Blueberry I

Wednesday morning 9:00 am

Where: Grand Gallery (main level) Room A & B
MI Recertification credits: 2 (1C, COMM CORE, PRIV CORE)
OH Recertification credits: 1 (presentations as marked)
CCA Credits: NM(0.5) PM(1.0) CM(0.5)
Moderator: Larry Bodtke, MSHS Board, South Haven, MI

9:00 am	Insect Issues in Michigan Blueberries (OH: 2B, 0.5 hr) • Rufus Isaacs, Entomology Dept., MSU
9:30 am	Designing Good Fertilizer Programs and the Latest Options for Fertigation • David Bryla, USDA ARS, Corvallis, OR
10:00 am	Blueberry Disease Management (OH: 2B, 0.5 hr) • Annemiek Schilder, Plant, Soil and Microbial Sciences Dept., MSU
10:30 am	Current Trends in Blueberry Breeding and Varieties • Jim Hancock, Horticulture Dept., MSU • Patrick Edger, Horticulture Dept., MSU
11:00 am	Session Ends

Designing Good Fertilizer Programs and the Latest Options for Fertigation

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Many blueberry fields are irrigated by drip. A major advantage of drip is the ability to fertigate. Fertigation is the practice of applying soluble fertilizers to the plants directly through the irrigation water. It is often a very efficient way to apply fertilizers because most roots in drip irrigated fields are located near the drip emitters. Some advantages of fertigation include reduced delivery costs (no need for tractors or spreaders), greater control of where and when the fertilizers are placed, the ability to target application of specific nutrients during particular stages of crop development, and the potential to reduce fertilizer losses by supplying only small amounts of fertilizer to the plants as needed. Disadvantages include costs associated with the need for higher fertilizer quality (i.e., purity and solubility) and the capital costs of the equipment required to inject the fertilizer through the irrigation system.

Drip line placement. While nitrate-N is very mobile and moves readily in moist soil to plant roots, ammonium-N moves much more slowly. Therefore, N in ammonium fertilizers will only be available to the plants when it is applied close to the roots. Any ammonium-N applied away from the roots will likely be nitrified and converted to nitrate-N and eventually will be leached from the field by rain or irrigation.

To fertigate, drip lines and emitters should be located near the base of the plants during the first year or two after planting and later repositioned 6-12 inches on each side of the plants, using two lines per row, as the root system develops. Only one drip line per row is needed for adequate irrigation of blueberry on most soil types, but two lines per row are suggested in order to encourage a larger root system and thereby increase plant access to soil nutrients. The drip lines should be installed under weed mat or buried under sawdust mulch to secure the lines and reduce water runoff on raised beds.

Since only a fraction of the soil is wet by the drip emitters, most of the N applied to the plants during fertigation is added directly to the roots. As a result, extra N is not required with fertigation when sawdust or pine bark is incorporated into the soil prior to planting or used as mulch.

Timing and rate of N with fertigation. Liquid fertilizers should be injected in small and frequent applications (e.g., once a week), starting at leaf emergence and finishing in late July or early August. Fertigation is not recommended for the entire growing season (i.e., April–September) because N applications in late summer reduce fruit bud set in blueberry and increase the potential for freeze damage over the winter, particularly in colder regions such as eastern Oregon and Washington.

Many growers using drip apply granular fertilizers in March or April and then switch to fertigation in May, once irrigation is required on a regular basis. The use of granular fertilizer in the spring is less expensive than fertigation and practical for mature plants. However, it may cause fertilizer "burn" (salt damage to shoots and roots from the fertilizer) in new plantings and, in severe cases, can kill young plants. Even small applications of ammonium sulfate applied at a rate of 20 lb/acre of N in the spring prior to fertigation reduced shoot growth and caused root damage in young 'Draper' plants.

The recommended N rates for fertigation are shown in Table 1. The rates are higher than those recommended for granular fertilizers in Oregon and British Columbia during the first two years after planting, but are similar to granular rates in the following years. Higher N rates are recommended initially for fertigation due to low application efficiency in young plantings. Over half of the emitters in drip tubing with standard 12 or 18 inch emitter spacings will end up between the plants and outside of the root

Table 1. Recommended rates of nitrogen (N) to apply based on planting age and application method (granular or fertigation).

	Recommended N rate (lb/acre)		
		Granular fertilizer	
Year	Fertigation	Oregon*	British Columbia†
1	90	25-40**	19
2	90	40-50**	27
3	60	50-60	45
4	70	55-65	50
5	75	65-75	65
6	85	80-100	70
7	95	90-120	90
8+	100-150	100-140	100

*Based on an in-row plant spacing of 2.5-3.0 feet; *Nutrient Management for Blueberries in Oregon*. These rates have been modified for a field without surface mulch. If sawdust mulch is used and replenished every 3 years, add 25 lb N/acre to the recommended granular rate.

**The rates for year 1 and 2 in Oregon assume that the fertilizer is applied by hand around the base of the plants. If a granular spreader is used, then increase the N rate to account for inefficiency of application method. It is assumed that the plant canopies will be touching at the 2.5 to 3 ft spacing in year 3.

†*2014 Berry Production Guide - Beneficial Management Practices for Berry Growers in British Columbia*.

zone. Therefore, much of ammonium will be unavailable to the plants. Granular fertilizer, on the other hand, is often applied by hand, directly around the base of plants.

Fertilizer products available for fertigation. Unlike most crops, blueberry requires the ammonium (NH_4) form of N over the nitrate (NO_3) form. Common inorganic sources of ammonium or ammonium-forming fertilizers available for fertigation include:

- Ammonium nitrate solution or AN-20 (20–0–0) [NH_4NO_3•H_2O] is ammonium nitrate fertilizer dissolved in water. This product is commonly used for fertigation in fruit and vegetable crops but is less suitable for blueberry due to the high concentration of nitrate in the solution. Under no circumstances should concentrated AN-20 be mixed with concentrated urea sulfuric acid, concentrated sulfuric acid, concentrated hydrochloric acid, or concentrated phosphoric acid. **NOT RECOMMENDED FOR BLUEBERRY**.
- Ammonium polyphosphate (10–34–0 or 11–37–0) [$(NH_4PO_3)_n$] contains 10-11% ammonium-N but is used primarily as a source of phosphorus nutrition.
- Ammonium sulfate [$(NH_4)_2SO_4$] is probably the most common source of N applied to blueberry and is available in the liquid form (8–0–0–9S). Solutions can be made using dry, granular ammonium sulfate (21–0–0–24S), which dissolves in water at a maximum solubility of 6.3 lbs/gallon at 70 ºF.
- Ammonium thiosulfate (12–0–0–26S) [$(NH_4)_2\ S_2O_3$] is typically used as an acidulating agent but could also serve as potential N source for blueberry plants growing in high pH soils. Research on this source of N for fertigation is planned for blueberry; in some crops this fertilizer has caused some crop injury – caution is advised at this time.
- Calcium ammonium nitrate or CAN-17 (17–0–0–8.8Ca) [$Ca(NO_3)_2$•NH_4NO_3] is high in nitrate-N, low in ammonium-N, and supplies calcium. Certain crops such as strawberry and raspberry appear to produce higher quality fruit when fertilized with CAN-17, but like ammonium nitrate solution, the fertilizer is too high in nitrate-N for blueberry. It should not be combined with any products containing sulfates or thiosulfates. **NOT RECOMMENDED FOR BLUEBERRY**.

- Urea solution (20–0–0 or 23–0–0) [$(NH_2)_2CO$] may be the most common liquid fertilizer used for fertigation in blueberry. Urea rapidly converts to the ammonium form of N in the soil but is less acidifying than ammonium fertilizers. It is also less costly per unit N and can be made as a weaker dilution by mixing granular urea (46–0–0) in water at a maximum solubility of 8.8 lbs/gallon at 70 ºF. Note that the solution will become extremely cold as the fertilizer dissolves. Some growers are currently combining urea and ammonium sulfate solutions to create a custom liquid fertilizer blend (20-0-0-5S) for blueberry. Urea is the preferred fertilizer (over ammonium sulfate) in situations where salt accumulation is of major concern.
- Urea-ammonium nitrate solution or UN-32 (UAN-32) (32–0–0) [$(NH_2)_2CO•NH_4NO_3$] is manufactured by combining urea (46% N) and ammonium nitrate (35% N) on an equal N content basis. Of the available N sources, urea-ammonium nitrate has the highest N concentration. It is marketed as a 32% N solution in warmer agricultural climates and as a 28% N solution in cooler agricultural areas. Urea-ammonium nitrate solutions should not be combined with CAN-17 or solutions prepared from calcium nitrate. Thick, milky-white insoluble precipitate forms, which could cause serious plugging problem.
- Urea sulfuric acid (various) [$CO(NH_2)2•H_2SO_4$] is an acidic fertilizer that combines urea and sulfuric acid. Combining the two materials eliminates many of the disadvantages of using them individually. The sulfuric acid decreases the potential for volatilization losses from the soil surface and ammonia damage in the root zone, while urea in the sulfuric acid is much safer than sulfuric acid alone. This product is commonly sold under various names such as N-pHURIC. DO NOT MIX UREA WITH SULFURIC ACID ON YOUR OWN (HIGHLY REACTIVE).

Recently, fertigation and granular fertilization using different sources of N fertilizer during the first five years of fruit production were compared in ‘Bluecrop’. Soil pH was slightly lower with granular fertilizers than with fertigation; however, leaf N was also lower with granular fertilizer, whereas yield was greatest when plants were fertigated using ammonium sulfate or urea sulfuric acid. The results indicate that blueberry is well suited to fertigation. Larger applications of N fertilizer also increased plant growth in the study but did not improve yield in any year, and was even detrimental to berry size during the first three years of fruit production and to yield during the third year when granular fertilizers were applied. Whether N was applied by fertigation or as granular fertilizer, only 65 to 90 lb N/acre per year was required to optimize fruit production.

In addition to applying N solutions, a number of blueberry growers in the PNW (and elsewhere) are incorporating humic acids (aka organic acids) into their fertigation programs. Humic acids are complex mixtures of many acids produced by decomposition of organic matter. They are present in soils, peat, coal, upland streams, lakes, and ocean water. Humic and fulvic acids (lower molecular weight and higher oxygen content than other humic acids) are commonly used as soil supplements and have been found to stimulate plant growth in a number of crops, including blueberry. Root growth of ‘Draper’ was particularly enhanced by humic acids during the first two years in a new planting. However, more work is needed to determine if humic acids have any benefits on growth and fruit production in mature plants.

In organic production, we have successfully fertigated fish emulsion and used this product as the sole nutrient source for eight years to date in a certified organic field. Fish emulsion generally has about 4% N. The total amount of N in a gallon of fish is then 4 lb (one gallon weighs about 10 lb). The total amount of N to apply was divided into seven equal portions and applied from mid-April (bloom) through mid-July every 2 weeks. Fish fertilizer also contains significant amounts of P, K, and Mg. When fertigating with organic products, it is important to dilute the product so the viscosity is suited to fertigating. Also, pressurize the system prior to injecting the fertilizer and run the irrigation after injection to ensure the system flushes well. While we have had good success fertigating with fish emulsion for several years, our

research does show a reduction in emitter performance over time—this may be due to accumulation of organic material from the fertilizer but could also have been caused by iron bacteria. Good maintenance of a drip irrigation system is important for maintaining performance over time.

References

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