



# MANAGING WATER AND FERTILITY FOR GREAT BLUEBERRIES

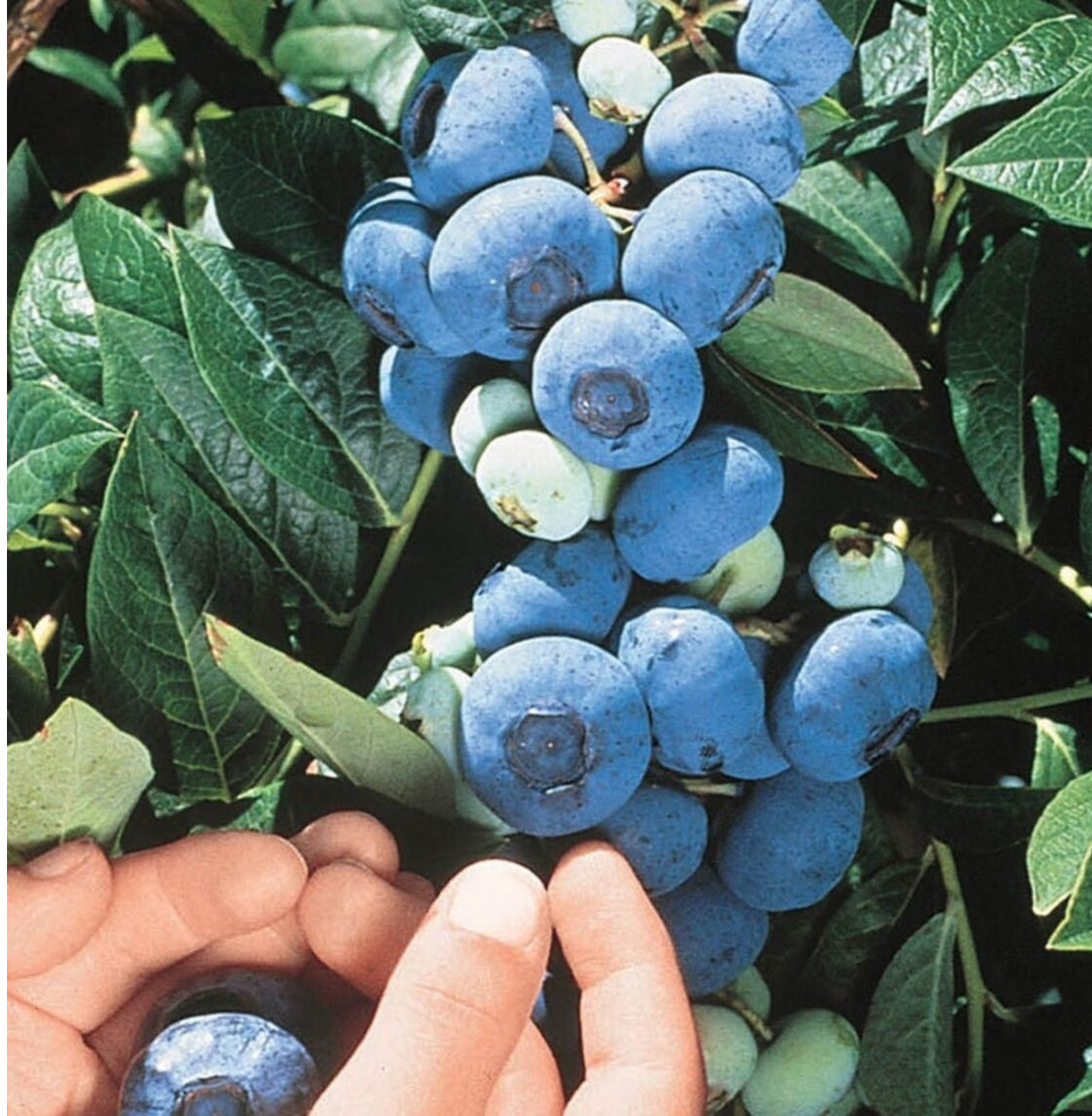
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# Significant topics

- Understanding blueberries soil and water requirements
- Types of irrigation systems
- Delivering enough water
- Pre-plant soil testing and preparation
- Fertility requirements of the producing plant





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# Vaccinium – what do they need?

- Acidic soils (4.5-5.0 pH)
- Plentiful access to water
- High organic matter
- Just enough nutrients
- Cultured blueberries need sites that temper winter injury



# Optimal soil characteristics

Soil Characteristic	Desirable Range*
pH	4.5 - 5.0
Organic matter	4 to 7%
Phosphorus	20 - 30 ppm
Potassium	100-120 ppm Base Saturation 3.0-5.0
Magnesium	100-120 ppm Base Saturation 2.0-4.0
Calcium	800 - 1000 ppm Base Saturation 20-30
Water table	12-24 inches from surface

\*Desirable range will vary with soil type (sand, silt, or clay), soil organic matter, and pH.

# No substitute for soil preparation

- Soil testing
- Soil amending
- Patience



North Carolina field prep

## Elemental sulfur needed to lower soil pH to 4.5 in different soil types

	Soil Type		
Current pH	Sand	Loam	Clay
5.0	175	530	800
5.5	350	1030	1600
6.0	530	1540	2300
6.5	660	2020	3030
7.0	840	2560	3830



# Irrigation

- Types of Irrigation Systems
  - Sprinkler
  - Trickle
- Water Sources
- Water Quality











# Types of Irrigation Systems

## SPRINKLER

- Requires robust water supply
- Delivers more water
- May help protect blossoms during freeze
- May be more expensive initially

## TRICKLE

- Best for farms with high water demand
- Usually less expensive initial investment





# Amount of water applied by irrigation

- size of the nozzle
- water pressure at the nozzle

## For example:

- 9/64" nozzle at 45 psi will deliver ~0.15"/hour
- At 0.15" water/hour, 0.6 inches of water is pumped in 4 hours



# Water loss?

- Evapotranspiration accounts for 20-30% of water loss from overhead sprinklers
- Uniformity – most overhead systems systems have a 70% uniformity
- This would result in increasing operating time by 20% for evapotranspiration and 30% for uniformity – operating time would increase by 50% (2 hours) to 6 hours
- These are non-factors for trickle systems





# When and how much to water?

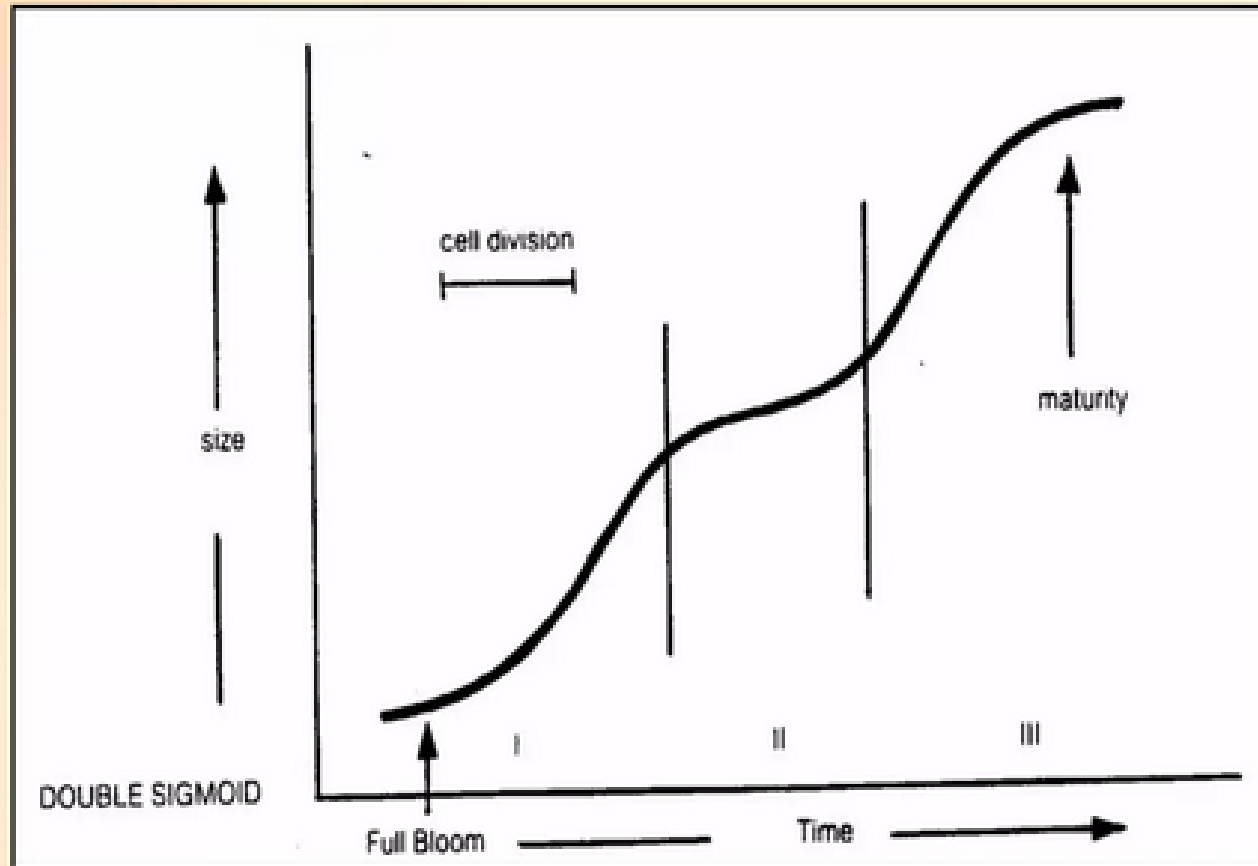
- For young plants, apply 20 gallons/day per 100 feet of row.
- For mature plants, apply 35 gallons/day per 100 feet of row.
- Peak daily demand for mature blueberries is ~4.5 gallons/plant/day.

Estimated Blueberry Water Use in Michigan Blueberries (inches)

Month	Monthly Use	Weekly Use	Daily Use
May	0.48	0.12	0.02
June	2.87	0.72	0.10
July	5.09	1.26	0.17
August	2.13	0.53	0.07



## Double Sigmoid Curve



### Three stages are seen

I. Ovary, nucellus and integuments of the seed grow rapidly, but the embryo and endosperm grow little.

II. Embryo and endosperm grow rapidly, but the ovary does not increase much in size, sclerification of the pit also begins and embryo achieve full size by the end and the amount of endosperm material increases greatly.

III. A new surge of ovary growth begins and continues to fruit ripening.

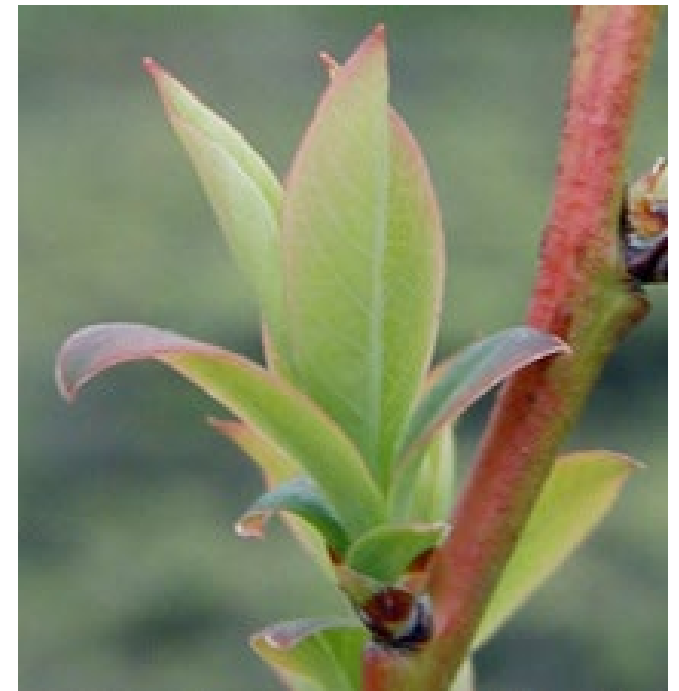
▪ Examples: Peach, plum, apricot, ber, raspberries, fig, blackberry, blueberry, cherry, persimmon, guava, grapes, olives, etc.





## Shoot growth stages

**Shoot expansion** - multiple leaves have emerged from the vegetative buds and unfolded. Leaves are enlarging and shoot growth has begun.



**Shoot tip set** - Shoot tips die and shoot growth stops. No new small leaves can be seen emerging from the shoot tip. The dead shoot tip may be visible as a small dead leaf at the base of the last leaf on the shoot.



# Fertility assessment

- Pre-plant soil test
- Soil testing every 2-3 years
- Foliar analysis annually at 3-4 years

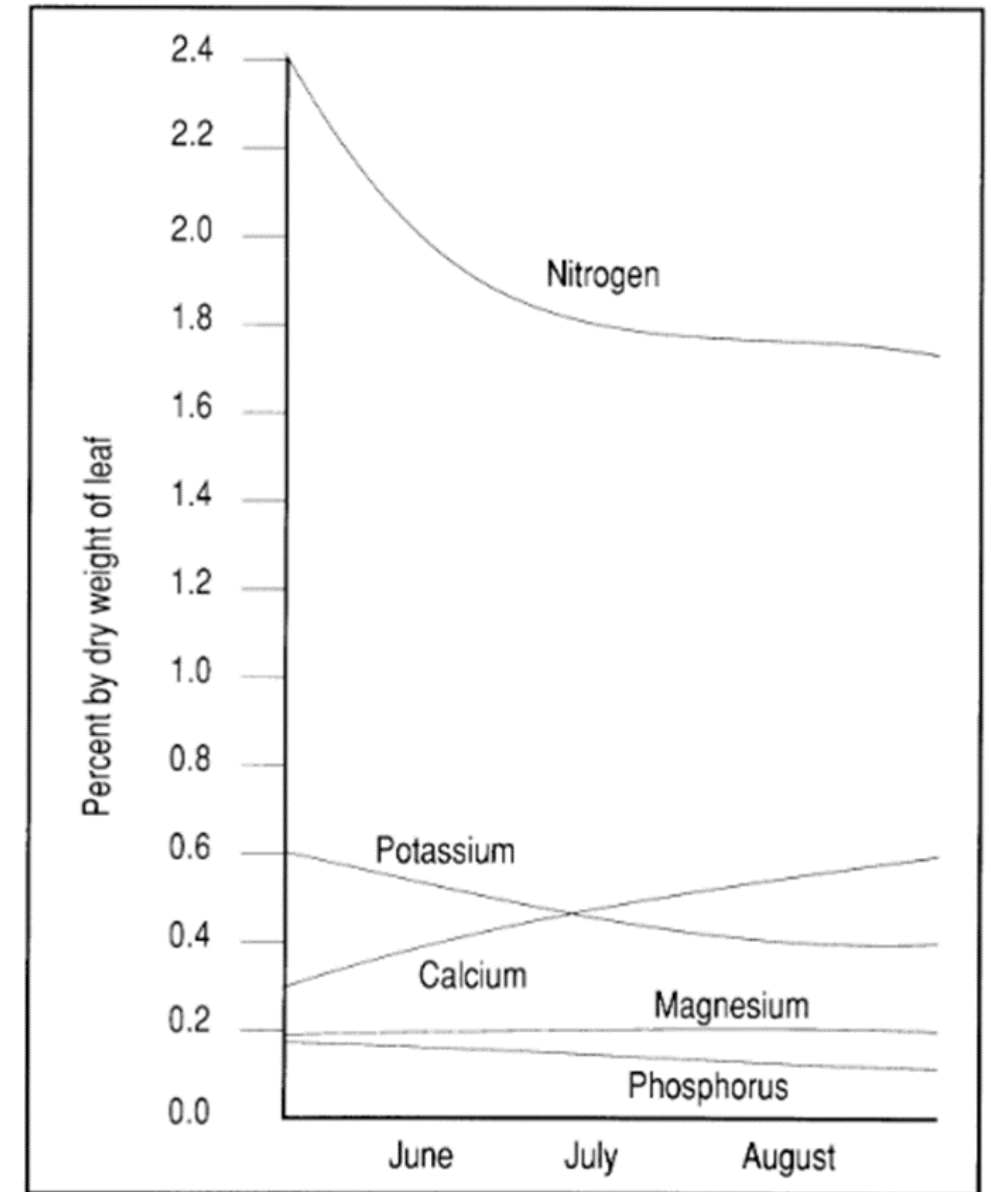




**Table 6.** Deficient, sufficient, and excessive nutrient concentrations in blueberry leaves.

NUTRIENT		DEFICIENT BELOW	SUFFICIENT	EXCESSIVE ABOVE
N	(%)	1.7	1.7-2.1	2.3
P	(%)	0.08	0.1-0.4	0.6
K	(%)	0.35	0.4-0.65	0.9
Ca	(%)	0.13	0.3-0.8	1.0
Mg	(%)	0.1	0.15-0.3	0.4
S	(%)	—	0.12-0.2	—
B	(ppm)	20	30-70	200
Cu	(ppm)	5	5-20	—
Fe	(ppm)	60	60-200	400
Mn	(ppm)	25	50-350	450
Zn	(ppm)	8	8-30	80

% by dry weight of blueberry leaf  
ppm=parts per million



**Figure 7.** Seasonal fluctuations in leaf nutrient concentrations.



A photograph of a young orchard. The trees are bare, suggesting late autumn or winter. A grassy path runs down the center of the orchard, flanked by rows of trees. The ground is covered with wood chips. In the background, there are hills and a forest.

— WATER IS THE  
BEST  
FERTILIZER.....



# Nitrogen

- Avoid nitrate fertilizers
- Split applications of granular fertilizer – one in early May, then later in early June
- Fertigate weekly until early July
- Late applications of Nitrogen can result in excessive growth and increase winter injury



**Table 1. Blueberry nitrogen recommendations (lb/acre).**

Years in field	N	Urea	Ammonium sulfate
2	15	35	75
4	30	70	150
6	45	100	215
8	65	150	300





# Nutrient Problems

FE DEFICIENCY:

SOIL PH IS TOO HIGH



POTASSIUM DEFICIENCY



PHOSPHORUS DEFICIENCY



MAGNESIUM DEFICIENCY



BORON DEFICIENCY





# Thank you!

QUESTIONS?

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