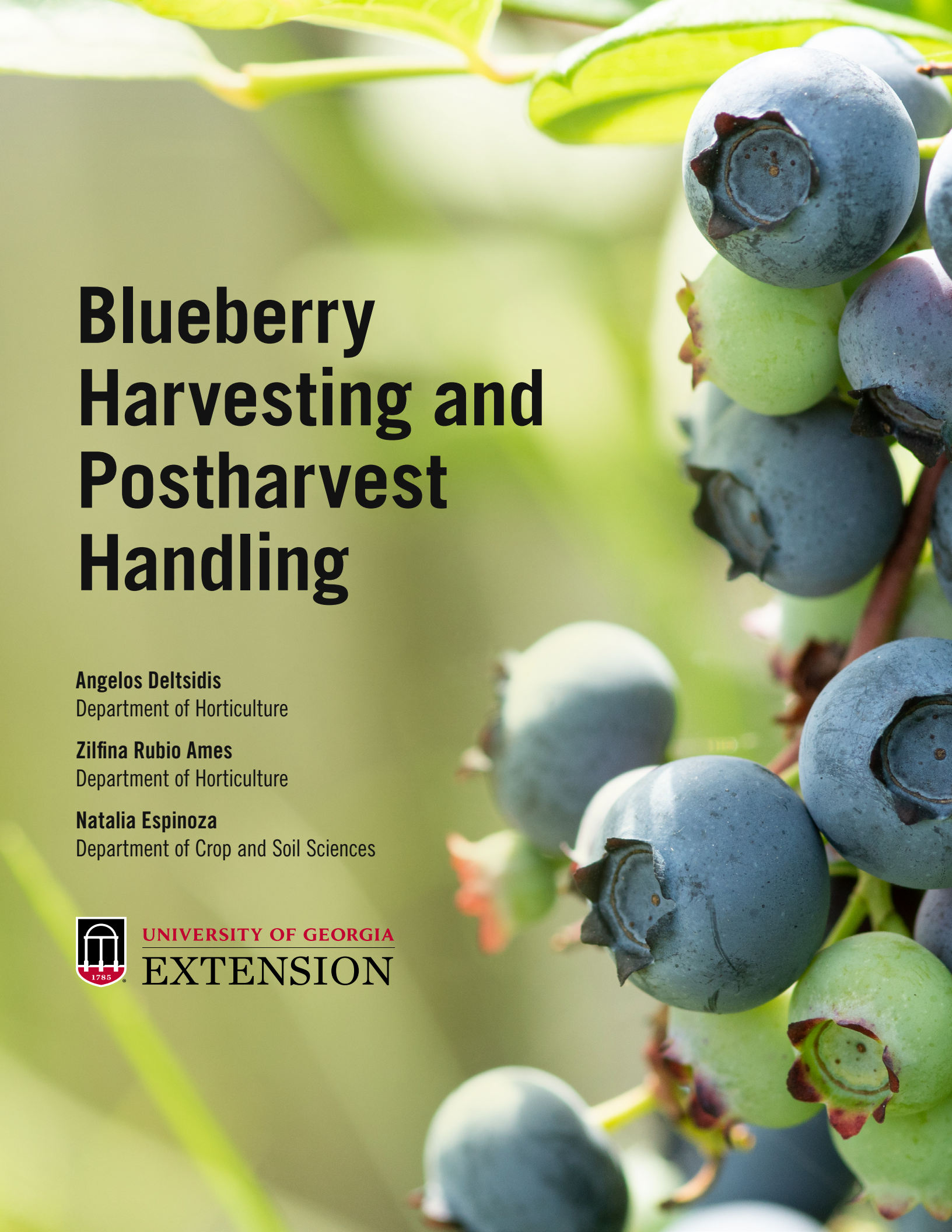

Blueberry Harvesting and Postharvest Handling

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Blueberries are harvested in Georgia from late April to late June. Southern highbush varieties are harvested early in the season while rabbiteyes ripen toward the end of the season. It is important to remember that berry quality is linked to both price and consumer acceptance, so providing consumers with good-quality fruit is key to the success of your operation.

Machine harvesting (Figure 1) is possible, especially for varieties that are resistant to bruising; hand-harvesting costs are a major expense in blueberry operations. Even though machine harvesters require a significant amount of capital, the investment is cost-effective in the long run for most producers.

Figure 1. Machine harvesting.

Photo: J. Jacobs

It is important to note that not all blueberry varieties are suitable for machine harvest. In Georgia, most rabbiteye varieties are machine-harvested, especially for the processed market.

Blueberries are a highly perishable commodity, and their shelf life often is limited by high rates of respiration, softening, water loss, loss of flavor, mechanical damage, and decay. Therefore, reducing the temperature of the fruit as soon as it is harvested is crucial.

Harvest Guidelines

Blueberries are harvested based on external color because fully colored berries have better flavor. Avoid picking reddish berries (Figure 2). Even though they may develop color, the *organoleptic* qualities—the qualities of blueberries that create a sensory experience for the consumer—will be poor.

Producers should:

- harvest early and late in the day when the air temperatures are cooler.
- not harvest when plants are wet from morning dew or rain. Harvesting while it is raining can lead to fruit splitting and reduce storage quality.
- gently tease the berries off the bushes to reduce splitting and bruising. Avoid compressing the fruit. Do not overfill rakes, containers, or large bins.
- rapidly cool fruit to the lowest safe temperature. Frequently transfer picked fruit to the cooling facility in order to avoid leaving fruit exposed to high temperatures.

Figure 2. Different blueberry colors on highbush blueberry (*Vaccinium corymbosum*).

Photo: Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org.

The disadvantage of machine harvesting is that, depending on how far the berries fall into the harvester, it may bruise fruit and affect storage life. Machine harvesting is therefore mostly used for berries intended for the processed market. It is important to keep the harvesters clean and remove debris to avoid contamination.

Cooling and Cold-Storage Guidelines

Fruit should be precooled right after harvest, ideally to the lowest safe temperature (32 °F)—but only if a constant temperature can be maintained from that point on. Since this is not always feasible, berries often are precooled to a temperature range of 50–55 °F, which is also used during sorting and packing and allows humans to work comfortably.

Forced-air cooling is the best method to cool blueberries. Pulling cold air across berries removes field heat more efficiently than air blown at stacks of berries from above. Berry containers should have slats or holes to allow for horizontal airflow.

Cool fruit to 32 °F as quickly as possible, but avoid rewarming. Forced-air cooling can take 90 min or longer to achieve this temperature. Cooling the fruit quickly reduces water loss, decay, and respiration, thus extending postharvest life. Measure pulp temperatures in the center of the load or container to ensure that the precooling step has been completed successfully. Note that the highest freezing point for blueberries is 30 °F, below which freezing injuries appear.

Avoid temperature fluctuation at all costs. If you do not have the infrastructure to keep berries at a constant temperature all the way from the field to the consumer, do not precool. Be aware that without precooling, the final quality of the fruit will be lower compared to properly precooled fruit that is held at low temperatures.

Blueberries exhibit respiration and respond to ethylene—similar to climacteric fruits, those that will ripen after being picked—but their flavor does not improve after harvest. The removal of ethylene from storage air may reduce disease development. Under optimal storage conditions, the respiration rate decreases and blueberries can be stored from to 2–4 weeks, depending on the cultivar, handling, and storage method.

Optimum Temperature
32 ± 1 °F

Optimum Relative Humidity
90%–95%

Rates of Respiration and Ethylene Production

32 °F
Emits CO_2 at 6 mg/kg•h

41 °F
Emits Ethylene at 0.1–1.0 µL/kg•h

67 °F
Emits CO_2 at 68 mg/kg•h

Packaging

The key to blueberry packaging is the capabilities of the container, which affect freshness, product protection, and display. Vented clear clamshells (Figure 3) commonly are used to hold the product intact while allowing air to flow through for efficient cooling.

Modified atmosphere packaging (MAP) involves either actively or passively controlling (or modifying) the atmosphere surrounding the product within a package. MAP can be used for shipments with 15%–20% carbon dioxide and 5%–10% oxygen to reduce the growth of decay-causing organisms. Whole-pallet covers and consumer packages to contain the modified atmosphere can be used during transportation.

Controlled Atmosphere (CA) is an atmosphere-modification method where gas concentrations are actively and closely regulated throughout storage. CA can be used in similar ranges as MAP (15%–20% carbon dioxide and 5%–10% oxygen) and in combination with cold storage to reduce the respiration and softening rates of blueberries. Prompt cooling should be done before atmosphere modification.

Figure 3. Recently packed blueberries.

Photo: Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org.

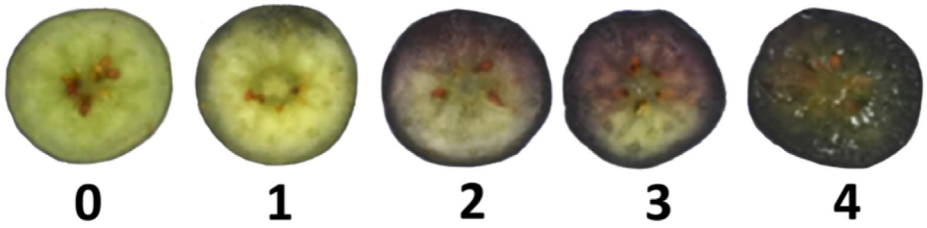

Figure 4. Scale used for assessing internal browning severity in blueberry fruit.

*Photo: "Firmness at Harvest Impacts Postharvest Fruit Softening and Internal Browning Development in Mechanically Damaged and Non-damaged Highbush Blueberries (*Vaccinium corymbosum *L.)" by C. Moggia, J. Graell, I. Lara, G. Gonzalez, and G. A. Lobos, 2017,* Front. in Plant Sci., 8, *535, p. 3 (*https://doi.org/10.3389/fpls.2017.00535*). Copyright 2017 Frontiers Media S.A.*

Postharvest Issues

Shriveling/Water Loss

Blueberries are susceptible to water loss, which results in fruit shriveling and loss of gloss. A 5%–7% water loss in fruits during postharvest storage reduces marketability as it results in too-soft or shriveled fruit.

Bruising

Bruising can occur at many points between the field and the consumer's hands, resulting in a loss of firmness and causing internal browning (Figure 4).

Decay

Alternaria rot (*Alternaria* spp.), anthracnose rot (*Colletotrichum acutatum*), and gray mold (*Botrytis cinerea*) all can cause postharvest rot of blueberry.

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