Growing Tips

FACTSHEET.......

There are many factors associated with the culture of healthy blueberry bushes, and hence the production of a high quality fruit crop. One such factor that most research workers and growers alike agree on is the need to feed the plants adequately and at the appropriate time, however, not everyone agrees on the right means to this end.

Soil pH

The key to growing healthy bushes lies largely in the choice of acid, well-drained soils, and no amount of fertiliser or "You Beaut" programmes seem to be able to make up for these factors if they are absent. The optimum pH range for Blueberries is from 4.5 to 5.2 with soils slightly above and below these having some potential for suitable soil amelioration. Soils that have a pH level greater than 5.5 will often lead to the development of chlorosis and iron deficiency, leading to reduced growth. The use of sulphur and ammonium sulphate based fertilisers to reduce the soil pH on marginally high soils has been effective although it is important to commence the treatments well in advance of planting. In very acid soils, particularly below pH 3.5 to 4.0 good results have been measured from the application of agricultural lime, or dolomite.

Various Approaches

1. Nutrient Replacement

The general thrust of this approach is to make an estimate of the loss / usage of any particular nutrient from the orchard in the previous season and to replace it gradually over the current season, attempting to apply it at the most useful times. The loss factors which must be taken into account include the following....

- The total in the harvested fruit
- That taken up for vegetative production.
- Losses due to leaching.
- Losses due to volatilisation.
- Nutrient immobilisation.

Obviously, these will vary between different soils, and the factor that will therefore be applied will normally be worked out along the lines of the following.....

- Light sandy soils..... multiply crop loss of an element by 4.

- Soils with a higher cation exchange capacity..... multiply by 2.

Recent research reported form Michigan has highlighted the fact that as much as 90% of fertiliser applied before the plants have reached vegetative bud break is wasted due to leaching before the plant is at a stage where it can be utilised.

2. Standard Fertiliser Programmes

This approach is still probably the most common in use by growers and involves the use as a base starting point a programme being used successfully in similar climatic areas of the United States, and then supplementing this with additions deemed necessary from the results of leaf tissue analysis taken form hardened "first flush" leaves, in early summer.

The North Carolina approach serves as a good example:

- Early Spring application..... after the winter months when rain has leached many of the nutrients there is a need to apply fertiliser as vegetative and flower buds begin to break to ensure a healthy bud break.

- Late Spring / Early Summer..... a second application is made to provide adequate nutrients to the plant as the fruit ripens.

- Post Harvest..... an application of Nitrogen to stimulate new growth, which becomes fruiting wood for next season, may be necessary unless the new shoot growth has been very vigorous already.

- Early Autumn..... an early autumn application of Nitrogen and Phosphorous (Diammonium Phosphate) may be made to encourage healthy root growth in the autumn and winter months.

The above fertiliser programme would normally involve the application of approximately 60 kg of actual Nitrogen per hectare in split applications and the use of fertilisers with ratios approximating the 10:10:10 N P K ratio.

As mentioned earlier, leaf tissue analysis may be used to provide a guide as to any problems with the major elements and also the trace elements, with "top up" applications being made as necessary.

Various Nutrients

1. Nitrogen

Nitrogen is found in many of the most important substances within the plant, including proteins, amino acids, enzymes and chlorophyll. It is the first element to exhibit deficiency symptoms in deficiency trials, and the following deficiency symptoms are usually evident:

- Pale yellowing of the leaves (4 weeks).
- The yellowing turns to pink and red.
- Plant growth is stunted.
- Reduced yields.
- Necrosis may occur and the growing tip may abort.
- Death.

Leaf tissue analysis has generally pointed to a deficiency level at or below 1.70%, whilst optimum levels are generally in the range from 1.8 - 2.1% (rabbiteye blueberries 1.2 - 1.7%).

High Nitrogen levels may be associated with low levels of calcium, which has been correlated with low yields in the U.S. Leaf levels greater than 2.5% are considered to be excessive. High levels of Nitrogen in New Jersey have led to reduced berry size, with no increase in production to match.

The form of Nitrogen applied is important as generally blueberries have a preference for the ammonium over the nitrate form, as can be seen by the colour and health of roots grown in the respective solutions at pH levels of 5.0 and above. However, at pH levels below 5.0 both forms of N have produced healthy plants and the preferred application by many growers is for ammonium - nitrate.

2. Phosphorus

Phosphorus is vitally important in the photosynthesis and respiration pathways of the plant. It is present in large quantities in the cell nucleus and protoplasm and it is important for the development of a healthy root system. Phosphorylated compounds act as intermediates in many biochemical reactions concerned in the metabolism of carbohydrates, fats and proteins.

Deficiency symptoms in blueberries normally show up as follows:

- symptoms show up fairly quickly as dull leaves
- developing leaves and stems may become purple
- the plant may be stunted and develop small leaves
- older leaves may develop purlplish tips and the underside of the leaves may develop a russet along the veins.

Leaf tissue analysis results below 0.1% are generally considered to be deficient, whilst the optimum range is considered to be between 0.12 and 0.40% (rabbiteye vars. 0.08 - 0.17). Toxic symptoms have developed as interveinal chlorosis and leaf abscission, which may occur where levels exceed 0.8%. High phosphorus levels may lead to magnesium, copper and manganese deficiencies.

Soil applications generally range from 25 to 50 KGs of actual P per hectare and diammonium phosphate may be a suitable form of application.

3. Potassium

A major role of potassium is in the ionic balance of the plant and in various enzymatic reactions in the cells. It affects water movement within plants and is essential for the formation and movement of starches, sugars and oils. Potassium levels affect fruit quality and it has a function in increasing the vigour and disease resistance of plants.

Deficiency symptoms are as follows.....

- symptoms generally show first on older leaves
- leaf symptoms include necrotic spots, leaf curling and marginal scorching
- the terminal growing tip may abort, with new axially growth developing an interveinal chlorosis similar to iron deficiency.

Deficiencies generally occur at below 0.3% levels and the normal levels are from 0.45 - 0.55% (rabbiteye blueberries 0.28 - 0.60%). The level of potassium in the fruit increases dramatically as the fruit ripens, and leaf tissue levels of potassium will drop significantly during the fruit ripening and harvest season. Standard fertiliser programmes generally aim to put on a base level of 40 kg actual potassium per hectare.

4. Calcium

Calcium is required by the plant in the cell walls of leaves and stems, and is essential for root health and development. It has a role in fruit ripening and quality and stimulates plant vigour and the uptake of nutrients. High levels of calcium are detrimental to blueberries, but plants growing in very acid soils have shown good response to the application of lime or dolomite.

Deficiency symptoms may be similar to the symptoms for iron deficiency, and include the interveinial chlorosis of young leaves, or marginal yellowing and scorching. Vegetative growth may be stunted and rosetting of terminal leaves may occur due to the shortening of the internodes. Low calcium levels have been correlated with low fruit yields.

Leaf levels below 0.13% are considered deficient and the optimum tissue level is 0.4 - 0.8% (rabbiteye 0.24 - 0.70%). In excess of 1.0% leaf calcium may lead to toxicity responses.

5. Magnesium

Magnesium is important to the plant in the structure and formation of chlorophyll, photosynthesis and general root performance. It is often deficient in high rainfall areas on sandy soils.

The symptoms of deficiency tend to show up on older basal leaves and include yellow leaf mottle, and deep red pigment in the centre of the leaf. Deficiencies may occur due to high potassium levels. Leaf tissue levels below 0.08% may lead to deficiency symptoms with the optimum range being 0.12 and 0.25%.

6. Iron

Iron is important in various enzyme systems and in the formation and structure of chloroplasts. Deficiency symptoms are often associated with high calcium and high pH levels, and appear as an interveinal yellowing that in the extreme may become white. In leaf tissue, levels below 60 ppm may show deficiency symptoms with normal levels varying from 60 to 200 ppm. In soils of pH greater than 5.2 it may be preferable to avoid the use of nitrate forms of nitrogen as these may lead to an iron deficiency.

7. Manganese

Manganese is essential in phosphorus transfer and in various enzyme systems within the plant. Because manganese levels tend to increase as the pH of the soil decreases, there are few instances of manganese deficiency, and the normal levels within healthy leaf tissue may vary from 50 to 350 ppm . Levels above 450 ppm may lead to toxicity problems and these may often be associated with low pH soils and poor drainage.

8. Boron

Boron is essential to a number of plant transport systems, cell differentiation, and cell wall formation. Boron deficiencies have been reported in blueberries, with the symptoms including the die back of apical tissues, and the development of chlorotic and misshapen leaves next to the terminal dieback region. Deficiency levels are reported to be at less than 20 ppm in leaf tissue samples, with normal levels ranging from 30 to 70 ppm.

9. Copper

Copper is important in various plant enzyme functions, respiration, oxidation - reduction reactions and in the utilisation of iron. Leaf tissue levels below 5 ppm are considered low, with the normal range being from 5 to 20 ppm.

10. Zinc

Zinc is important in auxin production and stem elongation. Deficiency levels below 8 PPM have produced leaf yellowing that may include the veins as well as the interveinal area. Normal levels vary from 8 to 30 PPM.

Leaf Tissue Analysis

The timing of sampling and the selection of suitable leaves is important in order to obtain results that can provide useful results in interpreting the nutrient status of the plant. The optimum period for sampling blueberries is following harvest on laterals just below the fruit clusters. The mid leaves of these laterals should be sampled.

A Useful Key to Visual Symptoms of Nutrient Deficiency

Specific nutrient deficiency symptoms are most easily recognised at intermediate stages of development. Plants suffering from nutrient deficiencies usually have some foliage in various stages of development. Leaves showing intermediate stages of visual symptom development should be studied carefully with particular reference to distribution on the plant, leaf, position on the shoot, relative age of leaf, leaf size, shoot length and the pattern of abnormal coloration on the leaf.

The following key may be used as a guide to tentative identification of nutrient deficiencies on blueberries with final reference to more detailed descriptions in the text. The ultimate test on any diagnosis is the recovery of plants treated with the deficient element.

A. Symptoms appear worse on oldest leaves.

B. Chlorosis, with yellow or coloration, between main lateral veins, spreading toward leaf margin, resulting in V-shaped green area with apex toward leaf tip.

Most severe in late summer...................Mg.

B. Lateral margins scorched, necrotic spotting, slight interveinal chlorosis near tips, leaves small... K.

A. Symptoms appear worse on youngest leaves.

B. Young leaves chlorotic with green veins.

C. Internodes shortened near tip of shoot; leaves smaller than normal, chlorotic and and somewhat folded upward along midrid.. Zn.

C. Internodes not shortened; fine lace-like network of green veins; leaves acquire more green colour with increasing age.. Fe.

B. Young leaves chlorotic or partly so; veins not distinct.

Young leaves yellow while older leaves pale green.................................... S.

Young leaves with marginal chlorosis and yellow - green blotches............ Ca.

B. Young leaves not chlorotic or only slightly so.

Short internodes near tip of shoot; leaves small, bluish - green and may be curved similar to a boat... B.

Young leaves small; uniformly pale green; reduced shoot growth; purple pigmentation on young shoots and main leaf vein. Pigmentation may disappear later in the season and leaf colour improves.. P.

A. Symptoms generally on any part or all of the plant.

B. Small leaves, reduced shoot growth, uniform pale green leaf colour.

C. No abnormal pigmentation. Pale leaf colour progressively becomes worse during season.. N.

B. No marked reduction in leaf size or shoot growth.

Palegreen to yellow colour between main veins. Large leaf veins show broad band of green. Very fine veins not distinguished. Increases in severity late in season............... Mn.

Note: deficiency symptoms of other essential nutrients are not sufficiently described to justify inclusion in this key.

Cain and Eck (1966) p.110