Establishing Blueberries: Avoiding Costly Mistakes

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Blueberry Fever
- An irrational desire to plant blueberries.
- Symptoms:
  - Need to plant blueberries.
  - Will plant in any site without testing.
  - Save money by cutting corners to get into production quickly.
  - Expect to make lots of money quickly.

Does and Don’ts
- Preplant decisions
  - Choosing the right site.
  - Preparing the site.
- Planting mistakes
- Cultural mistakes
  - Irrigation
  - Pruning
  - Herbicides
  - Mulching

Growing Blueberries
- Requires Special Soils
- Soil pH 4.5 to 5.5
- Usually Acid Sands or Acid Mucks
- Soil Should be Moist, But Not Wet
- Originally a Wetland Plant

Site Analysis
- Is this a blueberry site?
- Soil pH
  - Is an acid soil
  - Can I make it acid enough for blueberries.
- Naturally moist soil.
  - Poor drainage.
  - Water table close to surface.
  - Is drainage needed?

Michigan Blueberry sites
- Porous soils with high water tables.
Flooding

- Winter vs. Summer
- Roots need to breath
- Root death by drowning
- Restriction of the root zone

Blueberry Root Zone

Site Preparation

- Determine soil pH
  - Below pH 5.5
  - Between pH 5 – 4.5
- Use Sulfur to lower pH
- Control perennial weeds.
- Is drainage needed?
- Prepare irrigation system.

Soil Test for Soil pH and Nutrients

- Recommended soil pH is 5.5 to 4.5.
- Recommended nutrient levels for blueberries.
- Phosphorus - 50 ppm P,
- Potassium - 60 ppm K,
- Magnesium - 40 ppm Mg,
- Calcium - 250 ppm Ca.

Cation Exchange Capacity

<table>
<thead>
<tr>
<th>CEC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 5</td>
<td>Very sandy with not much clay or humus</td>
</tr>
<tr>
<td>6 - 10</td>
<td>Intermediate loamy texture or sandy with more humus</td>
</tr>
<tr>
<td>10+</td>
<td>More clay and/or humus</td>
</tr>
<tr>
<td>20+</td>
<td>Probably an organic soil</td>
</tr>
</tbody>
</table>
- CEC is nutrient holding capacity

Soil Nutrient Levels

- Nutrient concentrations are higher in heavier clay soils than sandy soils,
- Relative proportions of nutrients is an important measure of status.
- A suitable balance of soil Ca, Mg, and K as percent of exchangeable bases,
  - 60-80% Ca,
  - 15-30 % Mg,
  - 10-15% K.
Soil pH and Availability

- Solubility and availability of most minerals is influenced by soil pH.
- Blueberries are adapted to the nutrient levels in low pH soils.
- Extreme pH can cause mineral deficiencies or mineral toxicities.

Adjusting Soil pH

- Not a quick and easy process.
- The amount of sulfur required depends on the soil.
- Clay and organic matter act as a buffer, absorbing and releasing mineral ions.
- Little sulfur is needed on sands.
- Soils high in clay or organic matter require much more.
- Apply and incorporate sulfur a year before planting.
- If large changes in pH are needed, the change will take longer than a small change.

Adjusting Soil pH with Sulfur

<table>
<thead>
<tr>
<th>Elemental sulfur needed to lower pH to 4.5 (lb./acre)</th>
<th>Soil type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current pH</strong></td>
<td><strong>Sand</strong></td>
</tr>
<tr>
<td>5.0</td>
<td>175</td>
</tr>
<tr>
<td>5.5</td>
<td>350</td>
</tr>
<tr>
<td>6.0</td>
<td>530</td>
</tr>
<tr>
<td>6.5</td>
<td>660</td>
</tr>
<tr>
<td>7.0</td>
<td>840</td>
</tr>
</tbody>
</table>

1To substitute ferrous sulfate, multiply by 8.

Soil texture and CEC

- Soil tests may not always list soil texture.
- CEC is always listed and can be used to estimate soil texture.

<table>
<thead>
<tr>
<th>Estimating soil texture from CEC</th>
<th>Soil Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loamy sand:</td>
<td>&lt; 5 meq/100 g</td>
</tr>
<tr>
<td>Sandy loam:</td>
<td>6-8 meq/100 g</td>
</tr>
<tr>
<td>Loam:</td>
<td>9-12 meq/100 g</td>
</tr>
<tr>
<td>Clay loam:</td>
<td>12-17 meq/100 g</td>
</tr>
</tbody>
</table>

Planting

- **Don’t** plant before soil amendments have worked.
- **Do** break up the root ball when planting.
  - Roots never come out of the peat!
  - Small root mass dries quickly
- **Do** add peat to the planting hole.
- **Do** mulch the plants
- **Do** control weeds
- **Do** irrigate the planting

Buy the Plants!

- Many new growers try to save money growing their own plants.
- This puts them 3 years behind.
**Planting Blueberries**

- Plant in spring or fall
- Plant 2 to 3 feet apart
- Row spacing 10 to 12 feet
- Buy three year-old plants
- If planting potted plants, break up the root ball.
- Plant several varieties to increase fruit set and size.

**Planting Blueberries**

- Consider adding peat moss to the planting hole.
- Roots may have trouble moving out of root ball.
- Mix peat with native soil in the hole.
- Avoid an abrupt transition between the planting hole and the native soil.
- Mulch plants

**Use Mulches**

- 2-5" thick Mulch
- 2-4' wide
- Replenish every 2 to 3 years
- Materials
  - Softwood sawdust, wood chips, bark, straw, anything organic
  - Test pH!!
  - Avoid composted manures!!

**Benefits of Mulches**

- Increase Organic Matter
- Provide micronutrients increasing fertility of topsoil.
- Increase water holding capacity of soil
- Cool soil in hot summer
- Blueberry roots love the interface between the mulch and the soil.
- Just like Home!

**Mulching and Root Growth**

- These 3-year old blueberries were grown in silty clay loam. The one on the right received a 6 inch sawdust mulch.
- Mulching increases fine root numbers.
Raised Beds - Plastic Mulch

Raised bed plantings?
- Create healthy soil environment above old soil.
- Very Expensive!
- Could be best alternative in poor sites.

Weed Control

Common Problems
- Using glyphosate for weed control.
- Using products for off-site weeds.
- No Weed Control!

Glyphosate

- Using glyphosate as the only weed control.
- Many repeated doses of glyphosate.
- Uptake of drift on green shoots or leaves is carried down into crown of plant.
- Symptoms next year.
- Stunted growth.

 Glyphosate Stunted Plants

- Young plants collapse the next spring.
- Older plants are weakened.
- Loss of vigor.
- Die back of shoot tips.
- Loss of new shoots.
- Loss of bearing surface.
Pruning Young Blueberries

- If growth is poor, consider removing all shoots.
- Goal is to get good growth from the crown of the plant.
- Keep vigorous shoots, remove shoots with poor growth.
- Stimulate new growth.
- Avoid fruiting, it stunts the plants.

Pruning Young Bushes

First 2 seasons:
- Remove flower buds (strip off or prune off).
- Remove low-growing, spindly branches encouraging upright vigorous wood.

Optimize Fertility

- Soil tests reveal what is in the Soil, not what the plants is getting from the soil.
- Leaf Analysis, Tissue tests reveal what nutrients are in the plant in sufficient supply and if any are deficient.
- Law of the Minimum: Plant growth is dependent on essential elements and growth will be limited if one of these elements is limited.

Fertilizing Blueberries

- Blueberries need ammonium nitrogen for growth and potash when fruiting.
- Apply Ammonium Sulfate 21-0-0 if soil pH is more than 5.
- Apply Urea 46-0-0 at half 21-0-0 rate if soil pH is 5 or less.
- For complete fertilizers use acidifying fertilizers such as Miracid, look for nutrient ratios such as 20-0-10-5.

Fertilizing Blueberries

Do Not! apply the fertilizer too close to the Plant!
Apply in a diffuse ring about 8 to 12 inches away from the plant. Fertilizer salts will burn off the roots and kill the plant!

Nitrogen Fertilizers

- Annual applications,
- Use only ammonium N,
- Split application are best.
- More on sandy soil, less on organic soils
- Mulching increases demand for N.
Nitrogen

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>N</th>
<th>Urea</th>
<th>Ammonium sulfate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>15</td>
<td>35</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
<td>70</td>
<td>150</td>
</tr>
<tr>
<td>6</td>
<td>45</td>
<td>100</td>
<td>215</td>
</tr>
<tr>
<td>8</td>
<td>65</td>
<td>150</td>
<td>300</td>
</tr>
</tbody>
</table>

Other Fertilizers

- Potash (K) annual or biannual applications
- Magnesium (Mg) uptake may be suppressed by Potash

Fertilizers

- Too much Fertilizer can cause more problems than not enough.
- Foliar nutrients are OK but can be overdone also.

Water Management

- Irrigation allows plant growth and fruit growth to be optimized.
- Drainage removes excess water
  - Increases rooting volume
  - Decreases stress from flooding
- Need to Know your Soil!

Why Irrigate Blueberries

- Plant Growth is Dependent on Water:
  - Shoot Growth
  - Fruit Growth
  - Fruit Set for Next Year
- Blueberries do not manage water well.
- Moist soil is a requirement for good blueberry growth.

Blueberry Water Use

- Plants use little water if they have no leaves.
- As the leaves grow water use increases (Photosynthesis, transpiration).
- Organs grow by expansion.
- Pumped up by water.
Bluberry Leaves

- Harvest Light - Photosynthesis
- Stomates let air in and water out
- Stomates on bottom of leaf
- Transpiration
- Leaf Structure
- Conserve Water

Blueberry Root Zone

- Root Growth and Structure
- Absorb Water (passive)
- Absorb Nutrients (Active or passive)
- Root structure affects absorption
- Blueberries lack root hairs
- Mycorrhizal Fungi
- Blueberries have a small shallow root system.

Blueberry Roots

- Root Growth and Structure
- Absorb Water (passive)
- Absorb Nutrients (Active or passive)
- Root structure affects absorption
- Blueberries lack root hairs
- Mycorrhizal Fungi
- Blueberries have a small shallow root system.

Drought

- Lack of water reduces photosynthesis and causes wilting
- Reduced growth and reduced food reserves available for growth
- Available reserves are shifted to the roots.
- Fruit compete for available reserves

Water Use in Blueberries

<table>
<thead>
<tr>
<th>Month</th>
<th>Monthly Use</th>
<th>Weekly Use</th>
<th>Daily Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>0.48</td>
<td>0.12</td>
<td>0.02</td>
</tr>
<tr>
<td>June</td>
<td>2.87</td>
<td>0.72</td>
<td>0.10</td>
</tr>
<tr>
<td>July</td>
<td>5.09</td>
<td>1.26</td>
<td>0.17</td>
</tr>
<tr>
<td>August</td>
<td>2.13</td>
<td>0.53</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Soil Water Holding Capacity

<table>
<thead>
<tr>
<th>Soil Texture</th>
<th>In/ft</th>
<th>in/18 in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>0.84 – 1.20</td>
<td>1.26 – 2.40</td>
</tr>
<tr>
<td>Sandy Loam</td>
<td>1.08 – 1.80</td>
<td>2.16 – 3.60</td>
</tr>
<tr>
<td>Loam</td>
<td>1.68 – 2.28</td>
<td>3.36 – 4.56</td>
</tr>
</tbody>
</table>
Irrigation in Blueberries

<table>
<thead>
<tr>
<th>Month</th>
<th>Weekly Use</th>
<th>50% recharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>0.12</td>
<td>Every other week</td>
</tr>
<tr>
<td>June</td>
<td>0.72</td>
<td>Every 5 days</td>
</tr>
<tr>
<td>July</td>
<td>1.26</td>
<td>Every 3 days</td>
</tr>
<tr>
<td>August</td>
<td>0.53</td>
<td>Every week</td>
</tr>
</tbody>
</table>

Water Quality

- Check irrigation water quality.
- Blueberries are sensitive to salts.
- Bicarbonates of calcium and magnesium will increase soil pH.

Fruit Growth

- Double Sigmoidal Growth Curve
- Competition between fruits
- First fruit are the Largest Fruit
- Small Fruit are Always Small
**Dormant Shoot**

- Fruit Buds at Tip
- Withered flower Cluster at Base
- Vegetative buds on lower nodes
- Growth begins at tip

**Spring Growth**

- Flower bud opens and Blooms
- Rapid shoot expansion from vegetative buds
- Growth continues as long as conditions are good
- Buds develop in axils of leaves

**Mid-Summer Growth**

- Shoots are competing with fruit
- Terminal Bud Dies
- Shoot growth stops
- New terminal bud develops in axil of uppermost leaf
- Leaf buds develop below

**Late Summer and Fall Growth**

- Fruits Ripen
- Terminal bud develops into flower cluster bud
- Lower buds may develop into Flower buds also
Annual Cycle of Shoot Growth

- Fruit buds form on last year’s wood!
- Vigorous shoots usually have lots of flowers and grow vigorous new shoots for next years crop.
- Less vigorous shoots have few buds on only one or two small shoots with one fruit bud.
- The most fruitful canes are 4 to 6 years old.

Pruning

- Removes older less productive wood.
- Directs growth into new wood which is more fruitful.
- Better distribution of fruit buds, avoiding lots of short shoots with single buds.

Comparing Fruiting Wood

Desired Cane Mix for Jersey/Blucrop/Elliott
- 15-20 % young canes (1-2 year-old)
- 60-70 % intermediate (3-5 year-old)
- 15-20 % older (6 years and older)
Fields are Different!

• Every field has differences, good areas and poor areas.
• Focus your effort where it will do the most good.
• Determine why some areas are poor and if they can be redeemed.
• Be prepared to abandon areas that are poor and would cost too much to save.

Thank You