Aug 13th, 11:00 AM - 11:20 AM

Report on phytotoxicity on blueberries in New Jersey during the growing season of 2017

Peter Oudemans
Rutgers University - New Brunswick/Piscataway, oudemans@njaes.rutgers.edu

Thierry E. Besancon
Rutgers University - New Brunswick/Piscataway, thierry.besancon@rutgers.edu

Gary C. Pavlis 6250056
Rutgers University - New Brunswick/Piscataway, pavlis@njaes.rutgers.edu

Report on Phytotoxicity on Blueberries in New Jersey during the Growing Season of 2017

Peter Oudemans, Thierry Besancon and Gary Pavlis, *Rutgers University, Chatsworth, NJ*

Introduction:
New Jersey produces approximately 9% (50-60 million lbs) of the total US blueberry (*Vaccinium* spp.) crop, which represents approximately $70 million or 8% of the total value of utilized production for North America. The majority of the NJ crop is hand-picked for the fresh market and the product is widely distributed through North America and some is exported to Europe.

In North America highbush blueberries are produced from Florida to Michigan as well as on both coasts. There are 8 states that produce the majority of North American blueberries (WA, CA, GA, OR, MI, FL, NC, NJ) and 5 minor producing states (AL, AR, IN, MS, NY). In 2015, NJ was ranked 5th in area harvested but 8th in value of production. The pattern of blueberry ripening creates unique marketing challenges because harvest time between regions varies annually and can overlap, resulting in unpredictable peaks and valleys in the annual supply.

Crop value is determined by two major factors. Yield per acre is affected primarily by cultivar and climate which are related to many biotic and abiotic factors. Price is driven by supply and demand. In 2017 New Jersey growers were rebounding from 2 seasons of unusually warm winter conditions and resulting twig diseases exacted significant losses. In 2017, severe crop losses in Georgia (60%) and North Carolina (50%) created an unusually high demand (and price) for New Jersey fruit. Crop estimates suggest the New Jersey crop was near 50 million lbs (considered a light crop).

Climatic Conditions for 2017: The temperature patterns experienced in 2017 were characteristic of a "backwards spring" with higher temperatures in February followed by a cooler March. This is illustrated in Fig. 1 showing that degree day accumulation (which drives blueberry development) was accelerated from mid-February until early March. This was one of the earliest accumulations of degree days seen (2008 was similar). Rainfall in March was 5.3 inches which is above the average of 4.2 inches with concentration of rain days near the end of the month. April was dry with an accumulation of 2.6 inches well below the 4.2 inches average for Hammonton.

Crop development was slightly accelerated compared to average. Bud break (T3) began around 3/29/17 and bloom began by 4/18/17 (Fig 2A and B.). Typical pre-emergent herbicide applications were made during late March (weather permitting) through April.

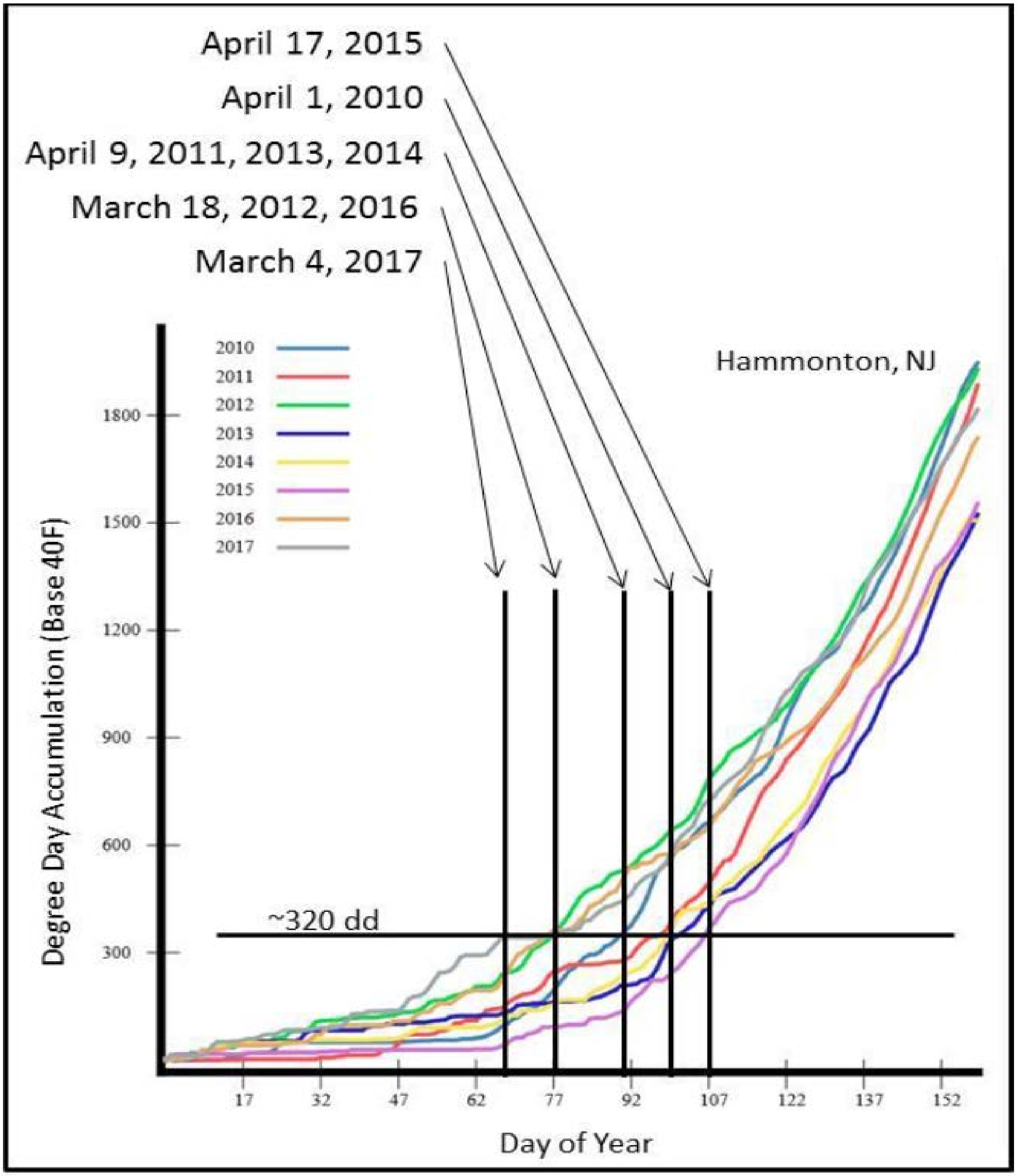
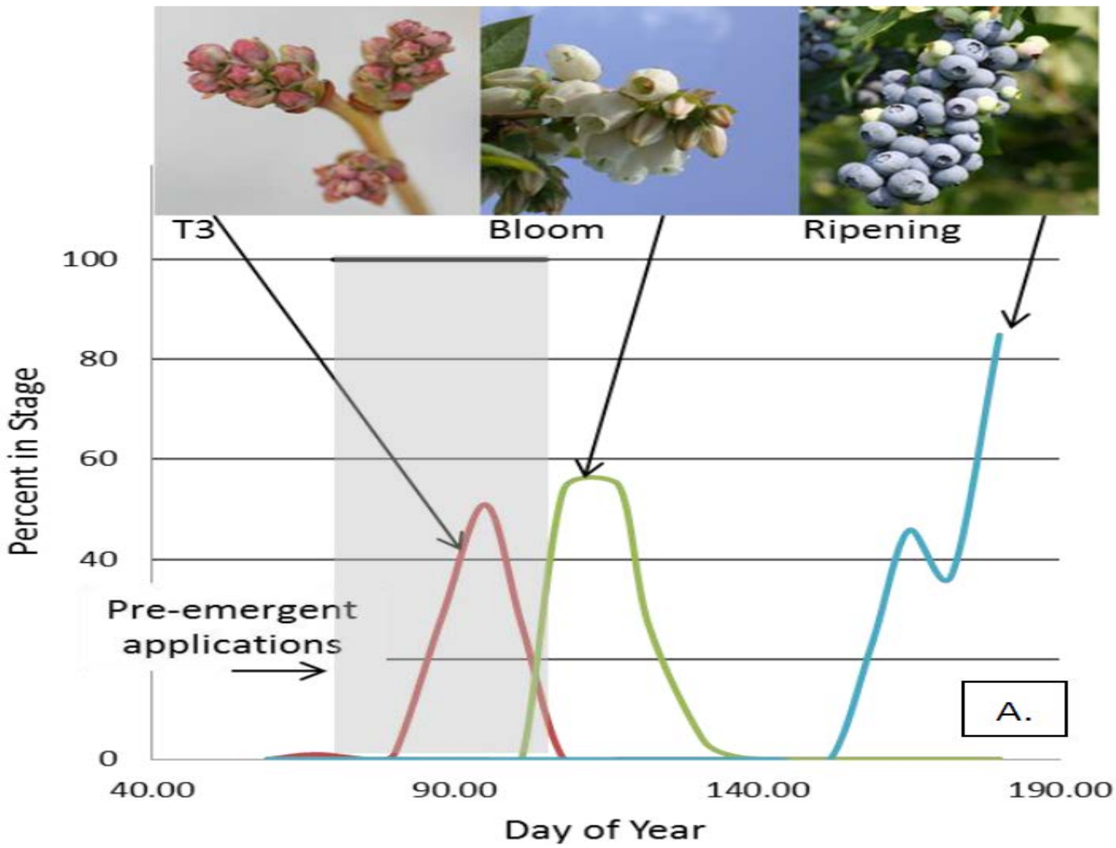


Fig. 1. Comparison of degree day accumulations for Hammonton, NJ taken from the degree day calculator (http://benedick.rutgers.edu/ Blueberryweather/).



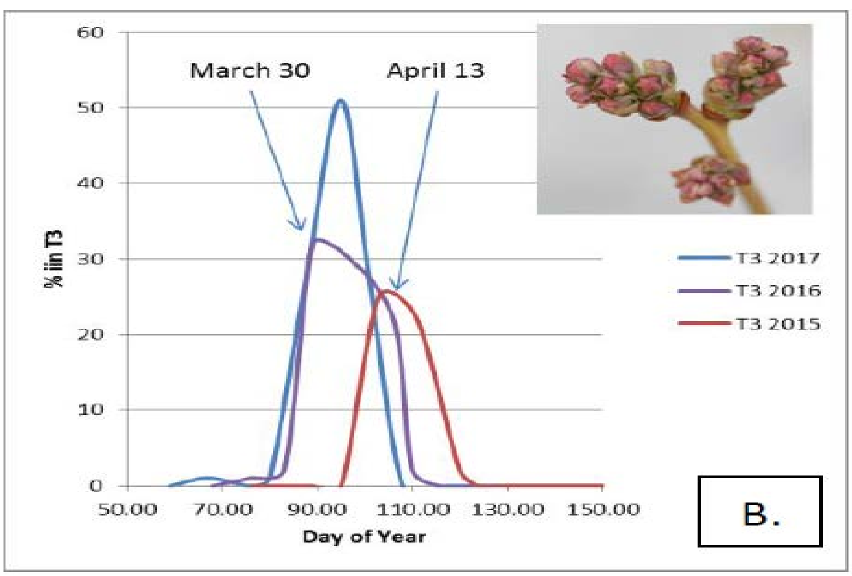


Fig. 2. A. Phenology of blueberry development (cv Duke) for 2017 in Hammonton NJ. B. Comparison of T3 budbreak for 2015-2017.

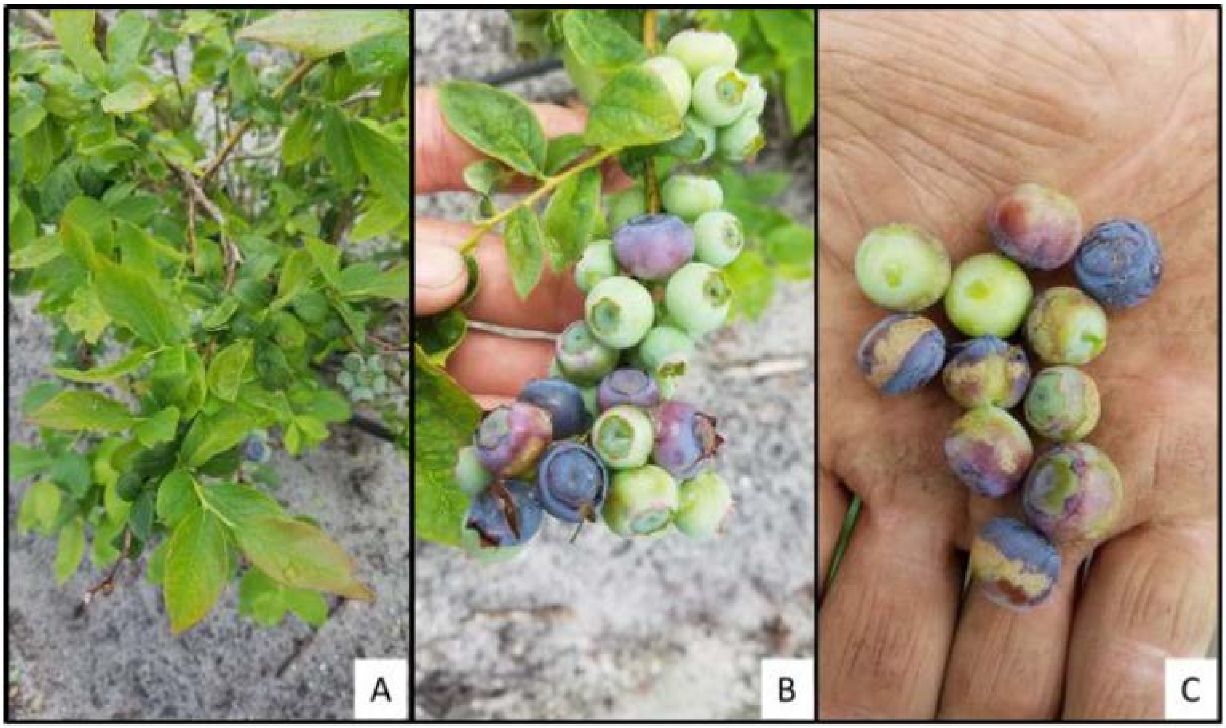


Fig. 3. Symptoms of phytotoxicity. A. Leaves stunted with shortened internodes. B and C. Fruit showing equatorial russeting and splitting. Also note a lack of calyx development.

Discovery and reporting of phytotoxicity: In 2017, bud break was seen around March 28th and bloom began around April 14th. Reports of unusual symptoms (see Fig. 3) began in mid-May. Plant materials were tested plants for virus and nutrient levels however nothing conclusive was found. By May 25th more reports had been received and it appeared that the problem was widespread. By late May, field professionals from Helena Chemical, Inc. and Crop Production Services, Inc. were receiving increasing grower complaints and approximately 15 farms were identified where similar symptomologies were seen. In reviewing pesticide application records it appeared an herbicide may be involved, although it was not clear which herbicide since growers typically utilize a cocktail. These field professionals subsequently contacted representatives of the chemical producers to inform them of an impending problem. Visitations to numerous farms ensued. On June 15th an emergency twilight meeting was held with growers who had reported similar problems. The purpose of the meeting was to provide an opportunity for growers to meet and discuss this problem with each other and extension personnel. In addition, some growers provided pesticide application records for investigative purposes. Based on these data (Table 1), pendimethalin was overwhelmingly the common denominator in fields where damage was reported. No other herbicide was strongly correlated with damaged bushes.

Table 1 shows that pendimethalin was overwhelmingly associated with damaged bushes on 1686 acres, of which 86% exhibited some level of damage. Of the 1817 acres where it not used, no damage was reported. On 241 acres (14%) where this herbicide was applied no damage was reported, however, it was observed that the greatest damage was on plants where applications were made later in the growing season (i.e. after April 1, 2017).

Table 1. Blueberry acreage with or without phytotoxicity damage as reported by growers separated by herbicide application		
	Herbicide application	
	Prowl H2O	No Prowl H2O
Damage	1445 acres	0 acres
No Damage	241 acres	1817 acres

ROOT PHYTOTOXICITY: Pendimethalin, when applied to soil, is reportedly absorbed by roots and because of its high lipophilicity, partitioned into membranes and other lipid components of root tissue resulting in very little acropetal translocation. Therefore, the most easily recognizable symptoms of injury caused by this herbicide is inhibition of secondary roots and thickening of root tips.

To determine if this type of injury was present, plants from a 13-year-old commercial field were carefully excavated on June 19, 2017. Soil particles were carefully washed from the roots with water. Half of the plants had received a pre-emergence application of pendimethalin plus sulfentrazone and mesotrione, the other half norflurazon plus flumioxazin plus mesotrione. Plants that received the norflurazon treatment (Fig. 4A and B) exhibited a high density of fine roots, whereas, the root system of plants that were sprayed with pendimethalin was less dense and a reduced network of fine roots (Fig. 4C and D).

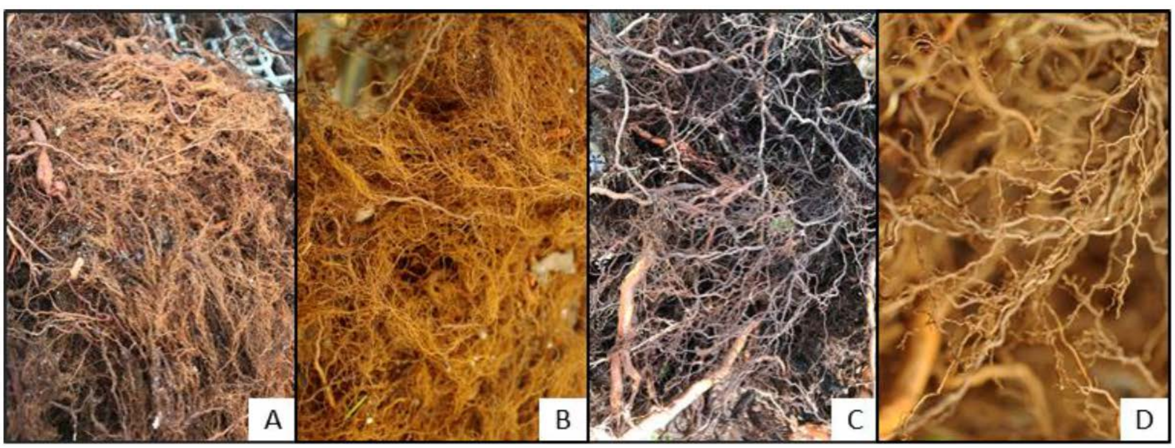


Fig. 4. Symptoms of root herbicide phytotoxicity. A and B. Root system of blueberry sprayed with Solicam in spring 2017. C and D. Root system of blueberry sprayed with Prowl H2O in spring 2017.

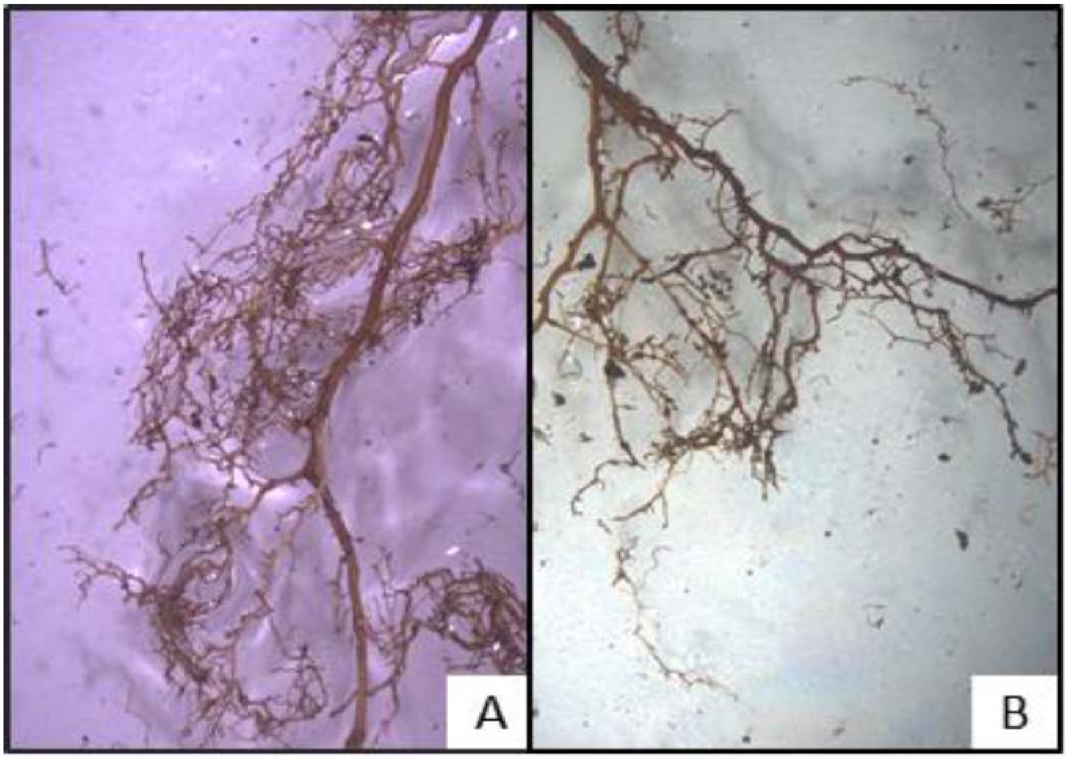


Fig. 5. Microscopic view (x40) of root morphology from roots treated with (A.) norflurazon, flumioxazin and mesotrione (B.) pendimethalin plus sulfentrazone and mesotrione.

Herbicide use in blueberry: Blueberry weed management relies primarily on soil applied residual pre-emergence herbicides to provide efficient control of a large spectrum of weeds. The herbicide applications may be divided between fall and spring timings. Fall applied residual herbicides control winter annual weeds such as horseweed [*Conyza canadensis* (L.) Cronq.] or annual bluegrass (*Poa annua* L.). Commonly used herbicides for fall application include napropamide (Devrinol), dichlobenil (Casoron), diuron (Karmex) or simazine (Princep). Pre-emergence applications in spring are aimed at controlling summer annual weeds such as goldenrod (*Solidago canadensis* L.) or goosegrass (*Eleusine indica* L.). Commonly used herbicides for spring pre-emergence application include diuron (Karmex), simazine (Princep), norflurazon (Solicam), flumioxazin (Chateau), terbacil (Sinbar), oryzalin (Surflan), sulfentrazone (Zeus Prime), and mesotrione (Callisto). Paraquat (Gramoxone) is also used in spring as a burndown for weeds already emerged. None of these materials were associated with the damage seen in 2017.

Pendimethalin (Prowl H2O) received a supplemental label in 2016 for use in blueberry for control of annual grasses and small seeded broadleaf weeds. This herbicide provides an alternative to the commonly used herbicide, norflurazon, for managing grasses and is reported to have an extended residual period providing control of sensitive weeds for most or all of the growing season. Prowl H2O is labeled at rates from 2 to 6.3 quarts per acre. In 2017, typical use in NJ was 5 to 6 quarts per acre.

Conclusions: Our findings provide strong circumstantial evidence that blueberry growers who used Prowl H2O (pendimethalin) during the 2017 season in New Jersey were more likely to experience crop damage than growers who used other herbicides. No damage was reported by growers that did not use Prowl H20 while growers who did use Prowl H2O experienced varying levels of damage. The level of damage was correlated with rate used and timing of application. Some compelling situations were observed. In particular, one grower used pendimethalin in only half of a field and damage was limited to the treated area only.