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Orchard Location

- No Soil Problems
- Full Sun
- Air Drainage
- Well Drained Soil
- Irrigation Water
- Cool Winter
- 400-1,000 hrs chilling
- No frost or rain during bloom (April)



Soil Testing

- Multiple sub samples (5-15)
- Two depths (6" and 18") (separate)
- Each sample represents different area
- Mix thoroughly
- Analyze for big 6: pH, P, K, Ca, Mg, OM
- Analyze for minor nutrients if suspect (boron, sodium, chloride, etc.)



Soil Chemical Properties

saturated paste extract

- Soil pH 5.0 – 8.5
- High Magnesium (< 1:1 ratio with Ca)
- High Calcium (> 8:1 ratio with Mg)
- Adequate Phosphorous (> 10 ppm P) = OK
- Adequate Potassium (> 125 ppm K) = OK
- High Chloride (> 10-15 meq/l Cl⁻)
- High Boron (> 2 ppm B)
- High Sodium (SAR > 15)



Soil Physical Properties

Prefer

- Sandy loam
- Loam
- Silt loam
- Clay loam
- Silty clay loam

OK

- Sandy soils

Avoid

- Clay soils
(slow drainage)



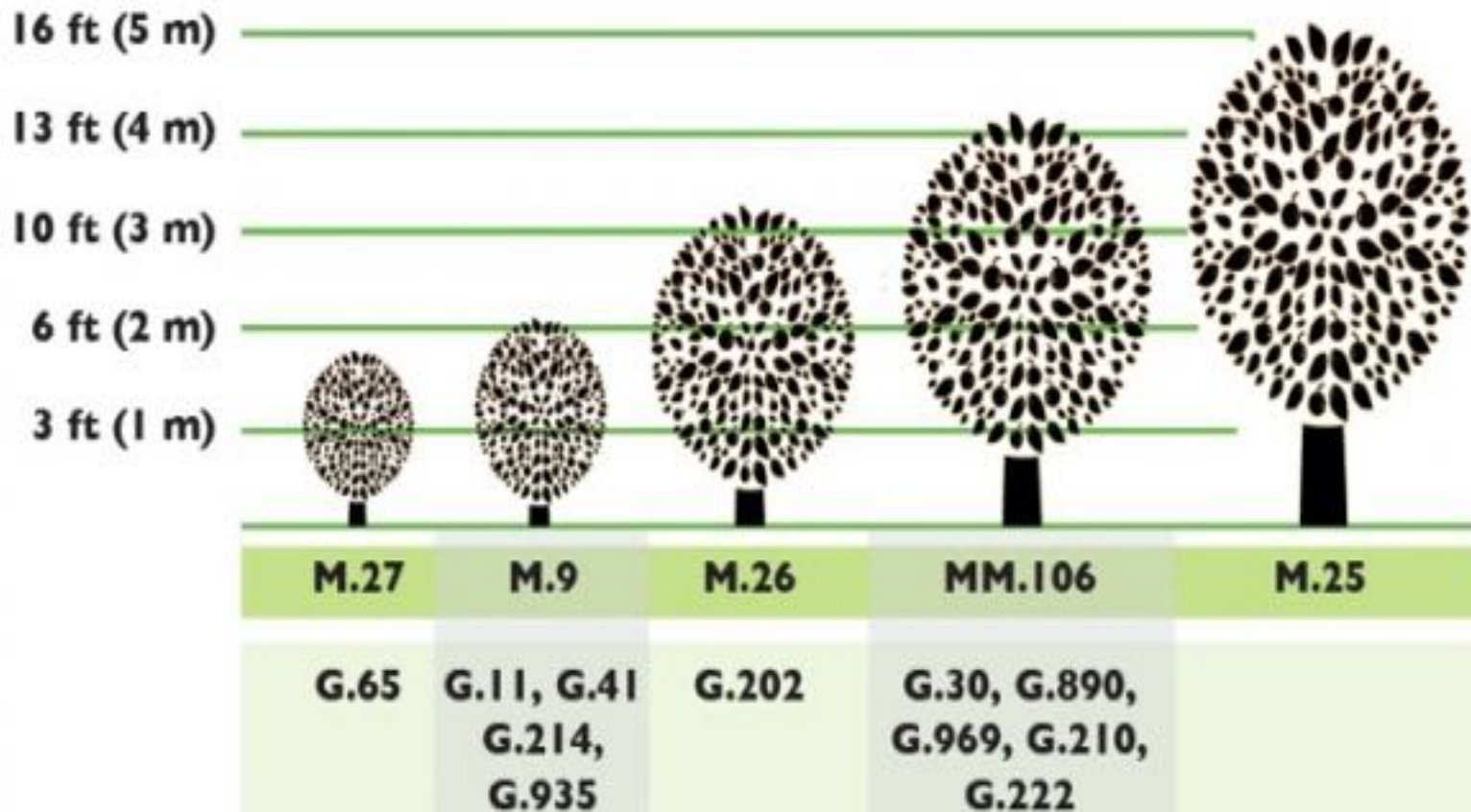
**Wet soil problem
one solution is
“Mound Planting”**





Rootstock – Size Control




Malling and Geneva comparative sizes



M-9 2nd Year



Apple Rootstocks

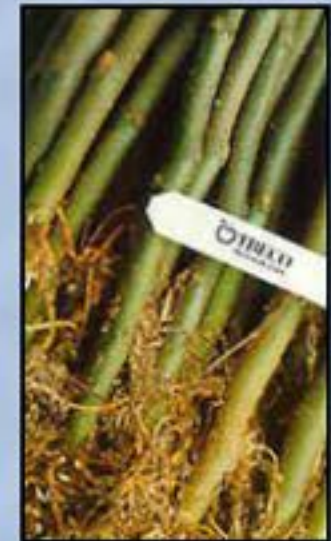
	M-9	EMLA-26	EMLA-7	EMLA-111
DWARFING	30–40% 	35–45% 	55–65% 	70–80% 
ANCHORAGE	Fair to poor—requires support	Fair—may require support	Good	Very good
SOIL PREFERENCES	Medium to heavy textured soils	Well drained lighter soils of high fertility	Deep fertile loam soils with medium to heavy texture	Adaptable for light to heavy soils
FIREBLIGHT	Susceptible	Susceptible	Susceptible	Somewhat resistant
BURR KNOT	Usually not a problem	Susceptible	Resistant	Resistant
WOOLLY APPLE APHID	Susceptible	Susceptible	Susceptible	Susceptible
SUCKERING	Very little	Some, very vigorous	Can sucker badly	Very little
VIGOR	Low	Medium	Medium—less vigor than 26	Vigorous
GOPHERS	Susceptible	Susceptible	Susceptible	Susceptible

Apple Rootstocks



- Home
- History
- Warranty
- Plant Care
- Rootstocks
- Inventory
- Prices
- Order

Bud 9	Bud 118	EMLA 27	EMLA 9
EMLA 26	EMLA 7	EMLA 106	EMLA 111
MARK	M-9 T337	M-9 NIC 29	M-9 Pajam 2
Geneva 41	Geneva 16	Geneva 11	Blank
Geneva 935	Geneva 30	Supporter 4	P-22
P-2	P-18	×	×
×	Prov. Quince	EMLA Quince A	EMLA Quince C



Apple Rootstocks



GENEVA® 'G.41' PP17,139

Home

Rootstocks

Origin

Geneva® 41 is a 1975 cross of 'Malling 27 X Robusta 5' by the Cornell University/Geneva Apple Rootstock Breeding Program.

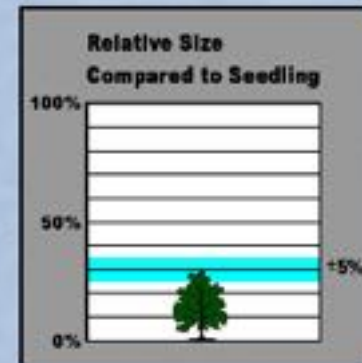
Influence on Scion Habit

Geneva® 41 produces trees that are similar to the less vigorous M-9 rootstocks with good precocity and fruit size.

Disease Resistance

Geneva® 41 is highly resistant to fire blight and *Phytophthora* with no known tree death from this disease in field trials. Its precocity and productivity have shown to be equal to or better than M-9.

Geneva® 41 shows to be resistant to replant disease and appears to be winter hardy with no damage following the test winter of 1994.



Rootstock Effects



'Yarlington Mill' on M106 (L) and M9 (R)



Cider Varieties



Hard Cider Varieties

(bittersweet – astringent – tannic – acidic)

- Chisel Jersey
- Trancendant Crab
- Ashton Brown
- Foxwhelp
- Hyslop Crab
- Kingston Black
- Roxbury Russet
- Pearmain
- Dufflin
- Yarlington Mill



Cider Apple Varieties and Juice Quality

C. Miles and J. King

**Northwestern Washington Research
and Extension Center**



<http://maritimefruit.wsu.edu>

Cider Apples: High Tannins

**High tannin varieties
produce complex flavors,
body, and astringency
when fermented**

**Dessert apples tend to be
thin and bland when
fermented**

**Blending produces cider
with high viscosity and
satisfying mouth feel**



SWEETS*Neutral*T¹<0.2, A²<0.45

Cider Apples

Berkeley Pippin

Court Royal

Eggleston Styre

Geeveston Fanny

Peau de Vache

Pomme Gris

Sweet Alford

Sweet Coppin

Vagnon Flocher

Wayne

Woodbine

Standard Apples

Baldwin

Ben Davis

Golden Russet (UK)³Fameuse³Golden Russet (USA)³

Grimes Golden

Hubbardston

McIntosh³

Rambo

Rome Beauty

Roxbury Russet³

Sops of Wine

Stark

Westfield Seek-No-Further

Winter Banana³**BITTERSWEETS***Tannic, astringent*

T>0.2, A<0.45

Cider Apples

Ashton Brown

Jersey

Ball's Bittersweet

Bedan

Broadleaf Norman

Cimitiere

Chisel Jersey

Cow Jersey

Dabinett

Gilpin

Harry Masters'

Jersey

Knotted Kernel

Medaille D'Or

Michelin

Nehou

Porter's Perfection

Reine des Hatives

Reine des Pommés

Royal Wilding

Sherrington Norman

Somerset Redstreak

Stembridge Jersey

Taylor's

Tremlett's Bitter

Vilberie

Yarlington Mill

Standard Apples

Lindel

Newtown Pippin

Red Astrakhan

SHARPS*Acidic, tart*

T<0.2, A>0.45

Cider Apples

Breakwell

Brown's Apple

Coleman's Seedling

Dymock Red

Fair Maid of Devon

Frederick

Hereford Redstreak

Ponsford

Tom Putt

Winter Stubbard

Yellow Styre

York Imperial

Standard Apples

Bramley's Seedling

Cox's Orange Pippin³

Crimson King

Esopus Spitzenberg

Gravenstein³

Jonathan

Northern Spy

Rhode Island Greening

Ribston Pippin³

Stayman

Wealthy³

Winesap

BITTERSHARPS*Tannic, acidic*

T>0.2, A>0.45

Cider Apples

Cap of Liberty

Dufflin

Foxwhelp

Improved Foxwhelp

Kingston Black

Stoke Red

Worcester

Pearmain

Crabapples

Dolgo

Hagloe

Joeby

Martha³

Red Siberian

Transcendant³

Grimes Golden (Sweet)



Chisel Jersey (*bitter-sweet*)



Bramley's (*Sharp*)



Kingston Black (*Bitter-sharp*)

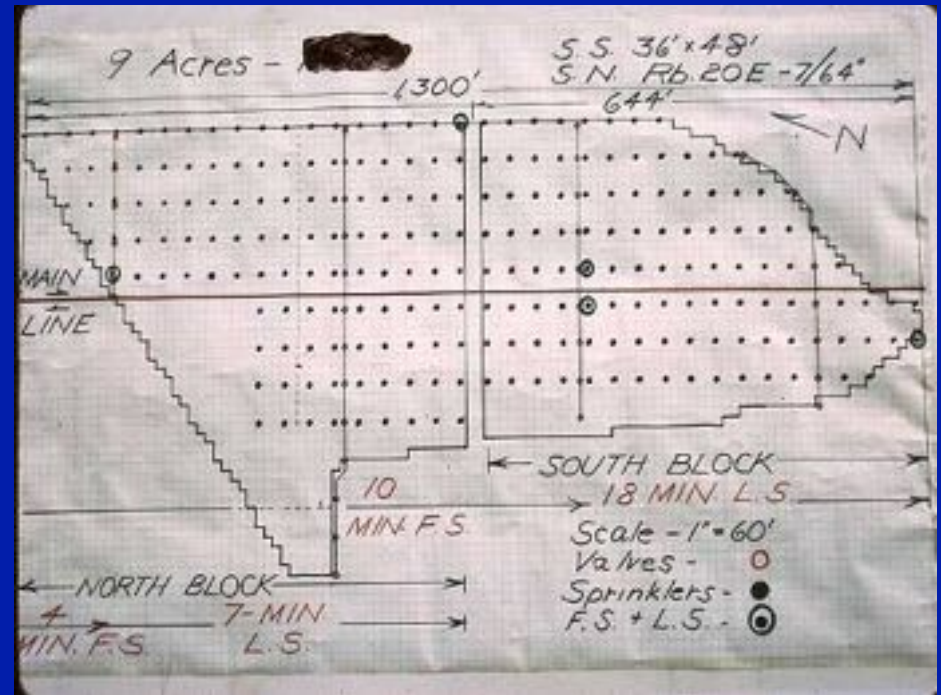


Rumanian Perry Pear



Land Preparation

- Improve drainage
- Add organic matter
- Adjust pH
- Control weeds
- Planting layout
- Irrigation layout
- Incorporate amendments

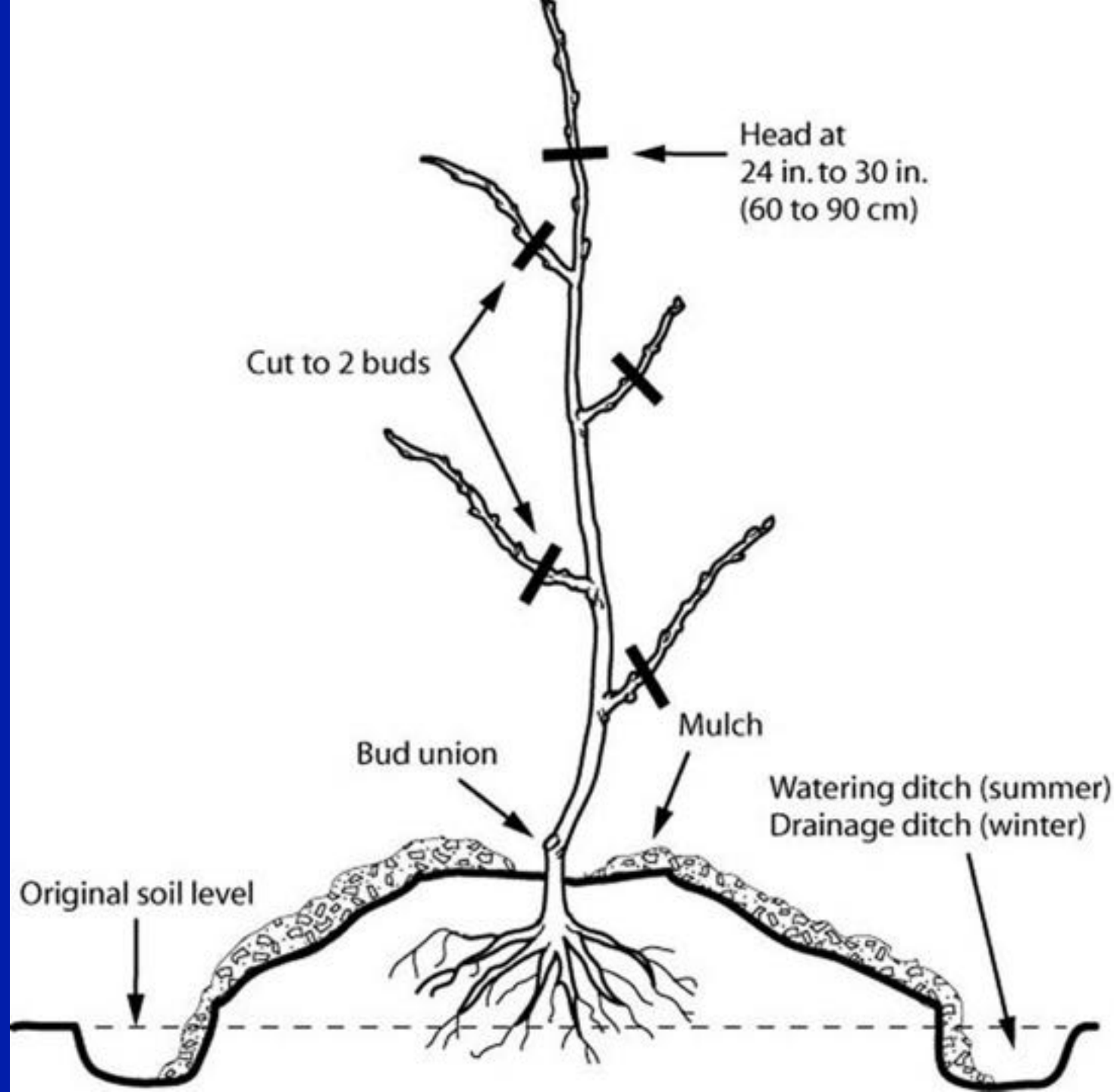


Planting on a mound



Prune at planting

Pruning a tree at planting



Raised bed planting



Tree Spacing

Tree height = $\frac{3}{4}$ row spacing

- 9' tall for 4' x 12' spacing – dwarf
- 12' tall for 8' x 16' spacing – semi-dwarf
- 15' tall for 10' x 20' spacing – standard
- Small trees are easier
- Air movement and sun exposure

What will tree size be?????

Apple Orchard Training Systems

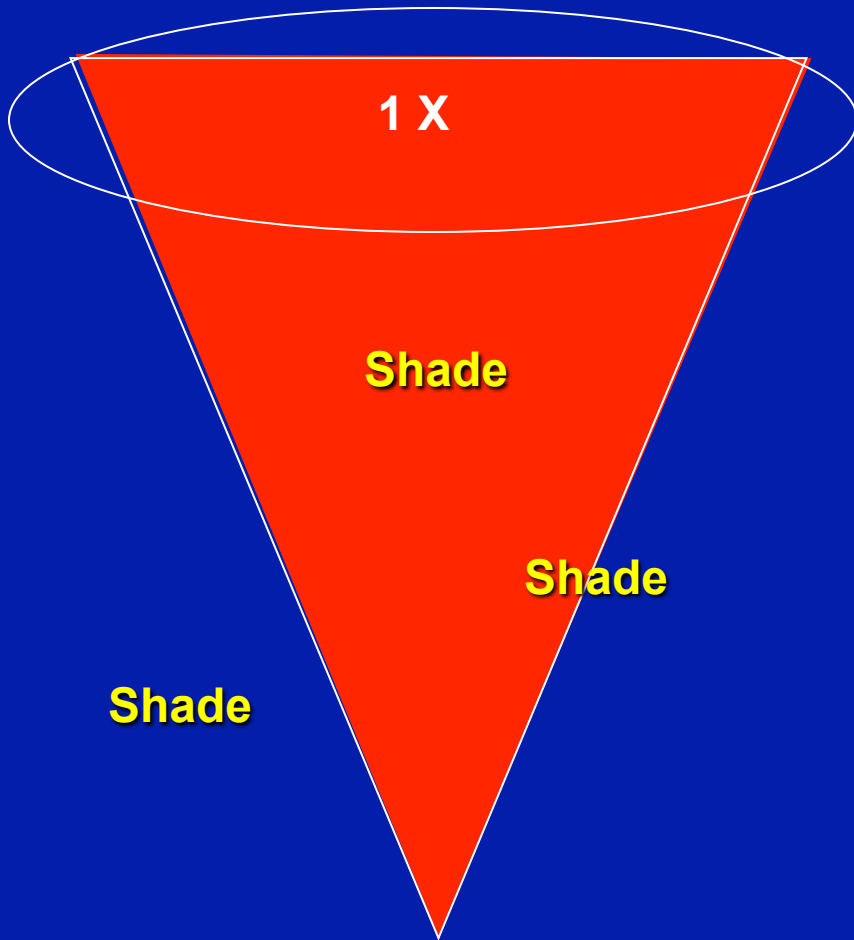


Central leader

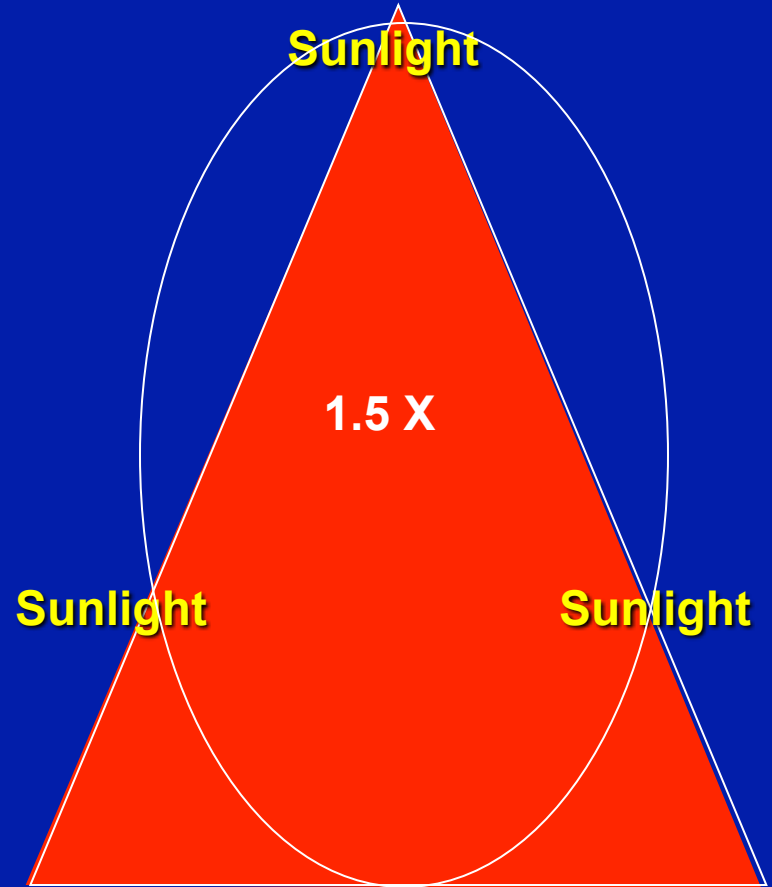


TREE SHAPE

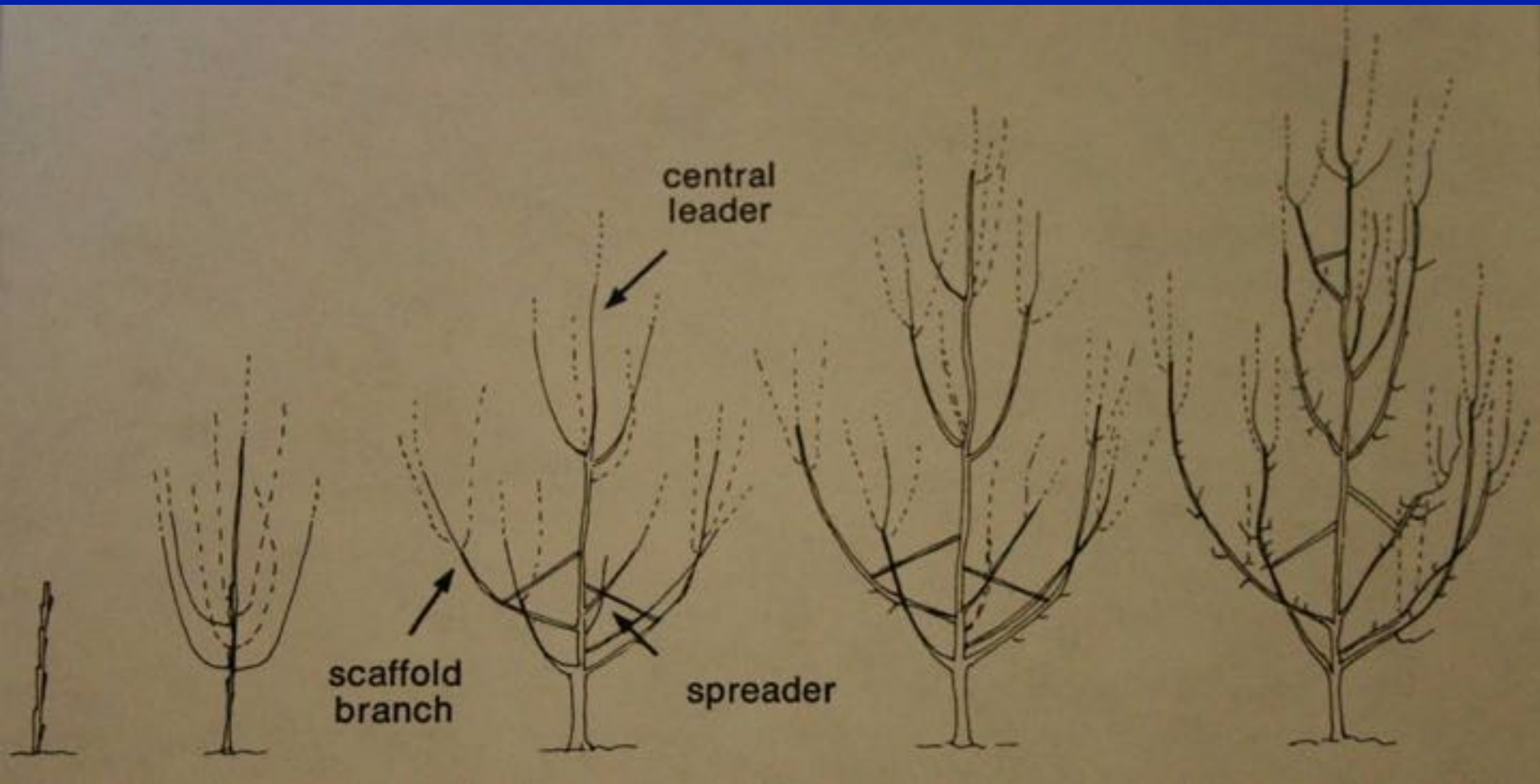
Sunlight



Sunlight



Central Leader Training



Robert Stebbins 1976



Young central leader apples



Central leader apples



Mature central leader apples



Central Leader Apples



Hedgerow Orchard



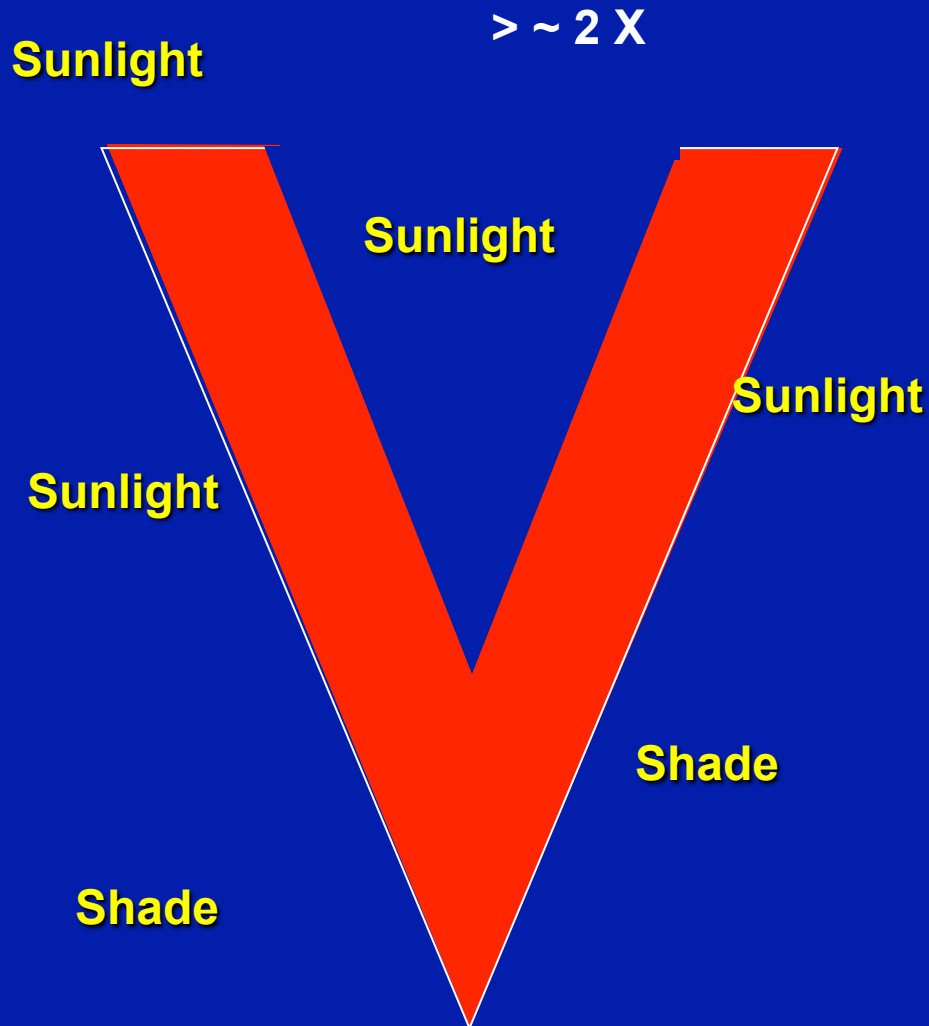
Cider apples on dwarf rootstock



Dwarf Central Leader for Mechanical Harvest



Light Management



- More Fruit Color
- Strong buds
- Strong Flowers
- Larger Fruit

Open Center – Vase Shape





Old Open Center Trees



Value of Water

- **Yield**
- **Fruit Size**
- **Fruit Quality - Color & Taste**
- **Cover Crop Mgmt.**
- **Erosion Control**
- **Frost Control**
- **Pest Mgmt.**
- **Nutrition Enhancement**

Plant - USE RATE

How Much Water Plants Use

Evapo - Transpiration (ET)

- Evaporation from soil surface = 10%
- Transpiration = 90% cooling of the leaves



EVAPOTRANSPIRATION (ETo) REFERENCE

Temperature

Relative Humidity

Wind

How hot & dry & windy is it?

Max Potential Water Use (May-October)

	<u>ET (inches)</u>	<u>Gal/Acre</u>	<u>Gal/Min</u>	<u>Gal/1,000ft²</u>
Marine	20	543,080	2.04	12,464
Coastal Cool	34	923,236	3.50	21,195
Coastal Warm	42	1,140,468	4.22	26,181

Water Use in Gallons / Day

Plant Size	ET _o →	0.1"/day	0.2"/day	0.25"/day	0.3"/day
	1 ft ²	0.062	0.125	0.156	0.187
	10 ft ²	0.62	1.25	1.56	1.87
	36 ft ²	2.25	4.50	5.61	6.73
	100 ft ²	6.20	12.5	15.6	18.7
	200 ft ²	12.4	25.0	31.2	37.4
	300 ft ²	18.6	37.5	46.8	56.1
	1 acre	2,715	5,431	6,788	8,146

4 gpm X 60 min/hr X 24 hrs/day = 5,760 gallons per day

Rainfall from Mother Nature

Rainfall 20 – 90” per year

Most of it runs off

Soil Water Holding Capacity

- Clay = 2.0 to 2.5 inches per foot
- Loam = 1.5 to 2.0 inches per foot
- Sand = 1.0 to 1.5 inches per foot



**Sebastopol soil ~ 2 ft. deep
underlain by impervious clay**

Soil Survey



Storie index: 0-100

Capability Unit

Soil Type

Soil Horizons

Rooting Depth

Water Holding Capacity



Site Selection Investigative Tool





Deeper in Very Deep Soils

Holding
 6-10" of
 water

Less in Shallow Soils

Holding only 2-3" of water



Drip Irrigation

- **Water plant daily**
- **Give the plant what it needs/wants**
- **Need is determined by ET**
- **Soil water holding capacity is not important**
- **Keep emitters 18" to 24" away from trunk**

Clean Cultivation



**Stops weeds from
using up soil
moisture**

Cover crops use water



Weeds can steal 2-4" water

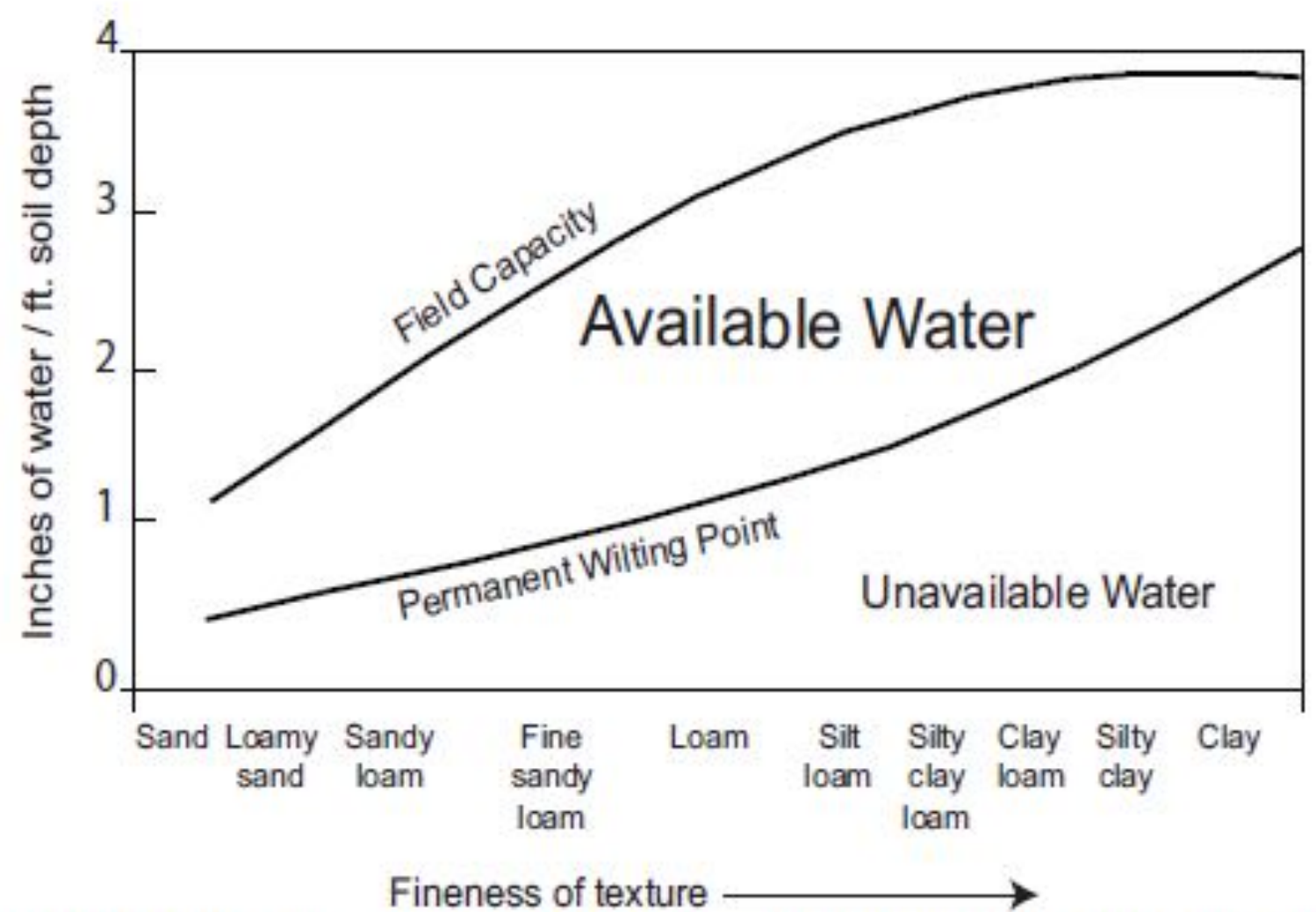


Figure 1. General relationship between soil moisture and texture.
Ohio Agronomy Guide, 14th edition, Bulletin 472-05

Cultivation Increases Erosion Risk



At least - no weeds near trees



Weed Control Comparisons



**Burlap – cheap,
biodegradable**









Wonder weeder



Wonder-weeder is fast





Wonder weeder



Organic wood chip mulch



**Organic wood chip mulch
expensive, biodegradable,
& requires annual
application**



Wood chips – vs – weed cloth

\$ 4,000/acre

\$ 700/acre

Double growth
with weed cloth
at 20% the cost



Herbicide treated



Minimum – keep weeds short

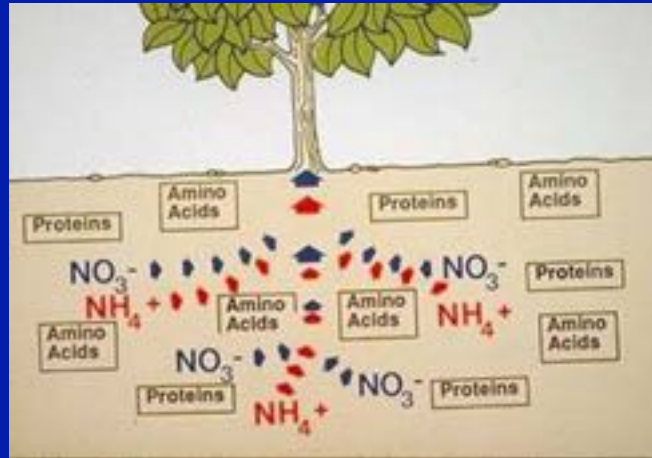


**BUT if its green -
its using water!!!**

WEED/COVER CROP EFFECTS ON TREE GROWTH

	<i>Shoot Length 1</i>	<i>Shoot Length 2</i>	<i>Trunk Diam. 1</i>	<i>Trunk Diam. 2</i>
<i>Mulch</i>	7.3 a	2.8 a	4.0 a	6.1 a
<i>Bare Soil</i>	5.3 bc	2.1 bc	3.4 b	5.0b
<i>Cultivated</i>	4.6 cd	1.7 c	3.6 ab	5.2 b
<i>Bluegrass Turf</i>	3.1 de	1.1 d	2.9 bc	3.8 c
<i>Fescue Turf</i>	1.7 e	0.4 d	2.2 d	2.5d

Apple Tree Nutrition



Adequate nutrition

- ~ 100 units of N (nitrogen) per acre per year
- ~ P (phosphorous deficiency is VERY rare)
- ~ Periodic application of K (potassium sulfates) 500 lbs./acre/five years
- ~ Calcium can be added if pH is below 5.5 to 6.0
- ~ Mg is usually only a problem on serpentine soils
- ~ Micro-nutrients are RARELY needed
- ~ Compost 2 tons/A
- ~ Fertigation 50% rate



2 tons/acre compost



Concentrated dry organic fertilizers – in a bag



Conventional Fertilizers and Slow Release Fertilizers



Cover Crops - Tilled in



Cover Crops - mowed



Cover Crops - mowed



Apple Thinning

- Hand removal to final spacing ~ 6-8 inches
- Chemical with hormones or oil-lime sulfur
- Improve size
- **Reduce biennial bearing**
- Improve color & finish



Conventional Chemical Thinning

- 3.4 to 4 gal ammonium thiosulfate/A
- 3 oz. NAA/A
- 1.5-3 qts. Carbaryl/A
- 1-3 pts. Ethephon/A
- 2 oz. NAD/A (amid thin)



Organic Chemical Thinning

- 6-8% lime sulfur
- **2% fish oil + 2-4% lime sulfur**
- 2% vegetable oil + 2-4% lime sulfur
- 1% supreme oil + 3% lime sulfur
- 10% vegetable oil or stylet oil



Primary Pest Problems for Apples

- Codling Moth
- Aphids
- Apple Scab
- Bitter Pit
- Weeds



Codling Moth Life Cycle



CM frass



Electronic CM trap



Organic Pest Controls

- Mating disruption
- Dormant oil
- BT
- Spinosad
- Kaolin clay
- Cover crops
- Sanitation
- Pheromone traps
- Neem oil
- Trunk banding
- Summer oil
- Ryania
- Fertility Management
- Granulosis virus
- Insecticidal Soap
- Lacewings
- Black light traps
- Trichogramma wasps
- Diatomaceous earth
- Entomogenous nematodes

UC-IPM Guidelines

- HOME
- SEARCH
- ON THIS SITE
 - What is IPM?
 - Home & landscape pests
 - Agricultural pests
 - Natural environment pests
 - Exotic & invasive pests
 - Weed gallery
 - Natural enemies gallery
 - Weather, models & degree-days
 - Pesticide information
 - Research

How to Manage Pests UC Pest Management Guidelines

[All apple pests](#) | [All crops](#) | [About guidelines](#) |

Apple

Codling Moth

Scientific Name: *Cydia pomonella*
(Reviewed 8/06, updated 12/09, pesticides updated 10/15)

In this Guideline:

- [Description of the pest](#)
- [Important links](#)
- [Damage](#)
- [Publication](#)
- [Management](#)
- [Glossary](#)

DESCRIPTION OF THE PEST

Codling moth has a 0.5 to 0.75 inch wingspan. The tip of each forewing has a coppery-tinged, dark brown band that distinguishes codling moth from other moths found in apple orchards. Females lay eggs singly on leaves and sometimes on fruit later in the season. The eggs are smaller than a pinhead, disk-shaped, and opaque white when first laid. Just before hatching the black head of the larvae becomes visible. Newly hatched larvae are white with black heads. Mature larvae are 0.5 to 0.75 inch long, pinkish white, with mottled brown heads. Depending on climatic conditions and location in the state, there are two to four generations of codling moth each year.



Organic Methods: mating disruption – oils
- codling moth granulovirus (Cyd-X) -
Entrust (spinosad) - kaolin clay (Surround).

Pheromone Confusion – Mating Disruption



Pheromone Puffers



**OR For cider apples you
do nothing for Codling Moth
control ?**

Aphids



**Spray
dormant
oil**

Apple Scab



APPLE SCAB OR PEAR SCAB



SPRING



WINTER

APPLE SCAB OR PEAR SCAB

SPRING



Scab control

- Plant Resistant variety
- Do nothing – occasional problem
- Sanitation – overwinters on leaves
- Spray with copper at bud break
- Spray with micronized sulfur
- Spray with conventional fungicide





Organic
Apple

PRODUCTION MANUAL

•Organic Apple
Production Manual -
3403

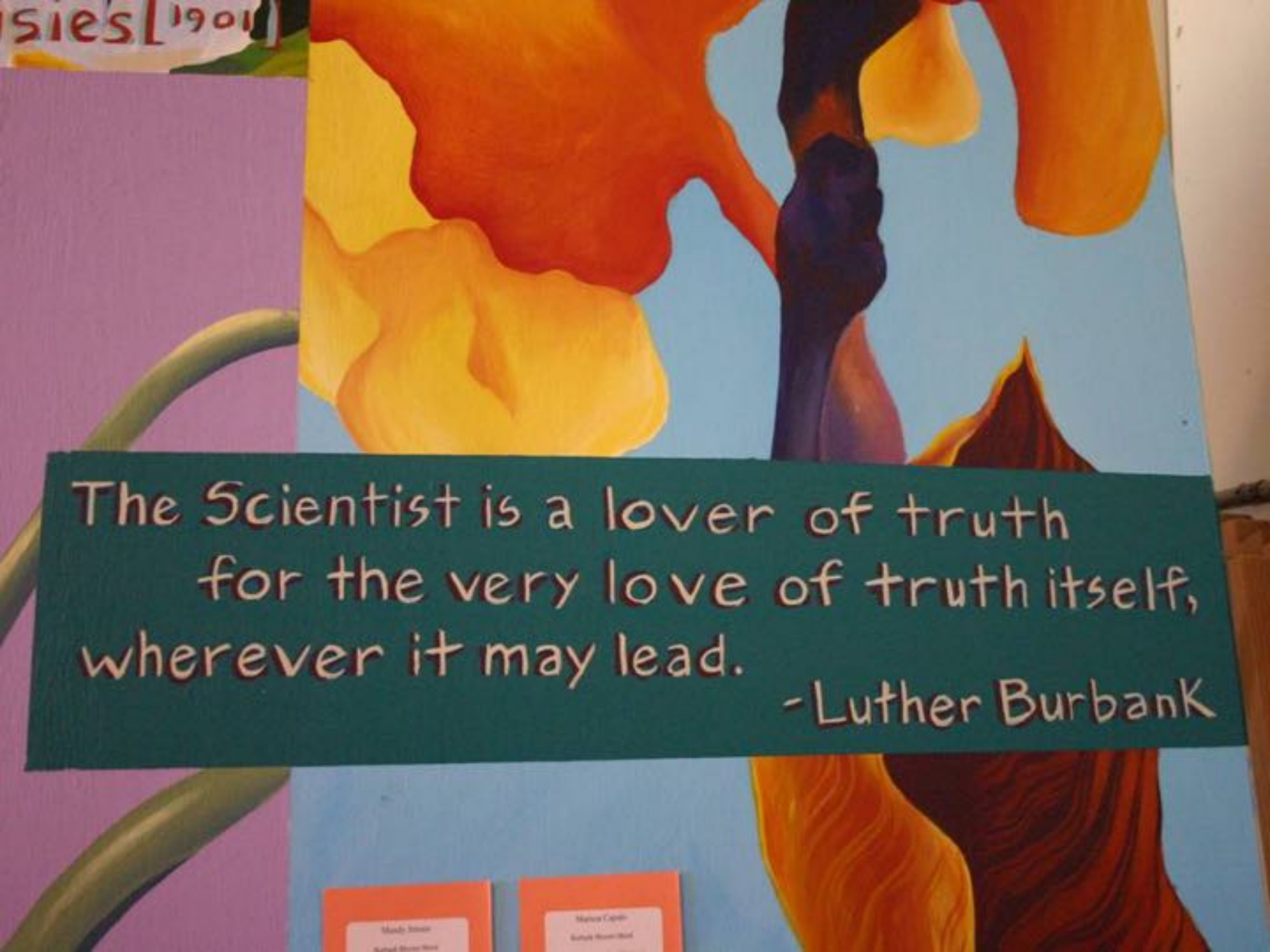
•IPM for Apples and
Pears # 3340

•Pests of the Garden
and Small Farm # 3332

•Pest Notes

[www.ipm.ucdavis.edu/
PMG/PESTNOTES/](http://www.ipm.ucdavis.edu/PMG/PESTNOTES/)

sies [1901]



The Scientist is a lover of truth
for the very love of truth itself,
wherever it may lead.
-Luther Burbank

Mandy Brown
Richard Brown West

Maria Caplan
Richard Brown West



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