# Small Fruit News

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## Special Reports

### The Period of Flower Receptivity in Rabbiteye Blueberry

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**Introduction.** Poor fruit set is considered one of the most important horticultural problems of the rabbiteye blueberry industry (Scherm et al., 2001). Rabbiteye cultivars are known to have a limited degree of self-fertility (El-Agamy et al., 1981). While the failure to produce adequate commercial crops may be due to a lack of cross-pollination, there may also be problems such as short periods of flower receptivity. The objective of this research was to establish the effective pollination period in rabbiteye blueberry.

**What is Effective Pollination Period?** The life-span of a flower can be quite short, therefore, pollination must occur on the few days that the flower remains receptive. Effective pollination period (EPP) is defined as the number of days during which pollination is effective to produce a fruit (Williams, 1965). Research has shown that short EPPs are linked to problems of low fruit set in crops such as apple, cherry, kiwi, pear, and plum (reviewed by Sanzol and Herrero, 2001). One approach to estimate the EPP is to hand-pollinate flowers at different time intervals from anthesis (the day of flower opening), and determine the final fruit set in those flowers. In our results with rabbiteye blueberry under controlled conditions (day/night temperatures of 73/50°F), fruit set decreased with flower age and little or no fruit set was obtained when flowers were pollinated 8 days after anthesis (DAA; Fig. 1). Assuming fruit set levels higher than 30% as adequate, the effective pollination period was 7 days. The length of flower receptivity in rabbiteye blueberry was similar to that of lowbush blueberry (Wood, 1962), and two days shorter than that of highbush blueberry (Moore, 1964).

The most interesting finding from our study was the interaction between cultivar and flower age. ‘Brightwell’ flowers were more receptive than those of ‘Tifblue’ from 0 to 2 DAA. This difference in flower receptivity could offer a partial explanation to the superior performance of ‘Brightwell’ relative to ‘Tifblue’ with regards to fruit set. The quadratic trend observed in both cultivars indicates that an unknown limiting factor is operating in young flowers to reduce fruit set. This factor was more prominent for the flowers of ‘Tifblue’.

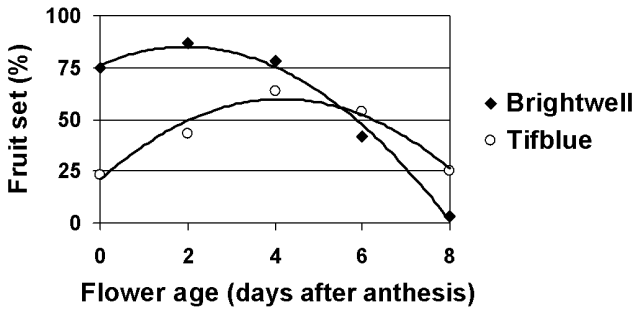


Fig. 1. Effect of flower age on fruit set of 'Brightwell' and 'Tifblue' rabbiteye blueberries following cross-pollination. Data points are averages from two consecutive years.

**Parameters determining the EPP.** EPP can also be defined as the longevity of the ovules minus the time lag between pollination and fertilization, providing that this value does not exceed the length of stigmatic receptivity (Sanzol and Herrero, 2001). The most limiting parameter of the EPP can be any of the following:

**Stigmatic receptivity.** The ability of the stigma to support pollen germination. Delayed maturation of the stigma could affect fruit set in young flowers. Early degeneration and rupture of papillar integrity could cause decrease in fruit set with increasing flower age.

**Pollen tube growth rate.** Faster rates are associated with longer EPPs. Fast pollen tubes are able to reach the ovary region while the ovules are still viable. Pollen tube growth depends on the species, cultivar, pollen source, and environmental conditions.

**Ovule longevity.** Incomplete or abnormal development of ovule structures and short ovule lifespan may impair fruit set. Ovule longevity usually plays a decisive role in EPP.

Stigmatic receptivity was assessed in rabbiteye blueberry by counting the number of germinated pollen grains (called *tetrads*) on the stigma 24 hours after pollination (Fig. 2). Pollen germination rate at the stigmatic surface increased with flower age. Flowers pollinated from 6 to 8 DAA exhibited the highest stigmatic receptivity. This contrasted with the rapidly decreasing percentage of fruit set observed in flowers of similar age (Fig. 1). Stigmatic receptivity cannot be the most limiting factor of the EPP in rabbiteye blueberry because this parameter and fruit set were not positively correlated.

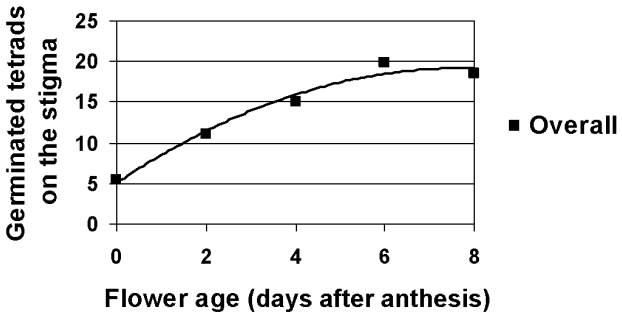


Fig. 2. Effect of flower age on stigmatic receptivity following cross-pollination. Year 2004. Data were pooled because no cultivar effect was found.

There was no cultivar effect on stigmatic receptivity (Fig. 2). Therefore, the low performance of 'Tifblue' flowers at anthesis cannot be explained by the low receptivity of the stigma, because pollen germination rates in both cultivars were the same. In young flowers, stigmatic receptivity had little effect on fruit set because the slow rate of pollen germination was outweighed by the longer time that pollen tubes had to reach the ovules.

## Conclusions

- The effective pollination period of rabbiteye blueberry flowers under day/night temperatures of 73/50°F was 7 days.

- Under the conditions of this study, stigmatic receptivity had little effect on fruit set of rabbiteye blueberry. Additional research is needed to establish whether pollen tube growth rate or ovule longevity is the most limiting parameter of the EPP. This unknown limiting parameter affected the performance of 'Tifblue' flowers during the first days from anthesis.

## Literature Cited

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# Bramble Chores

**Winter/Spring 2005**

Gina Fernandez
North Carolina State University

**PRUNING**

*Fall Bearing Raspberries*. Fall bearing (actually mid to late summer for most of NC) raspberries fruit at the top of the current season's canes ("primocanes"). The simplest way to manage these varieties is to mow them off at ground level during the dormant season. Be sure to mow them off close to the ground so that new shoots come from the roots and not from lateral buds on cane stumps.

*Blackberries and summer fruiting raspberries*. These types of brambles bear fruit on second year canes. During the winter prune out the spent floricanes from the previous season. The remaining primocanes are thinned 3-4 / ft2.

**HERBICIDES**

-Apply preemergent herbicide in spring if not applied in fall. There are several chemicals that are labeled for use in NC depending on age of plating and time of application, see your states agricultural chemical recommendations.
-Apply post emergent herbicides as needed. Be sure that the chemical you are using is labeled for bearing plants, many herbicides cannot be used beyond the first year.

**INSECT AND DISEASE CONTROL**

PREBLOOM
-Apply liquid lime sulphur or Bordeaux for control of anthracnose in late winter or early spring before new buds are less than 1/2” long
-Crown borers can be a problem in the early spring, as well as aphids, thrips, Japanese beetle, fruitworm, rose chafer, stink bugs and psyllids. Catch these early w/ a prebloom spray, see your states agricultural chemical manual for recommended control tactics.

BLOOM:
Double blossom (AKA rosette). Primocanes are infected in the spring or early summer, but disease symptoms are not evident until the following year when new growth begins on the fruiting canes. The best thing to do is to remove the infected floricanes to disrupt the cycle. With the loss of Benlate, chemical control of double blossom with that compound is no longer possible.
Botrytis: Apply fungicides at early bloom and repeat at full bloom.
-EPA has approved use of Savey 50DF for control of mites on caneberries, including black and red raspberries and blackberries. The preharvest restrictions are 3 days for caneberries (blackberries and raspberries). Please note that it is only effective on eggs. If you need a copy of the supplemental label, contact your Gowan distributor.

**IRRIGATION**

-Plan for the irrigation season. Bramble plants need about 1”-2” water/week applied to the soil.
-We have found that overhead irrigation during fruiting prevents loss of fruit due to sunscald.

**TRELLISES**

-Now is the time for trellis repair. Our experience with an “annual” ice storms in North Carolina has indicated that blackberries benefit from a sturdy trellis. Make sure posts are firmly in the

ground and wires are securely attached to the posts.

**FERTILIZER**
-Place nitrogenous fertilizers in row before new canes emerge in spring. Raspberries: Apply 500-800 lbs of 10-10-10 per acre in split applications. Apply half in Feb-March and the remainder in April-May. Spread uniformly across the row or side dress with half on each side of row in a 3-foot wide band.
Blackberries: In established plantings apply 60 to 80 lb/acre N. Nitrogen can be applied in split or single applications. If using a split application, apply the first portion at bud break and the remainder just after harvest. Ammonium nitrate is the most common form of N used on blackberries. The incorporation of P and K should be based on soil test recommendations.
Drip: many growers are now using their drip irrigation system for fertilization. We do not have any experience with rates and timing. However, use of the above amounts applied at regular intervals from Feb-May should suffice until we.

**PLANTING**
-*Order* plants from nurseries in late fall early winter to ensure that what you want is available. Bare root dormant nursery plants are usually available from November to March. Be sure to get clean and healthy plants. New stock should be purchased from nurseries that have grown plants on fumigated land well isolated from other brambles, have been sprayed regularly for insect and disease control, are virus tested and have inspected by state officials.
-*Prepare land for spring planting.* The land should be plowed thoroughly before for planting. NC recommendations suggest that land preparation should be done in mid- to late-February in the coastal plain region and during March in the mountains. Fumigation is recommended to give newly set blackberry plants an advantage by killing most weed seeds and soil pathogens. Optimal row orientation is north - south to minimize sunscald on fruit.
*Planting.* Early spring planting of dormant stock is best. If plants set late in the spring may be adversely affected by drought or drying winds. Make sure irrigation is available. Some nurseries sell erect blackberry root pieces as planting stock. These are usually cheaper but, you will need more root pieces to fill your row. Root cuttings should be placed 2 to 3 feet apart in a row. Tissue culture plants should be set after the last frost in spring.

**ORDER HARVEST SUPPLIES**. Determine your needs and order you supplies now. If you are picking into clamshell containers, a "low profile" container is best, you are limited in the amount of berries that you stack on one another.

**NC CERTIFIED BLACKBERRY NURSERY.** At the present time, one certified grower in North Carolina has obtained a license to propagate cultivars from the Arkansas breeding program which are the major cultivars grown in North Carolina and in the region:

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Home: 252 235 3248
Home fax: 252 235 0155
Mobile: 252 399 9844
Jim Mobile 252 230 2084
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**CHEMICAL RECOMMENDATIONS**
Agricultural Chemical recommendations for North and South Carolina can be found at the addresses listed below.
North Carolina:
http://ipm.ncsu.edu/agchem/agchem.html

**Woody control in Rabbiteye Blueberries (*Vaccinium ashei* Reade)**

Mark Czarnota[1], Scott NeSmith[1], and Danny Stanaland[2]
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Many growers are often faced with controlling unwanted woody plants in their blueberry orchards. Woody plants such as oaks (*Quercus spp*.), wax myrtle (*Myrica cerifera* L.), pines (*Pinus spp*.), and wild cherries (*Prunus spp*.) are often found growing amongst blueberry plants. Unfortunately, there are no registered herbicides that can be used over the top of blueberries to remove these plants. Growers often resort to pruning out this unwanted vegetation, but most of these plants re-sprout and continue to be a weed problem. Growers could avoid much of this re-growth if herbicides were applied to the cut stems of these unwanted woody plants. There are many herbicides that could easily control these unwanted woody plants, but many of these products could possibly leach from treated plant or be transferred via root grafts to blueberries causing damage. In order to understand this better, a study was designed to evaluate several products for control and damage to blueberry plants.

A site was chosen in Alma, Georgia that contained planting of Tifblue rabbiteye blueberry (*Vaccinium ashei* Reade). The blueberry orchard was established in the early 1980's, and average plant height was approximately 8 to 10 feet. The primary woody problem was wax myrtle (*Myrica cerifera* L.) (Figure 1.). On December 12, 2002, the study was initiated. The test was designed as a randomized complete block with 3 replications, and each treatment consisted of 3 blueberry plants. All unwanted woody growth was cut to a height of 18 inches with loppers or a chainsaw. Herbicides were then painted onto the cut stem so as to coat the entire cut surface, making sure to coat the cambium area (bark / wood union area). All herbicides were applied at 50% formulated strength, using distilled water to dilute. No cut stem was over 3 inches in diameter. Five herbicides were included in the trial, and consisted of Vanquish 4L (dicamba), Roundup UltraMax 5L (glyphosate), Tordon K 2L (picloram), Chopper 2L (imazapyr), and Garlon 3L (triclopyr). Control and injury ratings were taken for wax myrtle control and blueberry injury at 4 and 8 months after treatment (MAT). Weed control ratings were on a 0 to 100 scale, and numerical values represented the following:


**Figure 1**. Wax myrtle (*Myrica cerifera* L.) (A) infestation in Rabbiteye blueberries (*Vaccinium ashei* cv.'Tifblue') (B).

| Value | Control |
|---|---|
| 0 | No control as compared to the check |
| 10 to 30 | Very poor control as compared to the check. Regrowth from the cut stem was 90 to 70 % of the control. Some chlorosis and necrosis evident in emerged leaves. |
| 40 to 60 | Poor weed control as compared to the control. Regrowth from the cut stem was 60 to 40 % of the check. More noticeable injury or stunting to emerged leaves More pronounced chlorosis and/or necrosis to the leaf area of emerged leaves. |
| 70 to 90 | Fair to good weed control. Regrowth from the cut stem was 30 to 10 % of the control. Emerged leaves severely injured or dead. Greater than 50% of leaf surface showing signs of chlorosis and necrosis. |
| 90 to 99 | Excellent weed control. Regrowth from the cut stem was 10 to 1% of the control. Emerged leaves mostly dead and/or severely injured (chlorotic and/or necrotic). |
| 100 | No evidence of regrowth to the cut stem or treated plant. |

Plant injury was taken on a (0-100 scale) and numbers represented the following:

| Value | Plant Symptoms |
|---|---|
| 0 | No visual injury present |
| 10-30 | Minimal injury to desirable plant. Less than 10% of the plant leaf service area showing chlorosis and necrosis. |
| 40-70 | More noticeable plant injury or stunting. Greater than 50% of the leaf area showing symptoms of chlorosis and/or necrosis. |
| 80-90 | Plants severely injured. Most of the leaves and leaf surface showing signs of chlorosis and necrosis. |
| 100 | Plant appears dead. No signs of regrowth. |

Data were analyzed using analysis of variance and means were exposed to Fisher's least significant difference (LSD) test with a significance level of p=0.05. Ratings are presented below:

**Table 1. Ratings of wax myrtle (*Myrica cerifera* L.) control and Rabbiteye blueberry (*Vaccinium ashei* Reade) injury***

| Treatment | Active ingredient | Blueberry injury Apr 15, 2003 (4 MAT) | Blueberry injury Aug 04, 2003 (8 MAT) | Wax Myrtle Control Apr 15, 2004 (4 MAT) | Wax Myrtle Control Aug 04, 2004 (8 MAT) |
|---|---|---|---|---|---|
| Vanquish | dicamba | 76.7 ab | 30.0 a | 93.3 a | 96.7 a |
| Roundup UltraMax | glyphosate | 0.0 c | 30.0 a | 70.0 a | 83.3 a |
| Tordon K | picloram | 60.0 b | 16.7 a | 93.3 a | 96.7 a |
| Chopper | imazapyr | 80.0 a | 33.3 a | 86.7 a | 90.0 a |
| Garlon | triclopyr | 6.7 c | 0.0 a | 93.3 a | 96.7 a |
| Check | N/A | 0.0 c | 0.0 a | 0.0 b | 0.0 b |
| LSD (P=0.05) | | 19.27 | 64.06 | 26.50 | 16.16 |

*Means followed by the same letter do not significantly differ (P=0.05, LSD).

Control of the wax myrtle was greater than 70% with all treatments during both rating dates. As expected, however, injury with Vanquish, Tordon K, and Chopper was significant (> 60%) at the April rating. No significant injury was noted during the August ratings for Garlon treatments, but injury was still visually apparent with Vanquish, Roundup UltraMax, Tordon K, and Chopper.

On February 26, 2004, a second study was initiated in at the same location. The study was identical to the 2002 test, but due to injury caused in the previous study, Vanquish, Tordon K, and Chopper were dropped from the protocol. Three herbicides were included in the trial, and consisted of Roundup UltraMax 5L (glyphosate), Garlon 4L (triclopyr), and Lontrel 3L (clopyralid). Ratings were taken for wax myrtle control and blueberry injury 5 months after treatment. Data were analyzed using analysis of variance and means were exposed to Fisher's least significant difference (LSD) test with a significance level of p=0.05. Ratings are presented below:

**Table 2. Ratings for wax myrtle (*Myrica cerifera* L.) control and Rabbiteye blueberry (*Vaccinium ashei* Reade) injury***

| Treatment | Active ingredient | Blueberry injury Jul 22, 2004 (5 MAT) | Wax Myrtle Control Jul 22, 2004 (5 MAT) |
|---|---|---|---|
| Roundup UltraMax | glyphosate | 20.0 ab | 73.3 a |
| Garlon | triclopyr | 0.0 b | 43.3 b |
| Lontrel | clopyralid | 40.0 a | 66.7 ab |
| Check | N/A | 0.0 b | 0.0 c |
| LSD (P=0.05) | | 29.78 | 26.43 |

*Means followed by the same letter do not significantly differ (P=0.05, LSD).

Significant damage with (40 %) Lontrel was noted after 5 months, and although not significant, damage was also noted with Roundup UltraMax. All treatments provided significant control of wax myrtle and ranged from 43 to 73%.

**Making sense of it all:**

In South Georgia, growers are in need of a dependable herbicide that will prevent the regrowth of woody plant material from a cut stem. There are many products that are available for woody weed control, but in blueberries, only glyphosate (Roundup UltraMax) is labeled. The other products were tried for comparison. From this study, it is apparent that woody weed control could be achieved with Garlon (triclopyr) and Roundup UltraMax (glyphosate) with minimal damage to the blueberry plants. Although minimal, it was surprising to see damage with glyphosate. However, as the Roundup UltraMax label indicates, plants growing in close proximity to treated plants may share root grafts, which could lead to transfer of glyphoste to untreated plants. It would be expected that blueberry plant damage would increase with an increase in treated stems. This factor was not considered with the current study. Although no damage to established blueberries was seen in this study with Garlon, the use of Garlon for woody weed control in blueberry is currently not labeled and therefore the herbicide should not be used.

# From the Plant Problem Clinics…

Margaret A. Williamson, Clemson University

Shown below is a summary of small fruit samples received from the clinics in North Carolina (NC) and South Carolina (SC) between January and December, 2004.

| | | | NUMBER OF OCCURENCES | |
|---|---|---|---|---|
| **HOST** | **DIAGNOSIS** | **CAUSAL ORGANISM** | **NC** | **SC** |
| **Blackberry** | Tobacco Ringspot | Tobacco Ringspot Virus | 1 | |
| | Cane canker | *Botryosphaeria dothidea* | | 1 |
| **Blueberry** | Root rot | *Phytophthora* sp. | | 1 |
| **Elderberry** | Rust | *Puccinia bolleyana* | 1 | |
| **Grape** | Anthracnose suspected | | 1 | |
| | Armillaria root rot | *Armillaria* sp. | | 1 |
| | Black Rot | *Guignardia bidwellii* | 1 | 1 |
| | Coulure | Physiological | | 1 |
| | Fungal dieback | Undetermined | 3 | |
| **Strawberry** | Alternaria fruit rot | *Alternaria* sp. | 1 | |
| | Angular leaf spot | *Xanthomonas fragariae* | 9 | 1 |
| | Anthracnose | *Colletotrichum gloeosporoides* | 2 | |
| | Anthracnose | *Colletotrichum acutatum* | 1 | |
| | Anthracnose crown rot | *Colletotrichum acutatum* | | 1 |
| | Anthracnose fruit rot | *Colletotrichum acutatum* | 2 | |
| | Anthracnose fruit rot | *Colletotrichum* sp. | | 1 |
| | Botrytis blight | *Botrytis cinerea* | 2 | |
| | Botrytis dieback | *Botrytis cinerea* | 1 | |
| | Botrytis fruit rot | *Botrytis cinerea* | 3 | 1 |
| | Crown rot | *Phytophthora* sp. | | 1 |
| | Leaf spot | Undetermined | | 1 |

| | | | | |
|---|---|---|---|---|
| | Leaf blotch | *Gnomonia* sp. | 1 | |
| | Crown rot | *Phytophthora cactorum* | 15 | 1 |
| | Multiplier disease | *Phytoplasma* | | |
| | Petiole rot | *Rhizoctonia sp.* | | 1 |
| | Powdery mildew | *Sphaerotheca macularis* | | 1 |
| | Phomopsis fruit rot | *Phomopsis* sp. | 1 | |
| | Root rot | *Phytophthora cactorum* | | 1 |
| | Root rot | *Rhizoctonia* sp. | | 1 |
| | Root rot | *Pythium vexans* | 1 | |
| | Root rot | *Pythium* sp. | 1 | |

## Meetings

**Organic Blueberry Production Meeting**
-Tuesday, March 29, 2005 in Bacon and Appling Co, Ga.
-Registration at 9 a.m. in the Bacon Co. Ext. Office, next to the Courthouse in Alma
-Speakers from New Jersey and Georgia; Field Tour to Organic Transitional Field after Lunch, which is included in registration
-Register before March 18th: $10 for Members of Georgia Organics and $15 for non-Members, double after March 18
-Send to: Ga. Organics, POB 8924, Atlanta, GA. 31106; Phone: 770-993-5534

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**Editor and Contributor** ..... **Guido Schnabel**

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