United States Blueberry Production

- 2014
  - U.S. total production 5.67 million pounds
  - Nationwide average yield was 6,700 pounds per acre
  - Valued at approximately $200 Billion
  - Production use is divided between fresh and processed, with 55% sold for fresh consumption
  - Total production increased 5% and continues to rise

USDA, 2017

Blueberries

- Major Types Grown In The United States
  - Lowbush
  - Northern Highbush
  - Southern Highbush
  - Half-highs
  - Rabbiteye

Northern Highbush Blueberry

- Primary type grown commercially
- Performs the best in Missouri climatic conditions
- Adapted to USDA cold hardiness zone 5 – 7
- Perennial woody shrub can reach 6-10’ tall
- Chilling requirement from 650-900 hours
- Fruit ripens 60-100 days after petal fall
- Produces large, high quality fruit with thin skins
- Production ranges from 4,000-10,000 pounds per acre

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Pros and Cons of Blueberry Production

**Pros**
- Native to North America
- Long-lived perennial shrub
  - 20-30 years in Missouri
- Cold hardy to -20°F during midwinter
- Fruit is less perishable and stores for short periods of time

**Cons**
- Higher initial investment
- Specific soil requirements
- Bird & Critter Management
- Waiting period between planting and production
- Labor intensive
- Winter injury can occur during fluctuating spring temperatures

Pre-plant Considerations

- Cultivars
- Site Selection
- Site Preparation
- Cultural Practices
- Market for your crop
- Establishment Costs

Cultivar Selection

- Select cultivars that are adapted to the area’s climatic conditions (Zone)
- Consider bloom time and pollination
- Choose cultivars with optimal ripening season for your farm schedule
- Marketable in the area

Cultivars for Missouri

<table>
<thead>
<tr>
<th>Ripening Season</th>
<th>Early</th>
<th>Mid Season</th>
<th>Late Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluetta</td>
<td>Berkeley</td>
<td>Nelson</td>
<td>Chandler</td>
</tr>
<tr>
<td>Collins</td>
<td>Bluecrop</td>
<td>Ozarkblue</td>
<td>Coville</td>
</tr>
<tr>
<td>Duke</td>
<td>Bluejay</td>
<td>Reka</td>
<td>Darrow</td>
</tr>
<tr>
<td>Earlibue</td>
<td>Blueray</td>
<td>Sierra</td>
<td>Elliot</td>
</tr>
<tr>
<td>Nui</td>
<td>Brighta</td>
<td>Summit</td>
<td>Jersey</td>
</tr>
<tr>
<td>Patriot</td>
<td>Legacy</td>
<td></td>
<td>Lateblue</td>
</tr>
</tbody>
</table>

Bluecrop, Blueray and Duke are the three cultivars that make up 54% of Missouri production by Blueberry Council Members.

Critical Cold Temperatures for Blueberries

<table>
<thead>
<tr>
<th>Growth Stage</th>
<th>Critical Cold Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fahrenheit</td>
</tr>
<tr>
<td>Bud Swell</td>
<td>10° to 15°</td>
</tr>
<tr>
<td>Tight Cluster</td>
<td>20° to 23°</td>
</tr>
<tr>
<td>Early Pink Bud</td>
<td>23° to 25°</td>
</tr>
<tr>
<td>Late Pink Bud</td>
<td>24° to 27°</td>
</tr>
<tr>
<td>Full Bloom</td>
<td>28°</td>
</tr>
<tr>
<td>Petal Fall</td>
<td>32°</td>
</tr>
</tbody>
</table>

Table adapted from Midwest Blueberry Production Guide

Blueberry Bud Growth Stages

Source: Michigan State University
Blueberry Fruit Growth Stage

Source: Michigan State University

<table>
<thead>
<tr>
<th>Growth Stage</th>
<th>Fruit development and production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>Fruit coloring</td>
</tr>
<tr>
<td>Berries are changing from small to large.</td>
<td>Berries are changing from green to blue.</td>
</tr>
</tbody>
</table>

Site Selection

Location, Type of Operation, Air Flow

- **Location**
  - Easy access to customers and owners/workers

- **Type of Operation**
  - U-pick, truck farm, contracts

- **Air Flow**
  - Good air circulation; avoid areas where air flow is impeded

Water Drainage and Light Exposure

- **Water Drainage**
  - Blueberries will not grow on sites that are poorly drained
  - Avoid flood prone areas

- **Light Exposure**
  - Suitable site has full sun
  - Blueberries require at least 8 to 10 hours of sunlight per day

Site Selection – Soil Characteristics

1st step - SOIL TEST, SOIL TEST, SOIL TEST!

- Minimum of six months prior to planting
- Missouri soil will require amendments to be suitable for Blueberry production

- Soil test results give you:
  - the pH, acidity, cation-exchange capacity, soil organic matter, nutrient levels both micro and macro
  - A nematode test can also be beneficial
  - Blueberries grow best in an acidic soil with the pH between 4.8 and 5.2

Access to water

- Blueberries require irrigation for profitable production
- Adequate, clean water is essential
- Keep in mind potential microbial contamination of irrigation source
- Test water source

Elevation

- Elevated sites are preferred over lower sites
- Elevated sites reduce risk of spring frost damage
- Cold air moves from elevated to lower sites
Site Preparation

• Adjust pH
• Add Organic Matter
• Add Fertilizer
• Eradicate Perennial weeds
• Form Raised Beds

Site Preparation – Soil pH

• Begin at least 6 months prior to planting
• Adjust the soil pH
  • If pH is high apply elemental sulfur to lower pH
  • If pH is low apply lime to raise pH
• Keep in mind that soil pH is also affected by Calcium in the soil
  • If Calcium is greater than 2,500 pounds per acre it will be difficult to maintain a low pH in the desired range

Influence of Soil pH on Nutrient Availability

Site Preparation – Adding Organic Matter

• Optimal organic matter should be around 3%
• Incorporate peat moss, pine bark or composted sawdust
• Additional Nitrogen application may be necessary because soil nitrogen becomes temporarily unavailable as the wood products decompose
• Preplant cover crops year before planting
• Cover crops provide nutrients and organic matter, however, cover crops may raise the pH
• Monitor Regularly

Site Preparation – Weed Management

• Weed Management
  • Ideally want to manage persistent weeds before planting
  • Herbicides can be used prior to planting

Planting

• Obtain plant material
  • Use a reputable Nursery to avoid disease
  • Place order at least 6 months in advance
• Plan for correct size and proper arrival time
  • Typically plants are 1-3 years old and available bare root or container plants
  • Container plants more expensive, but have higher transplant success rate
  • Bare root are shipped dormant and must be kept refrigerated until planted
• Planting Time
  • Late fall – mid October to mid November
  • Spring – Mid February to end of April
  • Late fall is ideal as spring rains or cold weather can delay planting
Bare Root vs. Container Plant

- Between Row Spacing 10 to 12’
- Within Row Spacing 4-5’
- Do not plant too deep
- Plant at same depth as they were growing at the Nursery

Planting Layout

- Design planting to achieve the following goals:
  - Prevent soil erosion
  - Use land area efficiently
  - Optimize plant performance
  - Facilitate management and equipment operation
  - Utilize your farm for the type of operation you intend

Plant Spacing

- Between Row Spacing 10 to 12’
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Cultural Practices

- Mulching
- Irrigation
- Fertilizing
- Weed Management
- Disease Management
- Harvesting
- Pruning

Mulching

- Typically 4-6 inches
- Benefits of Mulch
  - Keeps soil cool
  - Retains moisture
  - Adds organic matter
  - Improves soil structure
  - Assists in preventing annual weeds
- Maintain every 2-3 years or as needed
- Add 2-3 inches
- 3-4’ band under plants
- Types of Mulch
  - Composted Sawdust
  - Peat Moss
  - Black Plastic

Irrigation

- Drip irrigation is typically used in Missouri
- Constructed of rigid or semi-rigid black plastic lines rated 7-10 yrs.
- Place emitters 12-24 inches apart
- Blueberries require 1.5 – 2 inches of water per week during the growing season
- If using black plastic make sure to place drip line underneath it first

Fertilizers

- Fertilize according to soil and tissue test reports
- Soil test – tells you what is available in the soil
- Tissue test – tells you what the plant has actually taken up
- Blueberry plants are sensitive to readily soluble fertilizers
- Excessive amounts can cause plant injury or death

Nitrogen Application Rate Based On Plant Age

<table>
<thead>
<tr>
<th>Age of Plant</th>
<th>Application</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newly Planted</td>
<td>2 applications of 10 lbs. actual Nitrogen per acre</td>
<td>Once at Bloom and again at 3 weeks</td>
</tr>
<tr>
<td>Young plants</td>
<td>10 lbs. actual Nitrogen per acre at each broadcast application</td>
<td>Broadcast in mid-April, mid-May, and mid-June during years 2-4</td>
</tr>
<tr>
<td>Mature Plantings</td>
<td>50 to 70 lbs. actual Nitrogen (should refer to tissue test – Leaf Nitrogen levels should be between 1.7 and 2.1 %)</td>
<td>½ mid-April and ½ mid May to mid-June</td>
</tr>
</tbody>
</table>

Weed Management

- Eliminate perennial weeds prior to planting
- Between Rows
  - Once beds are established maintain plant cover or grass in the row middle. A mix of fescue or creeping red fescue and ryegrass may be used
  - Too much cultivation can lead to erosion
- Within Rows
  - Use mulch, weed barrier fabric, herbicides

Disease and Pest Management

- Diseases can impact plant health and yield
- Proper site selection and cultural practices can reduce disease and pest pressures
- Cultivar selection important
- Implement the use of an Integrated Pest Management (IPM) program
- Refer to Midwest Fruit Pest Management Guide

Midwest Fruit Pest Management Guide

- Recommended Spray schedule for Blueberries
- Includes Fungicides, Insecticides and Herbicides
- Guide is available at: [https://ag.purdue.edu/to/hort/pages/spraysprayguide.aspx](https://ag.purdue.edu/to/hort/pages/spraysprayguide.aspx)
What is Integrated Pest Management?

- Multiple tools that use preventative strategies where possible
  - Cultural
  - Biological
  - Chemical
- Progresses from procedures with lowest – highest environmental impacts
- Treat only if need (observe thresholds)
- Combines procedures until safe, effective and economical pest control is attained

Phytophthora Root Rot

- Soil borne pathogen
- Caused by water mold (oomycete)
- Symptoms
  - Causes root decay
  - Yellowing or reddening of leaves
  - Eventual stunted growth, lack of new growth and plant death

Botrytis Blight

- Fungal Disease
- Symptoms
  - Blossoms turn brown
  - Water soaked appearance
  - Moves rapidly
  - Can move to wood
  - Green fruit starts to rot

Twig Blight

- Fungal Disease
- Symptoms
  - Dieback of flowers, twigs and shoots
  - Cankers are sometimes present at the base of infected canes

Godronia Canker

- Fungal Disease
- Symptoms
  - Reddish brown lesions on current year stems
  - Gets larger each year, may girdle stem

Mummy Berry

- Fungal Disease
- Symptoms
  - Infected flowers turn brown and wither
  - Stems and shoots turn dark brown
  - Brownish gray mass of spores develops on blighted flower stalks leaves
Anthracnose

- **Fungal Disease**
- **Symptoms**
  - Blighting of shoot tips
  - Flowers can turn brown or black
  - Leaf spots
  - Ripe berries may soften and pucker

Prevention of Fungal Diseases

- Open canopy to promote good air flow and adequate light
- Proper application of Nitrogen
- Proper use of fungicides
- Remove blighted blossoms or shoots
- Remove mumified berries
- Clean up any debris that spores could overwinter on
- Select resistant cultivars

Pruning

- Require annual pruning
- Prune while Dormant - Best in late winter or early spring before bud break
- Differs by cultivar and type
- Planting – remove 1/2 to 2/3 of top growth, remove flower buds, remove any damaged canes
- First 3 years – leave thicker shoots and remove spindly canes, remove any damaged canes
- After 3rd year – prune bush into an open vase shape, remove inward facing branches, remove 40-50% flower buds, any damaged canes
- Older plants – remove any diseased or injured wood, remove 20% of oldest canes, weak, low limbs

Fruit Buds – each bud will produce a cluster of 5-8 flowers
Vegetative buds – will produce leaves

Harvesting

- Harvest season occurs mid June through July
- Can vary with early, mid and late season ripening cultivars
- First crop typically during the third growing season
- 6-15 lbs. yield per bush; 4,000-10,000 lbs. per acre
- Blueberries ripen over several weeks – 60 to 100 days after petal fall
- Pick berries when fully ripen – about 3 days after they turn blue
- Make sure there is no pink or red left on the berry
- A ripe berry can remain on the bush for almost a week
- Cool berries soon after picking

Hand Harvest Typically Used in Missouri

- Harvest at least every 7 days

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Labor

- Harvest labor
  - 15-20 pickers per acre on a 5-7 day harvest schedule
  - $2000-$5000/acre
- Mechanical Harvest is better suited for larger acreage to justify machine cost

Marketing

- Vary by type of operation
  ✓ Upick
    - On farm – customers pick fruit
  ✓ Direct
    - Pre-picked for farmers market, CSA, roadside stand
- Wholesale Market
  - Produce Auctions
  - Grocery Stores
  - Schools
- Advertise via newspaper, flyers, email, social media, word of mouth
- Look for Agritourism opportunities in your area

Establishment Costs

- Investment Costs
  - Perennial crop that requires investment before crop matures
  - Establishment cost for 1 acre of blueberries is typically $6,000-$10,000 per acre
  - No crop revenue until at least year 3
  - Average payback around 7 years

Budjests

- Estimate a budget so you have a benchmark to go by
- Determine initial investment and start up cash required
- Cash flow needed to operate
- Sample Budgets:
  - University of Maine Extension
  - Penn State Cooperative Extension

References