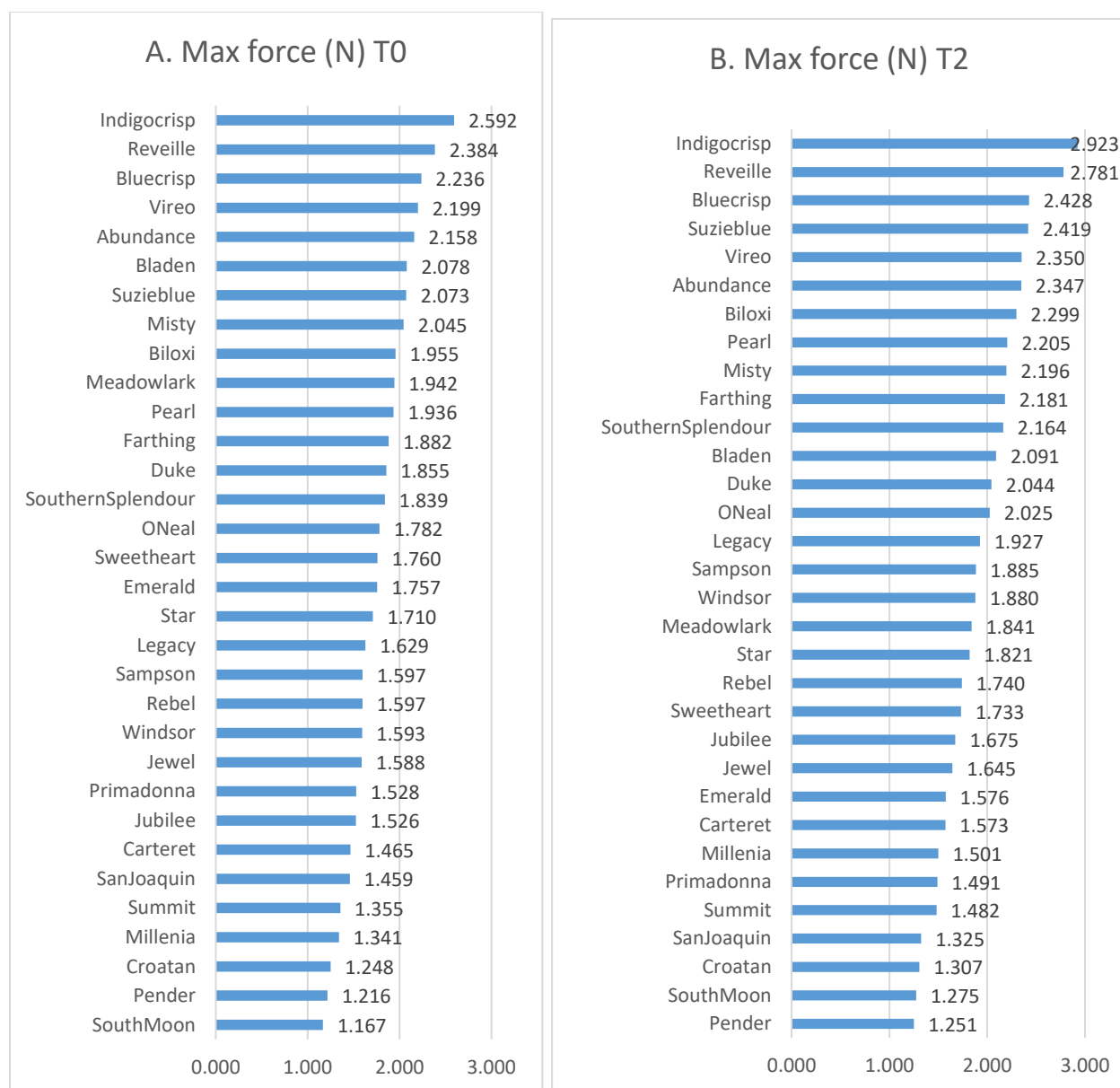


Figure 4. Maximum force values (2mm flat probe, TAX2plus meter) for blueberries at day 1 and day 14 storage at 2 °C. Notice that several of the soft cultivars are at the bottom of the chart and the crisp types are at the top.

Materials and Methods

Blueberries of 32 southern highbush cultivars grown at the Castle Hayne Research Station, North Carolina Department of Agriculture and Consumer Services (NCDA&CS), NC were harvested from May to July. All fruit were pre-cooled to 12-15 °C immediately after harvest and during transit to the Plants for Human Health Institute in Kannapolis.

Ten berries were placed in nut cups (100 ml volume), with 3 replicates per cultivar. Each cultivar was held at 2 C, 75% RH and room temperature (21 to 23 C, 70% RH) Lids with 5 holes evenly spaced (3 mm diam) were placed on cups. All were placed in plastic bins. Berries in cups at 20 C were evaluated after 5 days and those at 2 C were evaluated after 20 days storage for weight loss, mold, and wrinkle/shrivel.

Soluble solids content, pH, and titratable acidity were followed to compare changes in fruit composition relative to storage regimes, using fruit without visible mold or leakage. Berries were pureed using a particle homogenizer (Genogrinder 2010) and aliquots placed on digital SSC and acidity refractometers (Pal-1 and F5, Atago, Bellevue WA) and pH determined by electrode (Model A121, Thermo Scientific).

Texture attributes (resistance to puncture, skin elasticity, Young's modulus, springiness) (Giongo et al. 2022¹) were determined on 2021 blueberries using a texture analyzer (TA.TXPlus (London, UK).

¹Giongo, L., Ajelli, M., Pottorff, M., Perkins-Veazie, P., Iorizzo, M. 2022. Comparative multi-parameters approach to dissect texture subcomponents of highbush blueberry cultivars at harvest and postharvest. *Postharvest Biology and Technology*. 183, 111896