



Bearing Apples

**Soil nutrition is not
an exact science**

Snake oils do exist

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Soil Nutrition Bearing Apples

- ❖ Maximize Ca content in fruit
- ❖ Minimize N content in fruit

Changes In Soil Testing

- ❖ **Chemical extract method**
- ❖ **Soluble paste extract**
- ❖ **“Whole Health” soil testing**

Chemical Extract Soil Tests

- ❖ Nitrogen in lbs. per acre foot
- ❖ Organic matter in %
(1-2% common)
- ❖ pH 6.5 - 7.5
- ❖ Nutrients in PPM or Meq/100 grams
- ❖ Lime requirements if <7.0 pH

Chemical Extract Cont.

- ❖ **Bases are K^+ Ca^{++} Mg^{++} Na^+ $H^+ = 100\%$**

- ❖ **% exchangeable bases = % of soil sites occupied by cations (bases)**

Desired Base Ratios

K 4-7%

Ca 65-80%

Na 1%

Mg 10-20%

**H insignificant in
neutral high pH soils**

Soluble Paste Extract Methods

Measures nutrients that move freely with soil water movement

Does not measure nutrients that are bound to soil particles

Desired levels: Ca^{++} needs to be 50-55% of total soluble cations.

All soluble cations need to be twice that of all anions

**You shouldn't use a
paste extract without a
chemical extract test**

Nutrients Mined For Fruit

Production at 50

Bins/Acre

K	(Potassium)	50 lbs/acre
N	(Nitrogen)	18 lbs/acre
P	(Phosphorous)	6 lbs/acre
Ca	(Calcium)	4 lbs/acre
Mg	(Magnesium)	3 lbs/acre
S	(Sulfur)	2 lbs/acre

N-P-K Versus N-Ca-K

Total Nutrients Mined For Both

Fruit & Tree Production at 50

Bins/Acre

K	(Potassium)	90	Ibs/acre
N	(Nitrogen)	50	Ibs/acre
Ca	(Calcium)	36	Ibs/acre
Mg	(Magnesium)	11	Ibs/acre
P	(Phosphorus)	9	Ibs/acre

Soil Applied Calciums in Order of Soil Movement

**Mainstay calcium free cations bonded
with a soil surfactant**

Calcium thiosulfate

**Calcium chloride moves fast through soil
chloride anion inhibits N utilization**

Soil Applied Calciums in Order of Soil Movement Cont.

Calcium nitrate

**Calcium sulfate (gypsum) 80 mesh or
finer, solution grade is 200 mesh for
injection**

**Calcium carbonate (lime) 65 mesh or
finer.**

K is Important For Ca Uptake

- ❖ K is a stress element
- ❖ Stomata respiration important during heat stress which robs calcium
- ❖ Very xylem mobile

K is Important For Ca Uptake Cont.

- ❖ **Regulates water and nutrient flow**
- ❖ **Increases sugar**
- ❖ **K is a big counter cation, the plant has to balance out any free anions internally with K or Ca**

Soil Applied Potassium (K) in Order of Movement

Most Sol.

KCO₃

KTS

Mod. Sol.

KNO₃

KCI

Less Sol.

KSO₄

K Mag

Boron Aids Calcium Nutrition

**Foliarily use 3-4 lbs.
Mor-Bor 17 (17% A.I.)
per acre per season**

**Soil applied: 1-1.5 lbs. A.I.
per acre per year**

Don't do both

How Do Plants Pick Up Nutrients

Fixed on Soil Particles

- ❖ Roots exude carbohydrates at root membranes
- ❖ Microbes feed on carbohydrates
- ❖ Microbes give off CO₂

How Do Plants Pick Up Nutrients Fixed on Soil Particles Cont.

- ❖ **CO₂ combines with H₂O to form carbonic acid**
- ❖ **Carbonic acid solubizes nutrients off of soil particles**
- ❖ **Root membranes absorb solubized nutrients**

For Ideal Ca Movement Into Fruit

- ❖ Good reserve calcium
(% Ca exch. bases)
- ❖ Good micro-biological activity
(creates soluble Ca^{++})
- ❖ Add cations (Ca, K & Mg)
to create movement

**To increase reserve calcium
add fine mesh lime when pH
is low (<6.5) for target 70%
exchangeable Ca**

**Add fine mesh gypsum when
PH is Okay**

To increase biological activity you need to add humus (soluble carbon), compost, compost tea, soluble humic acid (H-85), sugar

“Typical” Apple Soil Program

(Assuming 50-75 bins/acre & a balanced soil)

35 lbs N per acre to maintain levels

No phosphorous

50-75 lbs. Potassium/acre as KCl, KSO₄ or K-Mag

40 lbs. Calcium as CaSO₄ or CaCl

High Bitter Pit Risk Apple Soil Program

**H-85 Humic Acid at 3-4
lbs./acre/season bloom to Labor Day**

**Mainstay calcium at 6-12
gals/acre/season bloom to Labor Day**

**Calcium thiosulfate at 6-12
gals/acre/season bloom to Labor Day**

**“My orchard is doing fine
with just some nitrogen”**

Keep pH balanced

Remember you are mining the soil

Ideal Leaf Nitrogen

1.8-2.2% honeys, goldens, older strains of fujis & reds

2.1-2.5% red fujis, galas, grannies, & Scarlets

Fruitlet Analyses Ratios

Good hard fruit N:Ca \leq 7:1

Soft or bitter pit N:Ca \geq 11:1

Good hard fruit $\frac{K+Mg}{Ca} \leq 21:1$

Soft or bitter pit $\frac{K+Mg}{Ca} \geq 31:1$

Fertilizing newly planted apples through drip irrigation

Soil sample before planting, & amend organic matter, pH & nutrients if needed

Start once tree has $\frac{1}{2}$ inch new growth

10-15 lbs nitrogen per acre per week on a 12 foot center

Keep soluble salts below 1.0 under emitters

Keep pH underneath emitters above 6.5

Fertilizing newly planted apples through drip irrigation cont.

Add soluble phosphorous for root growth and humic acid for microbe growth

Go 1/2 lb. Rootex + 1/3 lb. H-85 humic acid per orchard acre every week

If K is needed add 0-0-30, if iron is needed Ferriplus can be added, if sulfur is needed add KTS

Fertilizing newly planted apples with dry fertilizer

Soil sample before planting and amend organic matter, pH & nutrients if needed

Establish phosphorous levels at 35 ppm

Start once tree has ½ inch new growth

30-40 lbs N per acre every 2 weeks

Keep sol. salts below 1.0 in weed strips

Keep pH above 6.5 in weed strips

Fertilizing newly planted apples with dry fertilizer

cont.

Add 1 1/2 lbs Rootex soluble phosphorous per acre every 3 weeks thru weed sprayer

Add 1 lb H-85 humic acid per acre every 3 weeks thru weed sprayer or add humic with dry program

Add K or sulfur as needed

Choosing An Apple Soil Fertility Program

Chemical Extract Soil Tests

Paste Extract Soil Tests

Leaf Samples

Fruitlet Analyses



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