There are five main groups of blueberries, representing three main species. The most obvious differences between the types of blueberries are their growth habit and tolerance to cold temperatures.

Northern highbush cultivars require a chilling period of 550 or more hours below 45°F (7°C), making them unsuitable for hot and mild climates (Beale, Ben, et al., 2015). Higher chilling hour requirement varieties may yield poorly if grown in areas that are marginal for the needed chill hour accumulation.

Blueberries require day long, full sunlight for maximum production. Blueberries grow best in a well-drained, sandy loam soil. Northern highbush plant grows best in cooler climates, with moist, acidic soils. These bushes grow between 6 to 15 feet (1.8 to 4.6 meters) tall, producing large berries midsummer. Northern highbush are less hardy than the lowbush cultivars. Wild lowbush blueberries are grown commercially in some northern states. Since these don’t grow more than 1 - 2 feet tall (30 to 60 cm), they usually survive better under snow than the highbush cultivars. In hot and mild climates, the southern highbush and rabbiteye cultivars are best adapted. However, rabbiteye cultivars cannot survive below 0° to -10° F (-17° to -23° C).

Blueberries have a very shallow root system and are one of the few crops that require special soil conditions. Since the feeder roots lack root hairs and are very close to the soil surface, good soil moisture management and heavy mulches are recommended (Schloemann, S. and E. Garofalo. 2019). Conversely, unirrigated, deep sandy soils or heavy clay soils with poor aeration and little internal drainage can result in poor growth and yield.
The soils in most blueberry fields are considered marginal for other agricultural uses. Blueberries require a soil pH of 4.5-5.5 for acceptable plant growth. Since the required soil pH is so low, it can lead to blueberry nutrient deficiency and toxicity challenges. However, if soil pH is increased, and exceeds 5.5, the blueberry plants will encounter problems with (Fe) and zinc (Zn) availability. “Plants stunted by high soil pH usually do not recover even when soil pH is reduced” (Hart, et al., 2006). If soil pH is too low then problems develop with manganese (Mn) and aluminum (Al) toxicity (Strik, 2013). Advance planning for nutrient management is required for optimum blueberry production. They have low nutrient requirements, when compared to other small fruit crops (Hancock & Hanson, 1983). Collect soil samples for analyses in advance of final site selection and planting. If soil pH is too high, acidify the soil a year before planting. Adjusting soil pH after planting is expensive, difficult, inefficient, and sometimes impossible. Preplant acidification is achieved by applying and incorporating elemental sulfur (S) such as Tiger 90CR®. Elemental S can be supplied by a single application or by multiple smaller applications (Hart, et al., 2006).

Soil pH is not the only challenge faced by blueberry producers. It is also important to understand the root system. Blueberries have very small roots that are often colonized by mycorrhizal fungi – fungi that help the blueberry plant take up nutrients. “The smaller ‘feeder’ roots have a short life-span, with half the plant’s roots dying within 100 days. These shed roots are replaced by new root growth.” (Strik, 2015). The new roots are sensitive to adverse plant and environmental factors. Irrigation, fertilization, mulch type, and raised beds vs. flat ground can all influence blueberry root system growth and development as well as nutrient uptake.

**Nitrogen (N)**

Blueberry plants take up the ammonium (NH₄⁺) form of nitrogen (N). Maintaining soil pH at 4.5 to 5.5 delays nitrification, keeping the ammonium fertilizer in a form that can be taken up by the plants for longer duration (Strik, 2013). Urea, a good blueberry fertilizer, can experience N volatilization in some situations. Nitrogen deficiency symptoms generally present as chlorosis of the leaves along with reddish tinge and poor growth. Applications of excessive N can increase plant vigor, however this excessive N may decrease both yield and quality. Plants absorb fertilizer N more efficiently from late bloom through fruit maturity. Multiple applications of N are recommended. Nitrogen application rates are function of blueberry variety.

**Phosphorus (P)**

Phosphorus is mobile in plant, but very immobile in soil. If plants are stunted and/or have dark green leaves, this may be a sign of P deficiency in the plants. The leaves may also have red tinge due to accumulation of anthocyanins. Excessive applications of P will increase the root to shoot ratio. Early season P deficiency may be due to cool soil temperatures that lead to slower root growth.

**Potassium (K)**

Like P, K is mobile in plant, but immobile in soil. Potassium tissue levels are related to the crop load. If K levels are insufficient, the fruit may be soft. Older leaves with necrotic lesions are often found on K deficient plants. Sometimes excess K and the corresponding toxicity is referred to as “salt injury.”

Blueberries do not tolerate chlorides. Potassium chloride is a common material used in many blended fertilizers and should be avoided in fertilizing blueberries.
Magnesium [Mg]
Magnesium is mobile in plants but immobile in soil. Plants deficient in Mg have older leaves with interveinal necrosis or leaf edges starting to turn red to brown. On young rabbiteye plants, deficiency symptoms appear pink on the leaf margins and yellow between the veins. Highbush blueberries may show more of a classic green “Christmas tree” in the center of a yellow leaf. Magnesium deficiencies are more common on sandy soils with low pH or if soils are high in K.

Sulphur [S]
Sulphur bentonite is most commonly used in blueberries as a soil amendment to modify soil pH, not as much as a plant nutrient. Further details on the use of S as a soil amendment can be located in a previous Tiger-Sul Agronomic Tech Bulletin, “Rectify Soil Conditions with Tiger 90CR® Sulphur”, May 2014. As a plant nutrient, S moves with water in the transpiration stream but does not translocate within the plant. If the plant has S deficiencies, it will have a lower nitrogen use efficiency (NUE). Soil pH does not effectively change the amount of S taken up by the plant.

When S is applied to change the soil pH, it is not a fast process. Apply Tiger 90 CR a minimum of one year before the expected planting date of blueberries. During the winter months, do not expect the soil pH levels to drop. As soil temperatures increase, Thiobacillus sp. converts the sulphur bentonite to sulphuric acid. Soil pH can decline rapidly during the 3 to 4 months following a summer application. Late winter and spring rainfall usually provides enough moisture for the acidification reaction. Fall dry situations favor sulphur bentonite application, while waiting until spring typically can lead to a delay due to wet conditions.

Fall applications allow the pastilles to fracture into smaller particles due to freeze/thaw and wetting/drying cycles. Before planting blueberries, consider incorporating Tiger 90CR to a depth of 6 inches. Avoid applying more than 450 lbs/A of Tiger 90CR to established plants per year (Longstroth, n.d.). Soil test to determine when the soil pH levels are between 4.5 and 5.0 before deciding to plant. After planting, make broadcast applications of Tiger 90 CR as needed. Consider applying Tiger Micronutrients® Iron 22% with the after planting broadcast application.

Micronutrients
Tissue testing is the most accurate means in determining fertilizer needs and assessment of nutritional problems, especially the micronutrients. At a minimum, complete an annual tissue analysis to compare critical nutrient values and establish trends. The physiological age of the plant is more important than testing on a calendar date. Leaf nutrient concentrations are very dependent on tissue type (location on plant) and tissue age. In the Pacific Northwest, it is recommended to collect tissue samples from blueberry late-July to early-August of the most recent fully-expanded leaves from lateral stems (Strik, 2013).

Evaluate both the long term and short-term results to incorporate into the fertility management plan. Do not fail to utilize soil testing as well. Due to limited space the individual micronutrients will not be addressed. Although, attention needs to be directed to aluminum (Al) as the soil chemistry is significantly different for blueberries compared to most other crops. Aluminum is not an essential nutrient, but can greatly influence plant nutrient availability.

At the low soil pH required by blueberries, there is often a considerable amount of soluble Al in the soil solution. This can cause several negative results. First, soluble Al has a strong affinity for soluble P. This is the same form of P that the blueberries require. The result of the excess soluble Al can be the requirement for a higher soil P test. Another potential problem is the cation competition caused by excessive soluble Al. The likely result of this cation competition is reduced uptake of one or more of the cation micronutrients (Cu, Mn, Fe, and Zn). Preferred method to analyze for these micronutrient deficiencies is a plant tissue analysis® (Spectrum Analytic).
Summary

Blueberry fertility management requires an understanding of nutrient mobility. Nutrients requirements are affected by plant age, canopy size, yield, time of year. Fertilizer applications depends on both the method of application and amount of plant nutrients needed. Continued testing for both soil pH and soil nutrient levels are needed and should be corrected according to plant tissue and soil sample analyses. Tiger-Sul provides wide range of products that may be employed to eliminate or minimize blueberry yield limiting factors. Some of those products include TIGER 90CR®, TIGER XP®, TIGER 85®, TIGER Micronutrients® Iron 22%, TIGER Micronutrients Copper 12%, TIGER Micronutrients Zinc 18%, and TIGER Micronutrients Zinc 4%. These products contain S and varying levels of micronutrients.

References:


Spectrum Analytic Laboratory Inc. Fertilizing Blueberries. Washington Court House, Ohio.
