

## CRANBERRIES 101:

Highlights of  
Crop Growth and Development,  
Fertility and Fertilizers,  
Plant Nutrition,  
Water Quality,  
and Soil Characteristics

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### CROP GROWTH & DEVELOPMENT ANATOMY OF A CRANBERRY PLANT

#### Runners

- Juvenile part of the plant
- Typically occurs due to excessive fertilization
- Runners are for nutrient storage
- New plantings up to 6' lengths

### CROP GROWTH & DEVELOPMENT ANATOMY OF A CRANBERRY PLANT

#### Uprights

- Short vertical stems on runners
- Vegetative or reproductive
- 450 uprights /sq. ft. optimum density

### CROP GROWTH & DEVELOPMENT CRANBERRY ROOT SYSTEM

- Fine and fibrous, weblike
- No root hairs.
- Inefficient nutrient and water uptake.
- Rootlets grow from larger roots
- Adventitious roots form on stems covered with soil
- Sanding is very important for continued root development

CROP GROWTH & DEVELOPMENT  
Cranberry plant propagation

A cranberry plants' sole purpose is to propagate itself as much as feasibly possible.

- 2 choices
  - Produce Runner Growth
    - » (Increase plant vine mass)
  - Produce Seeds
    - » (90 million seed per acre of fruit)

CROP GROWTH & DEVELOPMENT  
Cranberry plant propagation

What determines the plants choice for max. propagation...

- N is the most limiting element
- N is critical for survival
- Plants accumulate as much N as possible, and put into storage
- Plants store excess N in runners
- When less N, plant produces seeds for max. propagation

CROP GROWTH & DEVELOPMENT  
ANATOMY OF A CRANBERRY BUD

- Terminal Buds form in August and September
  - Contains all flowers, leaves, and young shoot primordia for the next season.
- Any damage from harvest to early Spring will affect buds

CRANBERRY FERTILIZERS  
LIQUID FERTILIZERS

- FOLIAR FERTILIZATION
  - fertilizer applied with little water
  - most stays on the leaves for very quick uptake
  - Up to 90% absorption of N by cranberry leaves
- FERTIGATION
  - Injected through chemigation system
  - Uses large amounts of water
  - Most fertilizer percolates into the soil

CRANBERRY FERTILIZERS  
FOLIAR FERTILIZATION

- Why use Foliar Fertilizers?
  - Correct nutrient deficiencies quickly
  - Supplement nutrients to the plant at critical times of development
  - Overcome soil-induced nutrient deficiencies
- Examples:
  - For micronutrient applications
  - N appl. for a quick response

CRANBERRY FERTILIZERS  
FOLIAR FERTILIZATION

- Potential Problems with Foliar Fertilization
  - Phytotoxicity
    - » Ammonium nitrogen fertilizers
    - » Impure fertilizers
  - Plants absorb all nutrients that come into contact with leaves
    - » Overgrowth due to force-feeding
    - » Precision applications necessary

CRANBERRY FERTILIZERS  
READING A BAG OF FERTILIZER

Nutrients found in a bag of fertilizer

- |                   |                  |
|-------------------|------------------|
| • N -Nitrogen     | • Fe- Iron       |
| • P - Phosphorus  | • S - Sulfur     |
| • K - Potassium   | • Mn - Manganese |
| • Ca - Calcium    | • Al - Aluminum  |
| • Mg - Magnesium  | • B - Boron      |
| • Mo - Molybdenum | • Zn - Zinc      |
|                   | • Cu - Copper    |

BY LAW, THE BAG MUST BE LABELED  
WITH THE AMOUNT OF  
N, P, K

THE LABEL WILL CONTAIN CONC'N  
OF ALL NUTRIENTS IN THE BAG

CRANBERRY FERTILIZERS  
READING A BAG OF FERTILIZER

SAMPLE LABEL

6-24-24

Nitrogen (as ammonium)...6%

Phosphorus as  $P_2O_5$ .....24 %

Potassium as  $K_2O$ .....24%

CRANBERRY FERTILIZERS  
READING A BAG OF FERTILIZER

- NITROGEN
- Three Forms of Nitrogen
  - Urea (two ammonium attached)
  - Ammonium ( $\text{NH}_4$ )
  - Nitrate ( $\text{NO}_3$ )
- Cranberries Utilize Ammonium and Urea nitrogen
- Nitrogen transformations  
Urea --  $\text{NH}_4$  --  $\text{NO}_3$

CRANBERRY FERTILIZERS  
READING A BAG OF FERTILIZER

- Phosphorus
  - On the label  $\text{P}_2\text{O}_5$
  - Taken up by the plant as  $\text{PO}_4$
  - Utilized as P
- The label says 24 %  $\text{P}_2\text{O}_5$
- Actually only 10.5 % P
- Calculation:
  - $\text{bag\%} / 100 \times 0.44 = \text{ActualP}$

CRANBERRY FERTILIZERS  
READING A BAG OF FERTILIZER

- Potassium
  - On the label  $\text{K}_2\text{O}$
  - Taken up by the plant as K
  - Utilized as K
- The label says 24 %  $\text{K}_2\text{O}$
- Actually only 19.9 % K
- Calculation:
  - $\text{bag \%} / 100 \times 0.83 = \text{Actual K}$

CRANBERRY FERTILIZERS  
READING A BAG OF FERTILIZER

- All other nutrients, including Nitrogen, show exact percentages on the label.
- Example:
  - K-Mag
    - 0-0-20-9

CRANBERRY NUTRITION  
**BASIC PRINCIPLES OF NUTRITION USE**

- Perennial plants contain substantial nutrient reserves
- More fertilizer does not necessarily mean more fruit
- Plants don't use vitamins or stimulants
- There are 13 mineral elements + CO<sub>2</sub>, sunlight, and water

CRANBERRY NUTRITION  
**NUTRIENT INTERACTIONS IN SOIL**

Cranberry Roots actively take up nutrients  
 -Energy is needed

- If no energy, no nutrient uptake

**Nutrients in the soil solution can either help or hinder uptake of other nutrients**

Synergistic

- N--P

- N--Mg

• Antagonistic

- N--Ca

- K--Mg

- Fe-Mn

- P--Zn

**Climatic Conditions affect nutrient uptake**

Soil Temperature - Cold, slow uptake

Too Wet - No oxygen, slow uptake

Too Dry - No nutrient flow to rootlets

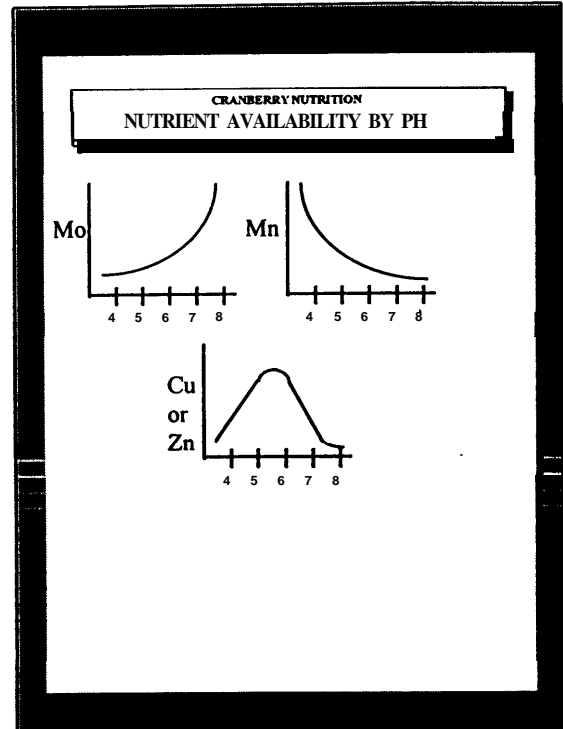
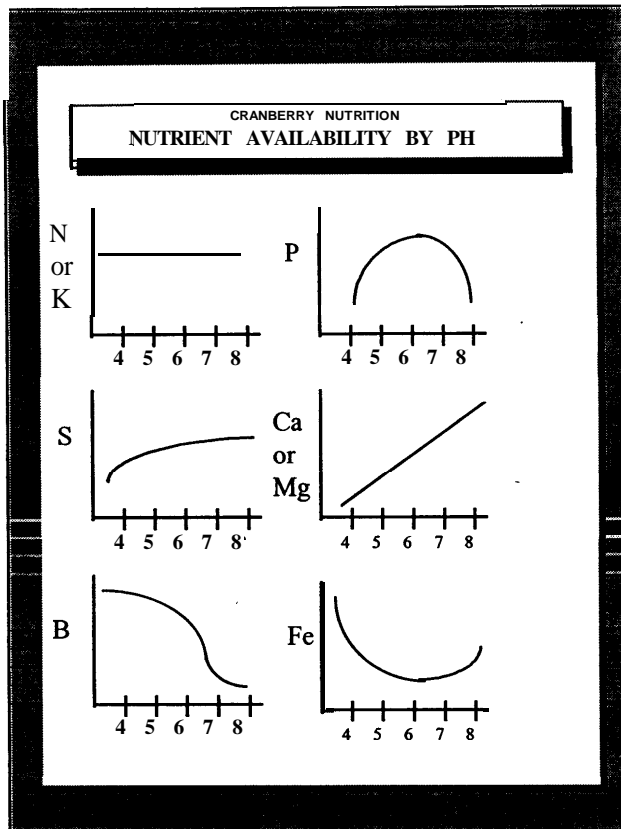
CRANBERRY NUTRITION  
**UNDERSTANDING PH**

- pH measures acidity of a soil
  - Hydrogen (H<sup>+</sup>)
  - Hydroxyl (OH<sup>-</sup>)
- pH range is 0 - 14
- Neutral is 7.0
- When a solution is neutral, there are equal amounts of H<sup>+</sup> and OH<sup>-</sup>
- A 1 pH unit change is a 10 fold difference in concentration!

CRANBERRY NUTRITION  
**OPTIMUM PH LEVELS**

- Best pH range: 4.5 to 5.5
  - The soil pH determines which nutrients hold tightly to the soil, and which are released.
- Why do Cranberries live in low pH?
  - Cranberry Roots tolerate high levels of Al and Mn
- When pH is too high...
  - Nutrient imbalances can affect plant functions

**PH IS THE BASIS OF ALL  
 PLANT NUTRITION**



WATER QUALITY  
BICARBONATES IN THE WATER

- Irrigation Water Analysis
  - pH
  - Various nutrients
  - Bicarbonates
- Bicarbonates can be toxic to plants, especially those which are “acid-loving”.
- $\text{HCO}_3^-$
- When combined with other elements
  - $\text{MgCO}_3$   $\text{CaCO}_3$   $\text{NaHCO}_3$

WATER QUALITY  
BICARBONATES IN THE WATER

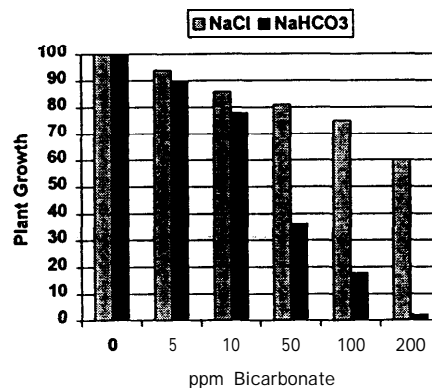
- Bicarbonates are not found in soils below pH 5.5
- If bicarbonates in the water, they will affect soil pH.
- Not been researched in cranberries at all.
- With respect to plant nutrition...
  - Fe Chlorosis (Iron)
  - Oversupply of P
  - Zn deficiency
- Levels found in water (WI)
  - 0 to 250 ppm

WATER QUALITY  
**BICARBONATES IN THE WATER**

- Bicarbonates contribute to the increase in soil pH.
- Example:
  - If your water contains 72 ppm
  - If you apply 3 acre-feet per year
  - You apply 583 lb. / acre of lime equivalents per year
- This can greatly influence your pH control decisions.

WATER QUALITY  
**BICARBONATES IN THE WATER**

Example of Growth differences comparing chloride to bicarbonate (radish)



WATER QUALITY  
**SOIL AMMENDMENTS**

- What are Ammendments?
  - Build soil body, tilth, strength
- Two Basic reasons for their use
  - Adjust pH levels
  - Improve Water Penetration
- Examples:
  - Lime, Sulfur
  - Organic Matter
  - Epsom Salts

WATER QUALITY  
**SOIL AMMENDMENTS**

- To adjust soil pH
- Increase Acidity
  - Elemental Sulfur
  - Sulfuric Acid
  - Lime Sulfur
- Decrease Acidity
  - Lime

WATER QUALITY  
SOIL AMMENDMENTS

- **Increase Water Penetration**
  - Irrigated Ag. farmland
  - Prevents puddling on soil surface
  - Use Gypsum
- **Why and How?**
  - Surface puddling is due to high sodium levels which form a crust and prevent water penetration.
  - Gypsum (Mg and Ca) displaces the sodium, allowing water to percolate

WATER QUALITY  
SOIL AMMENDMENTS

- **Will soil ammendments help percolation in cranberry soils?**
  - Only if sodium levels are v. high
  - SAR on water analysis > 6.0
  - So far, only 1 instance of an SAR>6.0. Using a water softener.
- **Other reasons for poor water penetration..**
  - Compacted soils from wheel pressure
  - Clay or hard pans
  - Too close to the groundwater

### Cranberry Self-Test

#### Crop Growth and Development

1. **True or False.** Prior to bud break in the Spring, the bud of a flowering upright already contains all the flower buds for the upcoming season.
2. On an upright, in what order do flowers open?
  - a) From Bottom to Top
  - b) From Top to Bottom
  - c) Random
3. **True or False.** Runners are formed by cranberry plants to store excess materials absorbed by the roots
4. **True or False.** Cranberry roots use root hairs to absorb water and nutrients

#### Fertility and Fertilizers

5. **True or False.** If we spread 6-24-24 fertilizer at 100 lb. per acre, we would be increasing the amount of phosphorous in our soil by 24 pounds per acre.
6. **True or False.** Foliar fertilizers can be effectively used to correct nutrient deficiencies.
7. **True or False.** Up to 90% of the foliar fertilizer which lands on the leaves is absorbed into the plant.

#### Plant Nutrition

8. Which is not a required nutrient for cranberry production.
  - a) Manganese
  - b) Boron
  - c) Silicon
  - d) Calcium
9. Which of these forms of nitrogen is not efficiently utilized by cranberry?
  - a) Urea
  - b) Nitrate
  - c) Ammonium

#### Water Quality and Management

10. **True or False.** When a soil pH is above 6.0 bicarbonates in the water can impact plant productivity

#### Soil Characteristics and Management

11. **True or False.** Sodium levels in our water should be considered as a serious threat to our soil structure.
12. Which of the following is a soil amendment?
  - a) Lime
  - b) Organic matter
  - c) Potassium and magnesium sulfate (K-Mag)
  - d) Elemental sulfur
  - e) Trick question. They are all soil amendments