

Strawberry Nutrition

Mark Bolda

UC Cooperative Extension

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

Work Order #: 2060799
Account #: 4004
Date Received: June 28, 2012
Date Reported: July 4, 2012

University of California - Mark Bolda
1432 Freedom Blvd
Watsonville, CA 95076-2741
Attn: Mark Bolda

Leaf Tissue Analysis

Date Received: June 28, 2012
Project # / Name: None / None
Sample Identification: Castroville Strawberry Fld.
Crop: Strawberry
Portion of plant analyzed: Leaves
Lab Sample #: 2060799-1/1

| | Your Results | Strawberry Optimum Range |
|----------------------------------|-----------------|-----------------------------|
| Total Nitrogen (N) | 2.0 % | 2.50-4.00 |
| Total Phosphorus (P) | 0.59 % | 0.25-1.0 |
| Potassium (K) | 0.90 % | 1.30-3.0 |
| Calcium (Ca) | 2.9 % | 1.00-2.50 |
| Magnesium (Mg) | 1.2 % | 0.25-1.0 |
| Water Soluble Sulfate Sulfur (S) | 0.038 % | - |
| Total Sulfur (S) | 0.23 % | - |
| | ppm (mg/Kg) | |
| Copper (Cu) | 11 | 6-50 |
| Zinc (Zn) | 29 | 20-200 |
| Iron (Fe) | 410 | 50-200 |
| Manganese (Mn) | 440 | 50-200 |
| Boron (B) | 170 | 23-50 |
| Molybdenum (Mo) | 2.3 | - |
| Aluminum (Al) | 24 | - |
| Sodium (Na) | 1800 | - |
| Chloride (Cl) | 7500 | - |
| Nitrate (NO ₃ -N) | 550 | - |

Basic components of a plant.

- Hydrogen
- Oxygen
- Carbon

Total about 92% of the plant.

Next basic components of a plant.

- Nitrogen: 2- 4 % of the total
- Phosphorous : 0.5-0.9% of the total
- Potassium: 1.3-1.8% of the total

6% of the total mineral content of the plant.

98%

Next basic components

- Calcium: 0.6%- 1.3% of the total
- Magnesium: 0.28 %-0.42% of the total
- Sulfur: 0.15% - 0.21% of the total

Total of 1% of the mineral content of the plant.

99%

Micronutrients (very, very small percentage)

- Zinc (0.002%)
- Iron (0.01%)
- Boron (0.005%)
- Manganese (0.03%)
- Copper (0.0004%)

Less than 1% of the total.

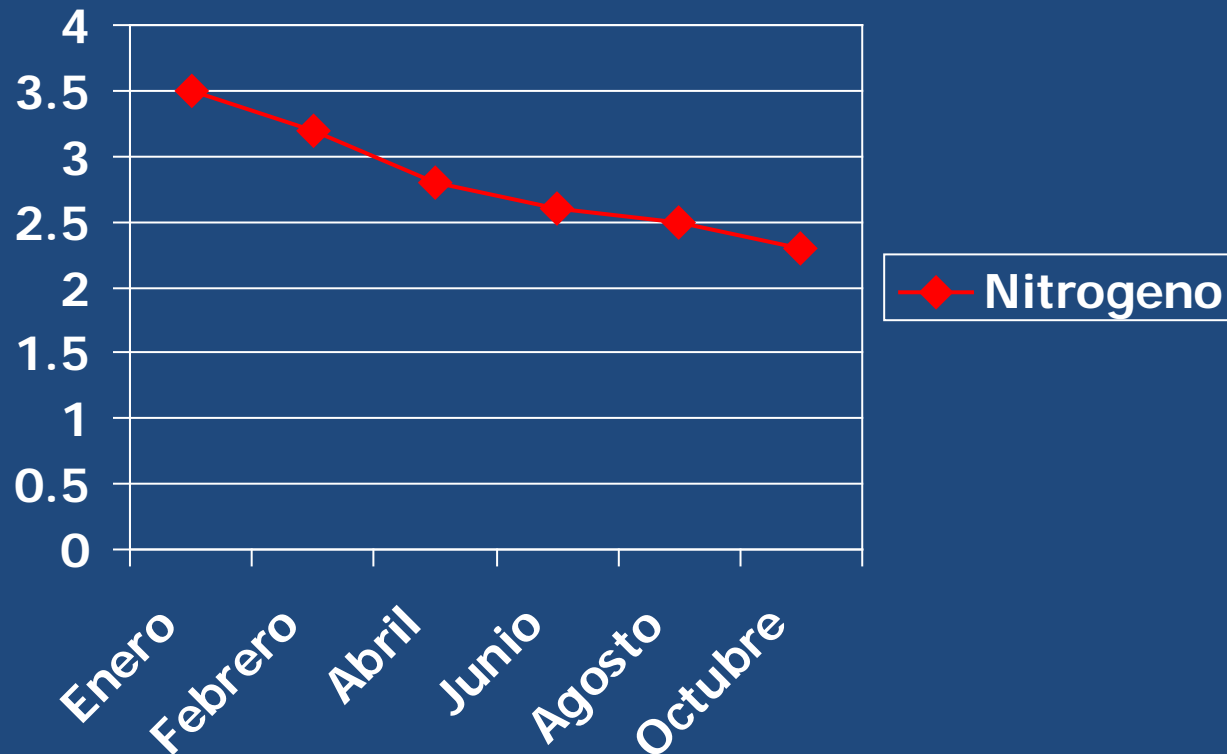
Analysis for Miracle Gro

- 24-8-16

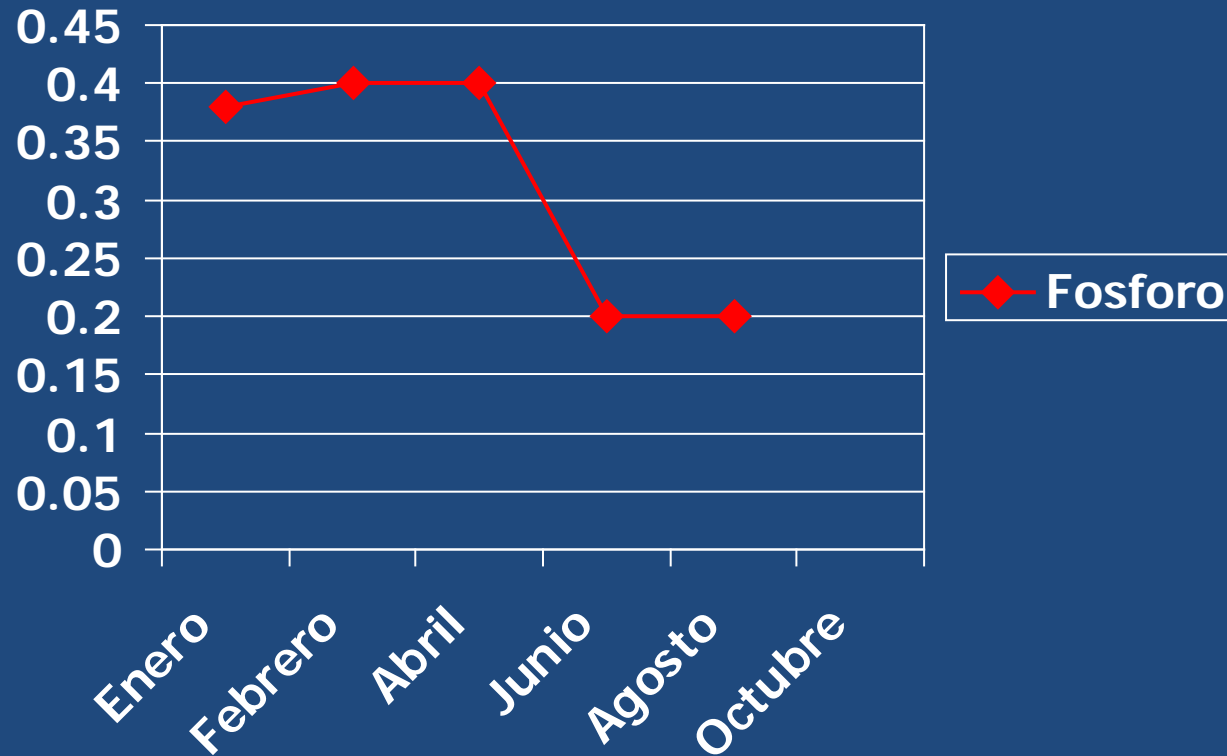
Leaf sufficiency in strawberry- pre-harvest

| | | Nutrient sufficiency ranges | | |
|--------------|---------------|-----------------------------|--|--|
| Growth stage | Nutrient | DRIS | | |
| pre-harvest | % Nitrogen | 3.1 - 3.8 | | |
| | % Phosphorus | 0.50 - 0.90 | | |
| | % Potassium | 1.8 - 2.2 | | |
| | % Calcium | 0.6 - 1.3 | | |
| | % Magnesium | 0.33 - 0.45 | | |
| | % Sulfur | 0.19 - 0.23 | | |
| | PPM Boron | 31 - 46 | | |
| | PPM Zinc | 13 - 28 | | |
| | PPM Manganese | 75 - 600 | | |
| | PPM Iron | 70 - 140 | | |
| | PPM Copper | 3.3 - 5.8 | | |

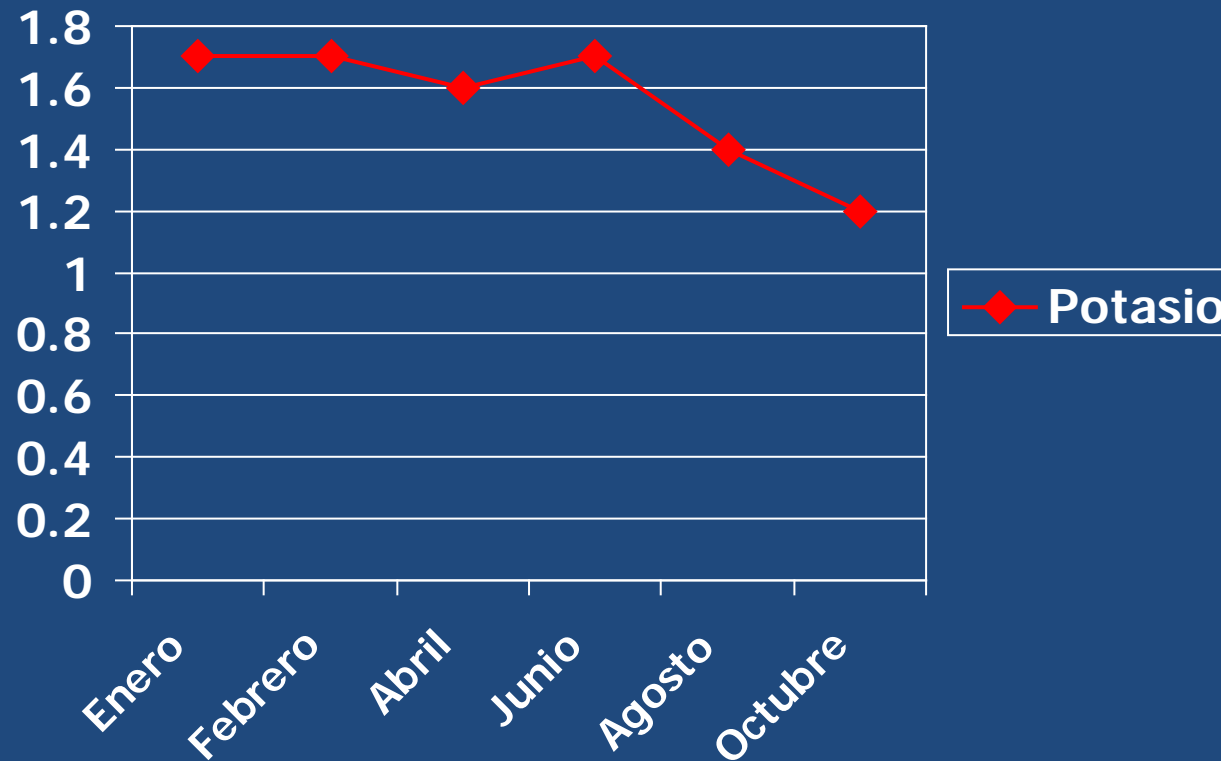
Level of nitrogen in the leaf



Level of phosphorous in the leaf

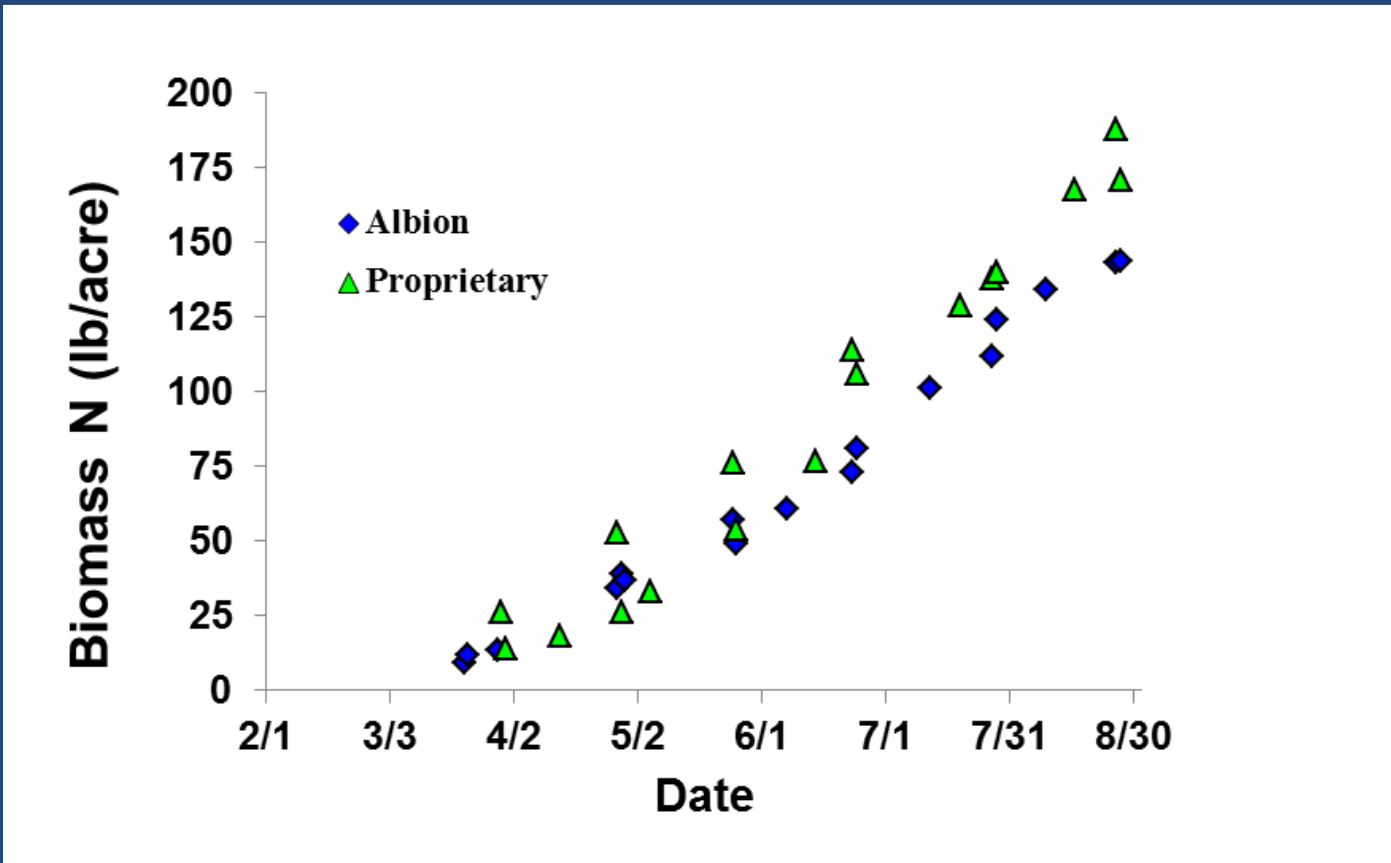


Level of potassium in the leaf



Nitrogen assimilation is constant:

Average from three fields per variety



- Acerca de 20 lb N/acre asimilado desde plantar hasta marzo.
- Acerca 1 lb N/acre/day por el resto de la estación.

Leaf sufficiency in strawberry - harvest

| main harvest | | | | |
|--------------|---------------|-------------|--|--|
| | % Nitrogen | 2.4 - 3.0 | | |
| | % Phosphorus | 0.30 - 0.40 | | |
| | % Potassium | 1.3 - 1.8 | | |
| | % Calcium | 1.0 - 2.2 | | |
| | % Magnesium | 0.28 - 0.42 | | |
| | % Sulfur | 0.15 - 0.21 | | |
| | PPM Boron | 40 - 70 | | |
| | PPM Zinc | 11 - 20 | | |
| | PPM Manganese | 65 - 320 | | |
| | PPM Iron | 85 - 200 | | |
| | PPM Copper | 2.6 - 4.9 | | |

Excess of salt



Salt damage



Comparing watered fields

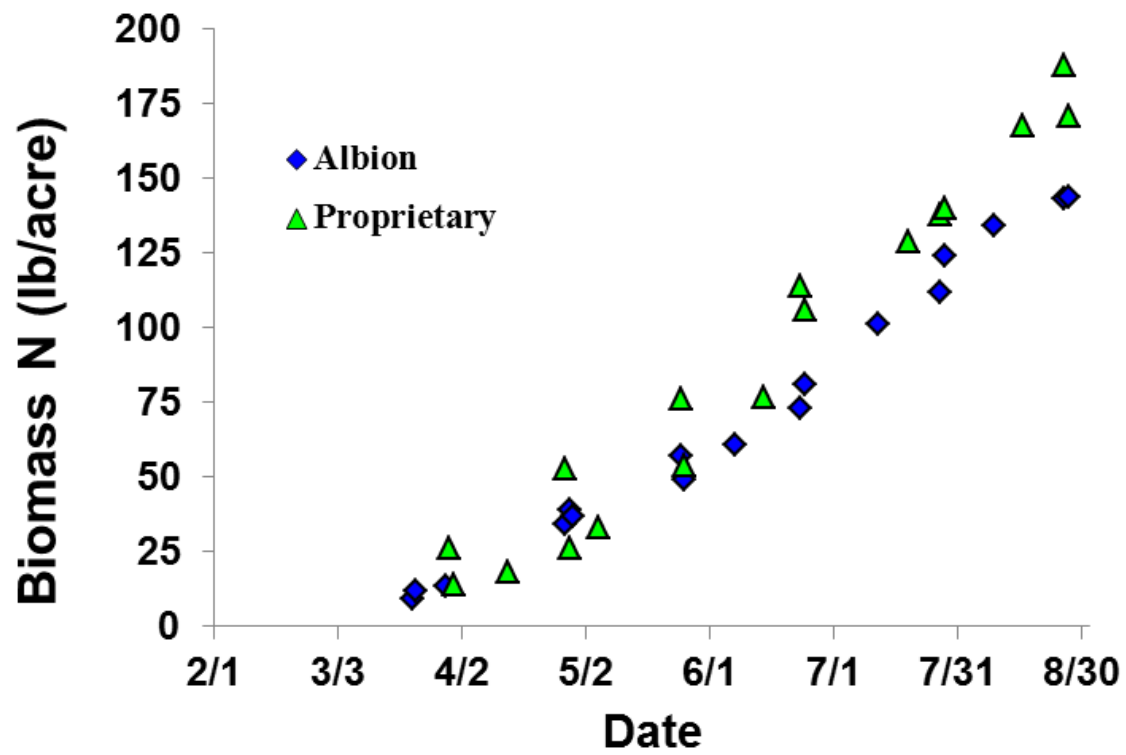
| | Nitrate (ppm) | Ammonium (ppm) | EC (dS/m) |
|------------------------------|------------------|-------------------|-----------|
| Sample 1 (not sprinkled): | 58 | 4.8 | 2.8 |
| Sample 2 (not sprinkled): | 72 | 5.2 | 4.2 |
| Sample 3 (not sprinkled): | 69 | 4.8 | 3.8 |
| Sample 4 (sprinkled): | 24 | 5.1 | 2.2 |





Potassium and phosphorous:

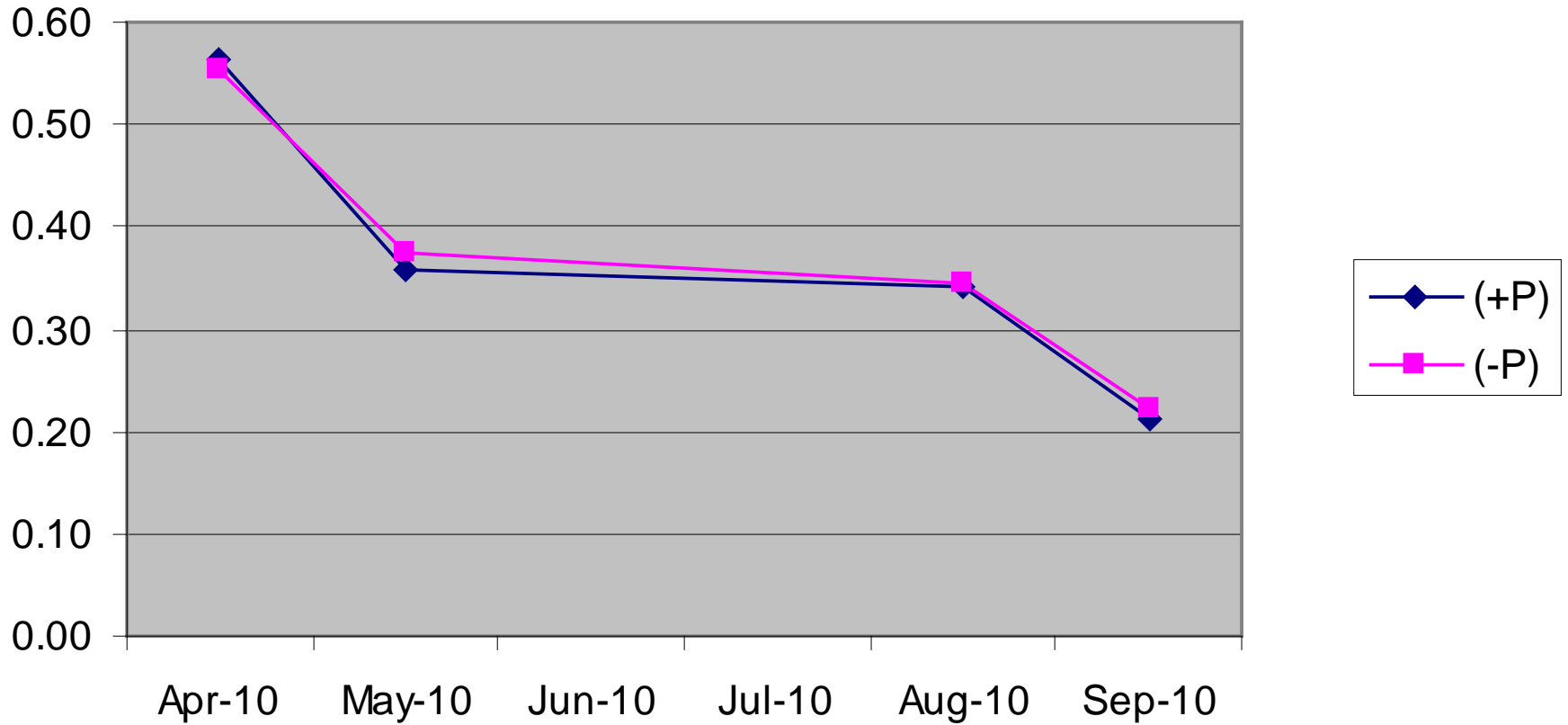
- A higher proportion of phosphorous and potassium goes to the fruit,
- but assimilation is a little later than nitrogen.
- Supposing a good yield, the nutrient requirements of strawberry are as follows:
 - 180 – 220 lb nitrogen
 - 90 – 110 lb phosphorous
 - 270 – 330 lb potassium



Comparison of using and not using phosphorous in a high P field.

| | 10/9/2009 | 9/8/2010 |
|------------------|--------------|--------------|
| 26 lbs P (+P) | 85.5 Olsen P | 79.6 Olsen P |
| 0 lbs P (-P) | 83.5 Olsen P | 77.3 Olsen P |

Phosphorous leaf concentrations



Fruit yield = same
Fruit quality = same

Potassium

- We do not often find potassium problems in our agricultural fields.
- Sufficiency should be between 200 and 300 ppm in the soil.

| Your Values (lbs/acre 6" deep) | | Suggested Values | RECOMMENDATIONS ALL VALUES lbs/acre 6" deep |
|---|------|---------------------|--|
| Ammonia (NH ₃ -N) | 11 | 10-50 OK | 125 Nitrogen (N) |
| Nitrate (NO ₃ -N) | 9.5 | 20-100 Low | 0 Phosphorous (P ₂ O ₅) |
| Total Available N | 21 | 75-150 Low | 100 Potassium (K ₂ O) |
| Phosphorous(P ₂ O ₅) | 450 | 100-300 High | 0 Gypsum (CaSO ₄) |
| Potassium (K ₂ O) | 500 | 450-750 OK | 2000 Lime (CaCO ₃) |
| Calcium (Ca) | 4000 | 3233-4041 OK | 0 Dolomite (CaCO ₃ & MgCO ₃) |
| Magnesium (Mg) | 680 | 323-646 High | 0 Sulfur |
| Sulfate (SO ₄ -S) | 130 | 100-200 OK | *Gypsum adds Ca and doesn't affect pH; Lime adds Ca and raises pH; Dolomite adds Ca & Mg & raises pH. |
| Sodium (Na) | 80 | < 250 OK | Lime Requirement: |
| Chloride (Cl) | 22 | 1-100 OK | Tons of 100% CaCO ₃ Lime per Acre 6" deep needed to raise pH of soil to: |
| ECe (dS/m) | 0.80 | 0.2-4 OK | pH 6.0 needs NA |
| Copper (Cu) | NA | 1 + | pH 6.5 needs NA |
| Zinc (Zn) | NA | 3 + | pH 7.0 needs NA |
| Iron (Fe) | NA | 8 + | Gypsum Requirement (needed for clay treatment) NA tons per acre 6" deep |
| Manganese (Mn) | NA | 4 + | Gypsum helps the soil structure by "loosening" the soil |
| Boron (B) | NA | 1.4 | |
| SAR | NA | 0-6 | |
| CEC (meq/100gms) | 13 | 10-20 OK | |
| ESP (%) | 1.3 | 0-10 OK | |
| pHs Value | 6.8 | 6.5-7.5 OK | |
| Organic Matter (%) | NA | | |

| Data: | | Method | Data: | | Method |
|--------------------|------------|-------------------|---------------|-------------|---------------------|
| NO ₃ -N | 4.7 mg/Kg | KCl | OrgMat | NA % | WalkBk |
| NH ₃ -N | 5.6 mg/Kg | KCl | Org-C | NA % | WalkBk |
| P | 100 mg/Kg | Olsen | SMP Buffer pH | 7.28 unit | SMP |
| SP | 48 % | Sat | GypReq | NA meq/100g | GypSol |
| pHs | 6.8 unit | Sat | Ca | 2000 mg/Kg | NH ₄ OAc |
| ECe | 0.80 dS/m | Sat | Mg | 340 mg/Kg | NH ₄ OAc |
| Ca | NA meq/L | Sat | Na | 40 mg/Kg | NH ₄ OAc |
| Mg | NA meq/L | Sat | K | 210 mg/Kg | NH ₄ OAc |
| Na | NA meq/L | Sat | | | |
| K | NA meq/L | Sat | | | |
| Cl | 0.64 meq/L | Sat | | | |
| SO ₄ -S | 4.3 meq/L | Sat | | | |
| SAR | NA ratio | Calc | | | |
| B | NA mg/Kg | CaCl ₂ | | | |
| Cu | NA mg/Kg | DTPA | | | |
| Zn | NA mg/Kg | DTPA | | | |
| Fe | NA mg/Kg | DTPA | | | |
| Mn | NA mg/Kg | DTPA | | | |

| Cation Exchange Capacity (CEC) and Base Saturation Percentages | | |
|--|---------------|-------|
| CEC | 13 meq/100gm | Calc. |
| NH ₃ -N | 0.3 % of CEC | Calc. |
| Ca | 73.4 % of CEC | Calc. |
| Mg | 21.1 % of CEC | Calc. |
| Na | 1.3 % of CEC | Calc. |
| K | 3.9 % of CEC | Calc. |
| H | 0.0 % of CEC | Calc. |

Lab Analyst:

M. L. Sullivan

| Your Values (lbs/acre 6" deep) | | | Suggested Values | RECOMMENDATIONS ALL VALUES lbs/acre 6" deep | | |
|---|-----------|-------------------|------------------|---|---------------|---------------------|
| Ammonia (NH ₃ -N) | 23 | | 10-50 OK | 50 Nitrogen (N) | | |
| Nitrate (NO ₃ -N) | 67 | | 20-100 OK | 0 Phosphorous (P ₂ O ₅) | | |
| Total Available N | 90 | | 75-150 OK | 300 Potassium (K ₂ O) | | |
| Phosphorous(P ₂ O ₅) | 540 | | 100-300 High | 6000 Gypsum (CaSO ₄) | | |
| Potassium (K ₂ O) | 580 | | 686-1144 Low | 0 Lime (CaCO ₃) | | |
| Calcium (Ca) | 6500 | | 5850-7312 OK | 0 Dolomite (CaCO ₃ & MgCO ₃) | | |
| Magnesium (Mg) | 1700 | | 585-1170 High | 0 Sulfur | | |
| Sulfate (SO ₄ -S) | 310 | | 100-200 High | *Gypsum adds Ca and doesn't affect pH; Lime adds Ca and raises pH; Dolomite adds Ca & Mg & raises pH. | | |
| Sodium (Na) | 210 | | < 250 OK | | | |
| Chloride (Cl) | 130 | | 1-100 High | Lime Requirement: Tons of 100% CaCO ₃ Lime per Acre 6" deep needed to raise pH of soil to: | | |
| ECe (dS/m) | 1.7 | | 0.2-4 OK | | | |
| Copper (Cu) | NA | | 1 + | pH 6.0 needs NA | | |
| Zinc (Zn) | NA | | 3 + | pH 6.5 needs NA | | |
| Iron (Fe) | NA | | 8 + | pH 7.0 needs NA | | |
| Manganese (Mn) | NA | | 4 + | Gypsum Requirement (needed for clay treatment) NA tons per acre 6" deep | | |
| Boron (B) | NA | | 1-4 | | | |
| SAR | NA | | 0-6 | Gypsum helps the soil structure by "loosening" the soil | | |
| CEC (meq/100gms) | 24 | | 10-20 OK | | | |
| ESP (%) | 1.8 | | 0-10 OK | | | |
| pHs Value | 7.1 | | 6.5-7.5 OK | | | |
| Organic Matter (%) | NA | | | | | |
| Data: | | Method | | Data: | | Method |
| NO ₃ -N | 33 mg/Kg | KCl | | OrgMat | NA % | WalkBk |
| NH ₃ -N | 12 mg/Kg | KCl | | Org-C | NA % | WalkBk |
| P | 120 mg/Kg | Olsen | | SMP Buffer pH | 7.26 unit | SMP |
| SP | 57 % | Sat | | GypReq | NA meq/100g | GypSol |
| pHs | 7.1 unit | Sat | | Ca | 3300 mg/Kg | NH ₄ OAc |
| ECe | 1.7 dS/m | Sat | | Mg | 840 mg/Kg | NH ₄ OAc |
| Ca | NA meq/L | Sat | | Na | 100 mg/Kg | NH ₄ OAc |
| Mg | NA meq/L | Sat | | K | 240 mg/Kg | NH ₄ OAc |
| Na | NA meq/L | Sat | | <hr/> | | |
| K | NA meq/L | Sat | | Cation Exchange Capacity (CEC) and Base Saturation Percentages | | |
| Cl | 3.1 meq/L | Sat | | CEC | 24 meq/100gm | Calc. |
| SO ₄ -S | 8.6 meq/L | Sat | | NH ₃ -N | 0.3 % of CEC | Calc. |
| SAR | NA ratio | Calc | | Ca | 66.7 % of CEC | Calc. |
| B | NA mg/Kg | CaCl ₂ | | Mg | 28.6 % of CEC | Calc. |
| Cu | NA mg/Kg | DTPA | | Na | 1.8 % of CEC | Calc. |
| Zn | NA mg/Kg | DTPA | | K | 2.6 % of CEC | Calc. |
| Fe | NA mg/Kg | DTPA | | H | 0.0 % of CEC | Calc. |
| Mn | NA mg/Kg | DTPA | | | | |

Lab Analyst:

Mike Galloway

| Your Values (lbs/acre 6" deep) | | Suggested Values | RECOMMENDATIONS ALL VALUES lbs/acre 6" deep | |
|---|------|---------------------|---|--|
| Ammonia (NH ₃ -N) | 48 | 10-50 OK | 50 Nitrogen (N) | |
| Nitrate (NO ₃ -N) | 32 | 20-100 OK | 0 Phosphorous (P ₂ O ₅) | |
| Total Available N | 80 | 75-150 OK | 0 Potassium (K ₂ O) | |
| Phosphorous(P ₂ O ₅) | 590 | 100-300 High | 0 Gypsum (CaSO ₄) | |
| Potassium (K ₂ O) | 830 | 527-879 OK | 6000 Lime (CaCO ₃) | |
| Calcium (Ca) | 5400 | 4497-5622 OK | 0 Dolomite (CaCO ₃ & MgCO ₃) | |
| Magnesium (Mg) | 800 | 449-899 OK | 0 Sulfur | |
| Sulfate (SO ₄ -S) | 230 | 100-200 High | *Gypsum adds Ca and doesn't affect pH; Lime adds Ca and raises pH; Dolomite adds Ca & Mg & raises pH. | |
| Sodium (Na) | 110 | < 250 OK | | |
| Chloride (Cl) | 23 | 1-100 OK | | |
| ECe (dS/m) | 1.3 | 0.2-4 OK | Lime Requirement: | |
| Copper (Cu) | NA | 1 + | Tons of 100% CaCO ₃ Lime per Acre 6" deep | |
| Zinc (Zn) | NA | 3 + | needed to raise pH of soil to: | |
| Iron (Fe) | NA | 8 + | pH 6.0 needs NA | |
| Manganese (Mn) | NA | 4 + | pH 6.5 needs NA | |
| Boron (B) | NA | 1-4 | pH 7.0 needs NA | |
| SAR | NA | 0-6 | Gypsum Requirement (needed for clay treatment) | |
| CEC (meq/100gms) | 19 | 10-20 OK | NA tons per acre 6" deep | |
| ESP (%) | 1.2 | 0-10 OK | Gypsum helps the soil structure by "loosening" the soil | |
| pHs Value | 5.4 | 6.5-7.5 Low | | |
| Organic Matter (%) | NA | | | |

| Data: | | Method |
|--------------------|------------|--------|
| NO ₃ -N | 16 mg/Kg | KCl |
| NH ₃ -N | 24 mg/Kg | KCl |
| P | 130 mg/Kg | Olsen |
| SP | 48 % | Sat |
| pHs | 5.4 unit | Sat |
| ECe | 1.3 dS/m | Sat |
| Ca | NA meq/L | Sat |
| Mg | NA meq/L | Sat |
| Na | NA meq/L | Sat |
| K | NA meq/L | Sat |
| Cl | 0.67 meq/L | Sat |
| SO ₄ -S | 7.5 meq/L | Sat |
| SAR | NA ratio | Calc |
| B | NA mg/Kg | CaCl2 |
| Cu | NA mg/Kg | DTPA |
| Zn | NA mg/Kg | DTPA |
| Fe | NA mg/Kg | DTPA |
| Mn | NA mg/Kg | DTPA |

| Data: | | Method |
|---------------|-------------|---------------------|
| OrgMat | NA % | WalkBk |
| Org-C | NA % | WalkBk |
| SMP Buffer pH | 6.81 unit | SMP |
| GypReq | NA meq/100g | GypSol |
| Ca | 2700 mg/Kg | NH ₄ OAc |
| Mg | 400 mg/Kg | NH ₄ OAc |
| Na | 53 mg/Kg | NH ₄ OAc |
| K | 340 mg/Kg | NH ₄ OAc |

| Cation Exchange Capacity (CEC) and Base Saturation Percentages | | |
|--|---------------|-------|
| CEC | 19 meq/100gm | Calc. |
| NH ₃ -N | 0.9 % of CEC | Calc. |
| Ca | 72.6 % of CEC | Calc. |
| Mg | 17.9 % of CEC | Calc. |
| Na | 1.2 % of CEC | Calc. |
| K | 4.7 % of CEC | Calc. |
| H | 2.6 % of CEC | Calc. |

Lab Analyst:

M-h Pullman

Calcium

- Structural component of cell walls and cell tissues of plants.
- A deficiency of calcium in the plant leads to a general collapse of the structure of the tissue and the cell walls.

Burn of the leaf points of strawberry leaves.



Burning of the points of leaves owing to a deficiency of calcium.



Calcium

- A leaf tissue concentration of less than 0.9% means the plant is deficient.
- Calcium sufficiency is in the area of 1.5 % of dry leaf tissue.

Santa Maria Results

June 2007

Top 3 Symptomatic, Bottom 3 Healthy

| N (Total) | P (Total) | K | S (Total) | B (Total) | Ca (Total) | Mg (Total) | Zn (Total) | Mn (Total) | Fe (Total) | Cu (Total) |
|---------------------|---------------------|---------------------|-----------------------|-----------------------|---------------------|---------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [SOP 525] % | [SOP 590] % | [SOP 550] % | [SOP 590] ppm | [SOP 590] ppm | [SOP 590] % | [SOP 590] % | [SOP 590] ppm | [SOP 590] ppm | [SOP 590] ppm | [SOP 590] ppm |
| 2.15 | 0.33 | 1.65 | 1570 | 48 | 0.69 | 0.26 | 20 | 88 | 277 | 4.3 |
| 2.54 | 0.33 | 1.56 | 1710 | 73 | 0.74 | 0.29 | 19 | 118 | 296 | 4.8 |
| 2.55 | 0.32 | 1.48 | 1850 | 117 | 1.27 | 0.38 | 23 | 143 | 310 | 5.6 |
| 2.41 | 0.33 | 1.56 | 1710.00 | 79.33 | 0.90 | 0.31 | 20.67 | 116.33 | 294.33 | 4.90 |
| 2.59 | 0.28 | 1.24 | 1640 | 101 | 1.71 | 0.54 | 23 | 131 | 396 | 4.8 |
| 2.35 | 0.28 | 1.41 | 1650 | 72 | 1.25 | 0.40 | 17 | 108 | 405 | 3.6 |
| 2.60 | 0.27 | 1.42 | 1680 | 81 | 1.49 | 0.51 | 18 | 136 | 296 | 4.2 |
| 2.51 | 0.28 | 1.36 | 1656.67 | 84.67 | 1.48 | 0.48 | 19.33 | 125.00 | 365.67 | 4.20 |

Quantities of Calcium

- Total calcium and available calcium.
- Total tells us how much there is, while available is what the root encounters. Available normally between 4- 8 meq/l.

Calcium sufficiency

- Crop requirement between 100-300 lbs per acre.
- Every 1000 ppm represents 2000 lbs per acre.
- However, this is not all available and need to look at Ca in the soil solution, which is measured in meq/L.
- Hydroponic solutions are 4-8 meq/L.


| | Your Values (lbs/acre 6" deep) | Suggested Values |
|---|-----------------------------------|---------------------|
| Ammonia (NH ₃ -N) | 15 | 10-50 OK |
| Nitrate (NO ₃ -N) | 120 | 20-100 High |
| Total Available N | 130 | 75-150 OK |
| Phosphorous(P ₂ O ₅) | 130 | 100-300 OK |
| Potassium (K ₂ O) | 360 | 450-750 Low |
| Calcium (Ca) | 3300 | 3783-4729 Low |
| Magnesium (Mg) | 1100 | 378-756 High |
| Sulfate (SO ₄ -S) | 73 | 100-200 Low |
| Sodium (Na) | 140 | < 250 See SAR |
| Chloride (Cl) | 39 | 1-100 OK |
| ECe (dS/m) | 1.7 | 0.2-4 OK |
| Copper (Cu) | 2.5 | 1 + OK |
| Zinc (Zn) | 2.0 | 3 + Low |
| Iron (Fe) | 110 | 8 + OK |
| Manganese (Mn) | 37 | 4 + OK |
| Boron (B) | 0.14 | 1-4 Low |
| SAR | 1.1 | 0-6 OK |
| CEC (meq/100gms) | 16 | 10-20 OK |
| ESP (%) | 1.9 | 0-10 OK |
| pHs Value | 4.4 | 6.5-7.5 Low |
| Organic Matter (%) | 3.2 | |

| RECOMMENDATIONS ALL VALUES lbs/acre 6" deep |
|--|
| 0 Nitrogen (N) |
| 150 Phosphorous (P ₂ O ₅) |
| 200 Potassium (K ₂ O) |
| 0 Gypsum (CaSO ₄) |
| 6000 Lime (CaCO ₃) |
| 0 Dolomite (CaCO ₃ & MgCO ₃) |
| 0 Sulfur |
| *Gypsum adds Ca and doesn't affect pH; Lime adds Ca and raises pH; Dolomite adds Ca & Mg & raises pH. |
| Lime Requirement: Tons of 100% CaCO ₃ Lime per Acre 6" deep needed to raise pH of soil to: |
| pH 6.0 needs 2.2 |
| pH 6.5 needs 2.7 |
| pH 7.0 needs 3.2 |
| Gypsum Requirement (needed for clay treatment) 1.3 tons per acre 6" deep |
| Gypsum helps the soil structure by "loosening" the soil |

| Data: | | Method |
|--------------------|-------------|--------|
| NO ₃ -N | 60 mg/Kg | KCl |
| NH ₃ -N | 7.7 mg/Kg | KCl |
| P | 29 mg/Kg | Olsen |
| SP | 48 % | Sat |
| pHs | 4.4 unit | Sat |
| ECe | 1.7 dS/m | Sat |
| Ca | 6.9 meq/L | Sat |
| Mg | 5.6 meq/L | Sat |
| Na | 2.6 meq/L | Sat |
| K | 0.33 meq/L | Sat |
| Cl | 1.2 meq/L | Sat |
| SO ₄ -S | 2.4 meq/L | Sat |
| SAR | 1.1 ratio | Calc |
| B | 0.069 mg/Kg | CaCl2 |
| Cu | 1.3 mg/Kg | DTPA |
| Zn | 0.98 mg/Kg | DTPA |
| Fe | 55 mg/Kg | DTPA |
| Mn | 18 mg/Kg | DTPA |

| Data: | | Method |
|---------------|--------------|---------------------|
| OrgMat | 3.2 % | WalkBk |
| Org-C | 1.8 % | WalkBk |
| SMP Buffer pH | 6.62 unit | SMP |
| GypReq | 1.5 meq/100g | GypSol |
| Ca | 1700 mg/Kg | NH ₄ OAc |
| Mg | 540 mg/Kg | NH ₄ OAc |
| Na | 71 mg/Kg | NH ₄ OAc |
| K | 150 mg/Kg | NH ₄ OAc |

| Cation Exchange Capacity (CEC) and Base Saturation Percentages | | |
|--|---------------|-------|
| CEC | 16 meq/100gm | Calc. |
| NH ₃ -N | 0.3 % of CEC | Calc. |
| Ca | 52.8 % of CEC | Calc. |
| Mg | 28.4 % of CEC | Calc. |
| Na | 1.9 % of CEC | Calc. |
| K | 2.4 % of CEC | Calc. |
| H | 14.1 % of CEC | Calc. |

Lab Analyst: 

SUMMARY REPORT OF ANALYTICAL RESULTS

| Sample Number | % Organic Matter | Nitrate N ppm | Phosphorus IF pH < 7.1 | Phosphorus IF pH > 7.1 | Potassium ppm | Magnesium ppm | Calcium ppm | Sulfur ppm | Zinc ppm | Manganese ppm | Copper ppm | Iron ppm | Boron ppm |
|---------------|------------------|---------------|------------------------|------------------------|---------------|---------------|-------------|------------|----------|---------------|------------|----------|-----------|
| RBFRB | 2.7 | 31.0 | 41 | --- | 230 | 458 | 1710 | 54.0 | 3.8 | 2.7 | 0.9 | 9.3 | 0.5 |
| RBRBN | 3.0 | 51.0 | 34 | --- | 226 | 514 | 1954 | 51.0 | 4.2 | 2.2 | 1.0 | 8.0 | 0.5 |
| RBBKG | 1.2 | 5.4 | --- | 12 | 193 | 366 | 1767 | 33.0 | 2.4 | 1.7 | 1.1 | 6.1 | 0.7 |
| RBKGN | 1.6 | 4.3 | --- | 20 | 222 | 448 | 2454 | 53.0 | 2.8 | 2.9 | 1.3 | 11.9 | 1.1 |
| RBPC | 1.0 | 3.7 | --- | 14 | 151 | 282 | 1755 | 42.0 | 1.5 | 2.4 | 1.4 | 11.1 | 0.7 |
| RBPCN | 1.2 | 6.0 | --- | 19 | 200 | 327 | 1300 | 26.0 | 2.1 | 1.5 | 1.1 | 8.2 | 0.7 |
| Average | 1.8 | 16.9 | 49 | 16 | 204 | 399 | 1823 | 43.2 | 2.8 | 2.2 | 1.1 | 9.1 | 0.7 |

| SUMMARY OF ANALYTICAL RESULTS | | | | | | | CATION EXCHANGE CAPACITY | | | | | |
|-------------------------------|---------|--------------|------------------|------------------------|------------|--------------|--------------------------|------|------|------|-----|-----------|
| Sample Number | Soil pH | Buffer Index | Excess Carbonate | Soluble Salts mmhos/cm | Sodium ppm | Bulk Density | ACTUAL % OF TOTAL CEC | | | | | Total CEC |
| | | | | | | | % K | % Mg | % Ca | % Na | % H | |
| RBFRB | 6.4 | 7.2 | VL | 0.54 | 106 | 1.08 | 4.0 | 26.1 | 58.5 | 3.2 | 8.2 | 14.6 |
| RBRBN | 6.5 | 7.3 | VL | 0.63 | 113 | 1.06 | 3.6 | 26.9 | 61.4 | 3.1 | 5.0 | 15.9 |
| RBBKG | 8.3 | --- | M | 0.34 | 93 | 1.32 | 3.9 | 23.9 | 69.1 | 3.2 | 0.0 | 12.8 |
| RBKGN | 8.3 | --- | L | 0.46 | 117 | 1.31 | 3.3 | 21.9 | 71.8 | 3.0 | 0.0 | 17.1 |
| RBPC | 8.0 | --- | L | 0.34 | 78 | 1.27 | 3.3 | 19.8 | 74.0 | 2.9 | 0.0 | 11.9 |
| RBPCN | 7.9 | --- | L | 0.29 | 78 | 1.40 | 5.1 | 27.0 | 64.5 | 3.4 | 0.0 | 10.1 |

Additional Tests

| Sample Number | RBFRB | RBRBN | RBBKG | RBKGN | RBPC | RBPCN |
|--------------------------------|-------|-------|-------|-------|--------|-------|
| Ammonium ppm | 1.2 | 0.5 | 0.2 | 0.2 | 0.2 | 0.5 |
| Chloride | 22.4 | 45.7 | 15.1 | 21.2 | 15.6 | 10.3 |
| Salinity Ammonium Nitrogen ppm | 5.6 | 4.2 | 5.6 | 5.6 | 4.2 | 4.2 |
| Salinity Bicarbonate ppm | 26.24 | 36.61 | 92.13 | 82.98 | 106.78 | 84.20 |
| Salinity Boron ppm | 0.24 | 0.23 | 0.17 | 0.18 | 0.19 | 0.18 |
| Salinity Calcium meq/L | 4.33 | 6.36 | 2.70 | 3.01 | 2.89 | 1.94 |
| Salinity Chloride ppm | 37.9 | 87.6 | 42.9 | 39.7 | 39.4 | 27.7 |
| Salinity Copper ppm | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Salinity ECE mmhos/cm | 1.09 | 1.53 | 0.77 | 0.88 | 0.74 | 0.61 |
| Salinity Iron ppm | 2.4 | 1.7 | 12.1 | 2.9 | 14.8 | 5.8 |
| Salinity Magnesium meq/L | 3.82 | 5.71 | 2.21 | 2.22 | 2.14 | 1.53 |
| Salinity Manganese ppm | 0.1 | 0.1 | 0.2 | 0.1 | 0.3 | 0.1 |
| Salinity Moisture % | 82.93 | 66.67 | 34.92 | 50.00 | 55.17 | 52.83 |
| Salinity Nitrate Nitrogen ppm | 43.9 | 79.3 | 7.3 | 7.0 | 3.9 | 10.8 |
| Salinity pH | 6.4 | 6.4 | 8.0 | 8.0 | 8.0 | 7.8 |
| Salinity PO4 ppm | 2.58 | 1.75 | 1.75 | 1.54 | 2.37 | 2.78 |
| Salinity Potassium meq/L | 0.45 | 0.44 | 0.47 | 0.44 | 0.56 | 0.45 |

Relation between evapotranspiration and concentration of calcium in the tissues.

- Mature leaves evapotranspire more than young leaves, flowers and fruit, which means they tend to subsequently have less problems with calcium deficiency.
- We see more problems with calcium when there is little evapotranspiration.

A couple of plant problems.

Yellow plants and water



Magnesium deficiency?



Iron Deficiency?



Low nitrogen







Low nitrogen.

| Nutrient Sampled | Average Concentration |
|-------------------------|------------------------------|
| Nitrogen (N) | 1.7 % |
| Phosphorous (P) | 0.3 % |
| Potassium (K) | 1.4 % |
| Calcium (Ca) | 1.5 % |
| Magnesium (Mg) | 0.4 % |
| Sulfur (S) | 0.1 % |
| Copper (Cu) | 4 ppm |
| Zinc (Zn) | 15 ppm |
| Iron (Fe) | 213 ppm |
| Manganese (Mn) | 805 ppm |
| Boron (B) | 80 ppm |

