

Organic Fertilization and Weed Management

Orchard Floor Management –
Organic Intensive Workshop
Wenatchee WA, Oct. 11, 2016

Chuck Ingels

Farm Advisor

UC Cooperative Extension, Sacramento County

<http://cesacramento.ucanr.edu>

Acknowledgements

Information Provided

- WSU
 - David Granatstein
 - Tianna DuPont
- Univ. of Calif.
 - John Roncoroni
 - Tom Lanini
 - Brad Hanson
- Companies/Individuals
 - GS Long Co.
 - Northwest Wholesale
 - Royal Organic Products
 - True Organic Products
 - Mike Devencenzi

Topics to be Covered

- Organic fertilization (Focus on N)
 - Manures and composts
 - Selected composts, manures, and fertilizers
 - Practices and considerations
- Weed management
 - Pre- and post-plant considerations
 - In-row weed management
- Trial results

Topics to be Covered

- **Organic fertilization (Focus on N)**
 - **Manures and composts**
 - Selected composts, manures, and fertilizers
 - Practices and considerations
- Weed management
 - Pre- and post-plant considerations
 - In-row weed management
- Trial results

Manures and Composts

- Typical application rates for both: 2-5 tons/acre
- Best banded, lightly incorporated
- Soil OM content
 - Enhanced by OM additions, destroyed by cultivation
 - Difficult to increase but OM important to add
 - Where in-row tillage used
 - Sandy & clay soils – Water & nutrient retention
 - Clay soils – Aeration & drainage

Manures

- Fresh/dried manure
 - N content and N release generally higher than compost
 - Food safety concerns: Cannot be used within 90 days of harvest
 - Strong odors
 - Salinity concerns



Composts

- Finished compost
 - Thermophilic heating process with turning
 - Temperature low, no ammonia smell
- Chicken compost
 - Partial composting to kill microbes, reduce bulk
 - High N, quick release
- Dairy compost
 - Low N, slow-release
- Salinity concerns

Topics to be Covered

- **Organic fertilization (Focus on N)**
 - Manures and composts
 - **Selected composts, manures, and fertilizers**
 - Practices and considerations
- Weed management
 - Pre- and post-plant considerations
 - In-row weed management
- Trial results

Supplier and Product Information

- Companies were contacted and several responded
- Mention or omission of companies or products does not imply preference
- Nutrient values are approximate
 - May vary greatly and may change

Selected Compost/Manure/Fertilizer Products

- Dairy compost (1.5% N)
- Chicken manure/compost (3-4% N)
- Dried poultry waste (NW Wholesale) (3-7% N)
- Royal Organic Products
 - Royal Classic (1.4% N), green waste + herbal matter
 - Soil Suplimint (4.2% N), mint biomass

Selected Compost/Manure/Fertilizer Products

- Strutzman Farms
 - Nutri-Rich
 - 4-3-2 (dried poultry waste), pelleted
 - 8-2-4 (DPW + blood, feather, SOP), granular
 - Sup'r Green (3% N), composted chicken manure
- Perfect Blend
 - 4-4-2, 4-4-4, 6-3-3, and 7-2-2
 - Mostly chicken manure + feather meal/raw fish

Selected Specialty Fertilizer Products

- Feather meal (12-13% N)
- True Organic Products
 - Protein meals: Feather, meat, bone (& fish)
 - 12-3-0 (and many other products)
- ProNatural Dry
 - 10-1-0 (feather, crab, and shrimp meals)
 - 6-2-1 (feather, alfalfa, shrimp, fish bone meals)

Liquid Fertilizers for Fertigation

Examples

- True Organic Products
 - 4-0-2 (reduced sugar molasses + fish)
- BioLink
 - 3-0-0 (hydrolized soy protein)
- Injected multiple times through season

Topics to be Covered

- **Organic fertilization (Focus on N)**
 - Manures and composts
 - Selected composts, manures, and fertilizers
 - **Practices and considerations**
- Weed management
 - Pre- and post-plant considerations
 - In-row weed management
- Trial results

Organic Nitrogen Fertilization

Most Common Practices

- Chicken compost
 - If 30% moisture, approx. 50 lbs. of N applied per wet ton, likely half available over growing season
 - 2 tons might be 50 lbs. avail N
 - 3 tons might be 75 lbs. avail N
- Or dried poultry waste
- Ask to see recent analysis (% N, % moisture)

Organic Nitrogen Fertilization

Most Common Practices

- Difference often made up with feather meal or other product
- For N, chicken compost plus feather meal is usually the least expensive
- Incorporate (or sprinkle?) to reduce ammonia loss



Application Timing

Manure, Compost, and Dry Organic Fertilizers

- Fall applications common, often spring also
- Spring and early summer best; fall too late
- N release temp. dependent, but greatest in 1-2 months following application, even in fall
- Nitrate leaching below root zone

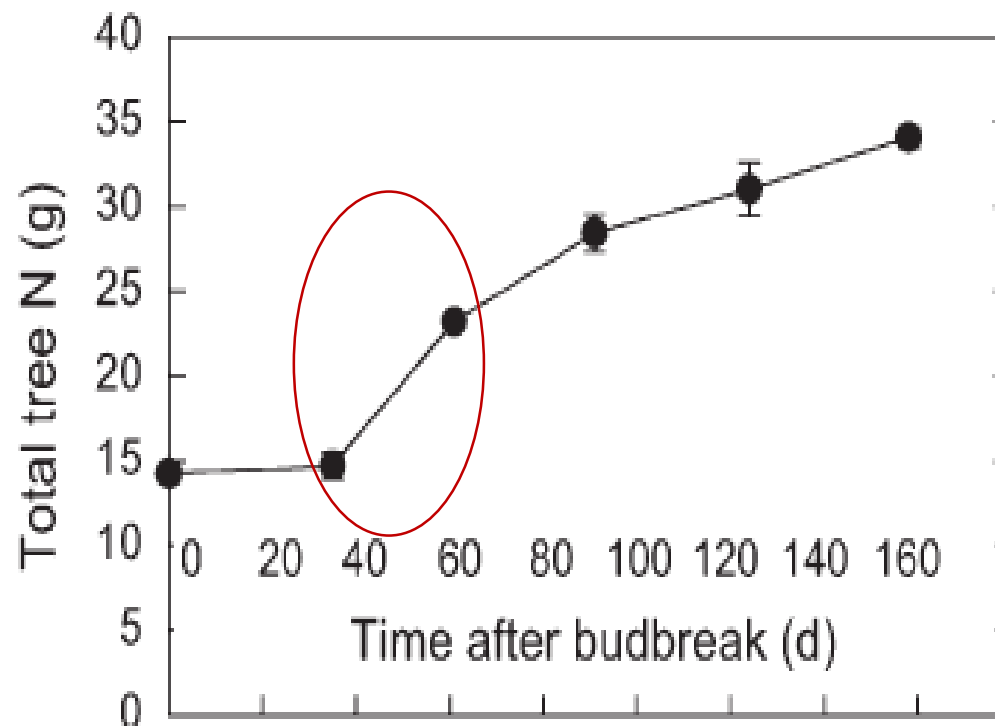
Use In-Row Cover Crop?

- Removes excess N in winter, but:
 - Vole habitat
 - Grass competes with trees for N, water



Synchronize needs with availability

Organic N fertilization 4-6 weeks
after bloom optimum, highest need



Cheng and Raba, 2009
Courtesy T. DuPont



[Home](#)

[User Guide: Organic Fertilizer Calculator](#)

[Download Commercial Calculator](#) (per acre calculations)

[Download Small Farm/Garden Calculator](#) (square foot calculations)

ORGANIC FERTILIZER CALCULATOR QUICK USER'S GUIDE

<http://smallfarms.oregonstate.edu/organic-fertilizer-calculator>

Home
Events
Newsletter
Beginning Farmers
Livestock
Pastures
Crops
Soils
Marketing
Organic Fertilizer
Calculator

Enter your information in yellow cells. Results are in green cells.

MATERIAL	FERTILIZER ANALYSIS					
 	Total % N from label ("as-is" basis; % of product)	Total % dry matter (% of product)	%PAN at 28 days (% of amendment total N, dry wt basis)	%PAN after full season (% of amendment total N, dry wt basis)	PAN at 28 days (lb N per 100lb amendment "as-is" basis)	PAN after full season (lb N per 100lb amendment "as-is" basis)
ORGANIC FERTILIZERS						
Blood meal (12.5-1.5-0.6)	12.5	91	60	75	7.50	9.38
Bone meal (3-20-0.5)	3.0	95	17	32	0.52	0.97
Chicken manure - dried (4-3-2)	4.0	85	41	56	1.62	2.22
Feather meal (granulated) (13-0-0)	13.0	97	60	75	7.80	9.75
Fish meal (10-6-2)	10.0	92	60	75	6.00	7.50
Meat and bone meal (7-8-0)	7.0	93	60	75	4.20	5.25
Muriate of potash (KCl) (0-0-60)	0.0	100	0	0	0.00	0.00
Soy meal (6.5-1.5-2.4)	6.5	90	60	75	3.90	4.88
Sulfate of potash (0-0-50)	0.0	99	0	0	0.00	0.00
Sulfate of potash magnesia (0-0-22)	0.0	99	0	0	0.00	0.00
chicken manure 433	4.0	90	37	52	1.47	2.07
			0	0	0.00	0.00
SYNTHETIC FERTILIZERS						
Triple super phosphate (0-40-0)	0.0	N/A	100	100	0.00	0.00
Urea (46-0-0)	46.0	N/A	100	100	46.00	46.00
		N/A	100	100	0.00	0.00
		N/A	100	100	0.00	0.00
COMPOST						
Composted manure (1.5-0.5-0.5)	1.5	60	5	10	0.08	0.15
HIP compost	2.2	100	5	10	0.11	0.22
			0	0	0.00	0.00
COVER CROPS						
				%PAN after full season (70 days)		
0	N/A	0	N/A	0	N/A	N/A

OSU Organic Fertilizer Calculator

N. Andrews et al.

Guidelines for PAN

Nitrogen %	C:N ratio	% N Available
Fresh Material		
1	35	0
2	18	15
3	12	30
4	9	45
5	7	60
6+	<6	75
Composts		
1	25-35	5
2-3	10-15	10

Year 2 PAN – 5-10% of total initial N

Compost – 2%/yr N mineralization from Yr 4 on

(Cogger et al.)

PAN of Selected Organic N Fertilizers

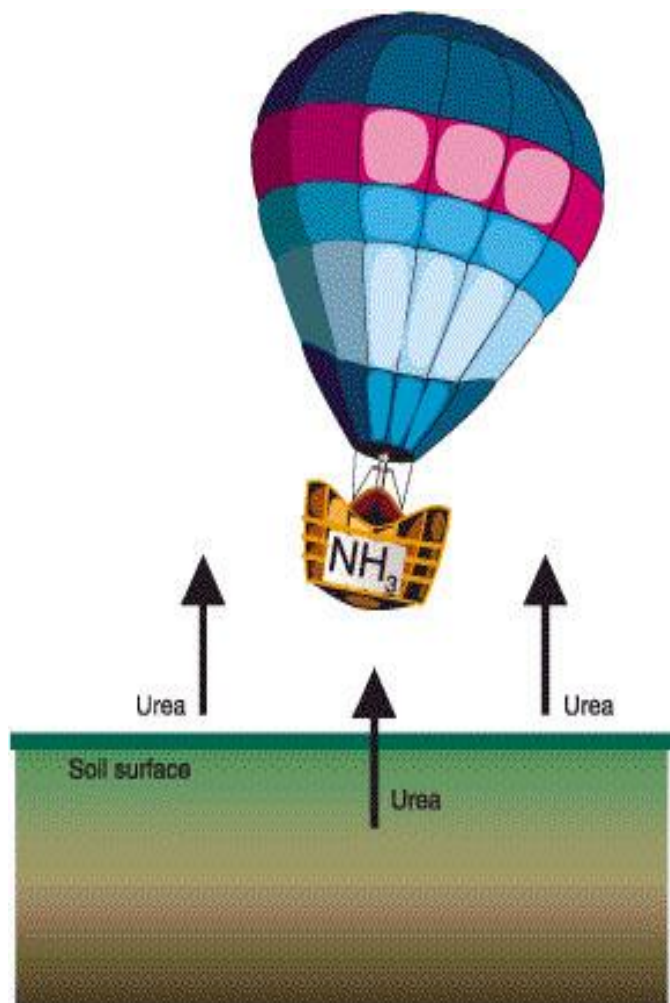
Amendment	%N	% PAN, Season DW Basis	PAN, Season Lb. N/100 lb. “As Is”
Chilean nitrate	16	75	12
Feather meal	13	75	10
Blood meal	12	75	9
True Organic	12	75	9
Fish meal	10	75	8
Meat & bone	7	75	5
Soy meal	7	75	5

Org. Fertilizer Calculator

PAN of Selected Organic N Fertilizers

Amendment	%N	% PAN, Season DW Basis	PAN, Season Lb. N/100 lb. “As Is”
Perfect Blend	7	75	5
ProNatural	5	67	3.3
Ch. manure dried	4	56	2.2
Bone meal	3	32	1.0
Nutri-Rich	4	10	0.4
Comp. manure	1.5	10	0.2

Volatilization



% of N Retained

Application Strategy: Incorporation...	Poultry manure	Other manure
The same day	0.75	0.50
Within 1 day	0.50	0.40
Within 2–4 days	0.45	0.35
Within 5–7 days	0.30	0.30
After 7 days/none	0.15	0.20

Courtesy T. DuPont

Fertilization Summary

- Compost important to add
 - At least every other year
- Fertilizer choice depends on need and cost
- Price materials based on \$/lb. N
- Consider PAN
- Consider N contributions from previous years
- Avoid fall & winter applications

Topics to be Covered

- Organic fertilization (Focus on N)
 - Manures and composts
 - Selected composts, manures, and fertilizers
 - Practices and considerations
- **Weed management**
 - **Pre- and post-plant considerations**
 - In-row weed management
- Trial results

Weed Management Before Planting

Chemical approaches before organic certification

- 3-year transition – can certify before the first or second harvest
 - e.g., glyphosate on field bindweed, fumigate for nematodes or replant disease
- Makes weed control by organically-approved means more effective and less expensive later

Weed Management Before Planting

Organic approaches

- Reduce weeds through repeated tillage
 - Irrigate and germinate, then till or flame
 - Mainly annual weeds, not as good on perennials
 - nutsedge, field bindweed, bermudagrass, etc.
- Soil solarization in the planned tree rows

Cultivation

- Best when weeds are small (< 4 in.)
- Do not cultivate wet soil
- Dry conditions after cultivation help to prevent re-rooting

Topics to be Covered

- Organic fertilization (Focus on N)
 - Manures and composts
 - Selected composts, manures, and fertilizers
 - Practices and considerations
- **Weed management**
 - Pre- and post-plant considerations
 - **In-row weed management**
- Trial results

In-Row Weed Management

- Shallow in-row cultivation/mowing
- Mulches
- Flaming
- Hand hoeing
- Weedeaters – Potential trunk damage
- Organically acceptable herbicides
- Cross disking
- Cross mowing
- Bio-control (animals)

In-Row Mechanical Weed Control

- Cultivators
 - Wonder Weeder
 - Hydraulic arm retraction:
 - Weed Badger, Kimco cultivator, etc.
- Mower

In-Row Cultivation

- Disturbs soil to uproot weeds
- Allows incorporation of amendments, fertilizers
- Disrupts rodent tunnels
- May injure tree roots or root flare/crown
- Drip/microsprinkler lines raised

Wonder Weeder

- Cultivator heads operate by rolling on ground
- 2-3" tillage depth
- Shear bar moves weeds and soil
- Cuts some tree roots
 - May weaken young trees?



Courtesy: D. Granatstein

Wonder Weeder

Shear bar removed for new trees



Courtesy: D. Granatstein

Weed Badger and Kimco Cultivator

- Rotating tines
- Greater depth than WW
 - Rodent tunnels
- Moves into row center
- More moving parts than Wonder Weeder
 - more maintenance?



Mowing

- Avoids soil disturbance
- Weeds remain
 - Compete with trees
 - Vole habitat



Mulches

- Act by blocking light to weeds
- Numerous organic and synthetic materials
- Mostly fabric/plastic or wood chips

Landscape Fabric



Landscape Fabric

- Expensive, but cost spread over...5-10 years?
- Labor intensive to install
- Can pull back annually
 - Remove debris, weeds on top
 - Add compost
- Mower may rip it
- Party time for voles



Voles Thrive Under Fabric



Wood Chip Mulch



Wood Chip Mulch

Good control of annual weeds if thick enough



Wood Chip Mulch

- 2" to 5" depth
- Reapplication every 1-3 years
- Requires front loader and spreader
- Harbors fewer rodents than fabric
- Adds OM, slow-release nutrients

Propane Flamer

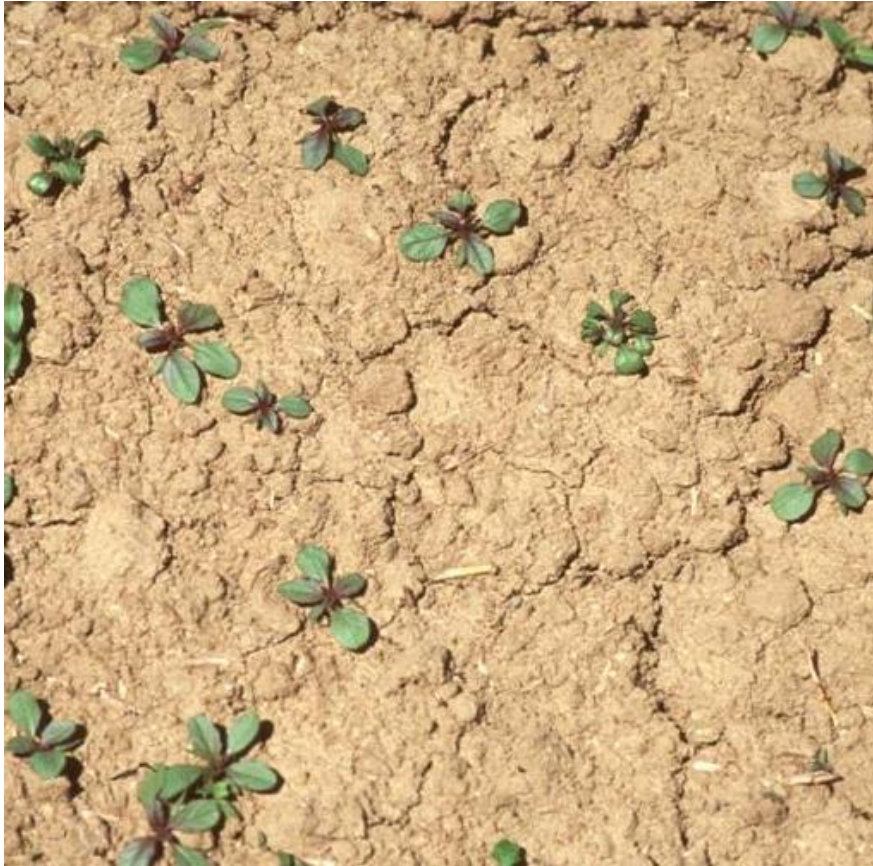
- Kills weeds like a contact herbicide
 - Dessicates leaf cells
- Best on young broadleaf weeds
- Avoid young trunks, drip lines
- Worker safety & fire concerns



practicalfarmers.org

Propane Flamer

Just prior to flaming



5 min. after flaming



T. Lanini

Propane Flamer

10 min. after flaming



T. Lanini

Organic Herbicides

- Acids
 - Weed Pharm (acetic acid)
 - Suppress EC (caprylic/capric acids)
- Essential Oils
 - Avenger AG (citrus oil)
 - GreenMatch EX (lemon grass)
 - Matran EC (clove)
 - WeedZap (clove & cinnamon)
- Others?

Organic Herbicides

- Nonselective, contact only
- Young weeds only
- Good spray coverage is essential – 70 GPA
- Work better in warm weather (25°C)
- Organic adjuvants improve weed control
- Repeat applications needed for larger weeds
- May control weed escapes in mulches

Prevention

- Avoid letting weeds go to seed
- Do not let weeds come in on equipment

Weed Management Summary

Method	Advantages	Drawbacks
In-row mowing	Fast, cheap	Weed competition
Wonder Weeder	Uproots weeds, incorporate amendments	Cuts tree roots
Weed Badger	Same, but generally deeper	Slower, problem with rocks
Fabric mulch	Effective, fairly long lasting (5-10 years)	Expensive, weed growth on top, easily ripped, rodents, disposal
Wood chips	Fairly effective, adds OM	Must re-apply, N tie-up, perennial weeds not controlled
Flamers	Quick, good on young annual broadleaves	Grasses not controlled, timing critical, safety concerns
Org. herbicides	Could control weed escapes	Generally ineffective, expensive

Topics to be Covered

- Organic fertilization (Focus on N)
 - Manures and composts
 - Selected composts, manures, and fertilizers
 - Practices and considerations
- Weed management
 - Pre- and post-plant considerations
 - In-row weed management
- **Trial results**

Finding Cost-Effective Weed and Nutrient Management Practices in Organic Pear Orchards

(Funding: OFRF, Calif. Pear Advisory Board)

Chuck Ingels, UCCE Sacramento County

Tom Lanini, UCD Plant Sciences Dept.

Karen Klonsky, UCD Ag. & Resource Economics

Ken Shackel, UCD Plant Sciences Dept.

Chris Frieders, Joe Green Ranch (Grower Cooperator)

Experimental Methods

Trial Started Oct. 16, 2008

- Bosc, 18' x 10', planted 2001
- RCB design, 7 treatments, 5 reps
- Plot size: 6 trees/rep

Treatments

- | | | |
|---------------------|--------------|---------|
| 1. In-row mowing | no N | |
| 2. In-row mowing | manure | 2 T/A |
| 3. In-row mowing | manure | 4 T/A |
| 4. In-row mowing | feather meal | 0.5 T/A |
| 5. Landscape fabric | manure | 4 T/A |
| 6. Wood chips | manure | 4 T/A |
| 7. Herbicide strip | manure | 4 T/A |

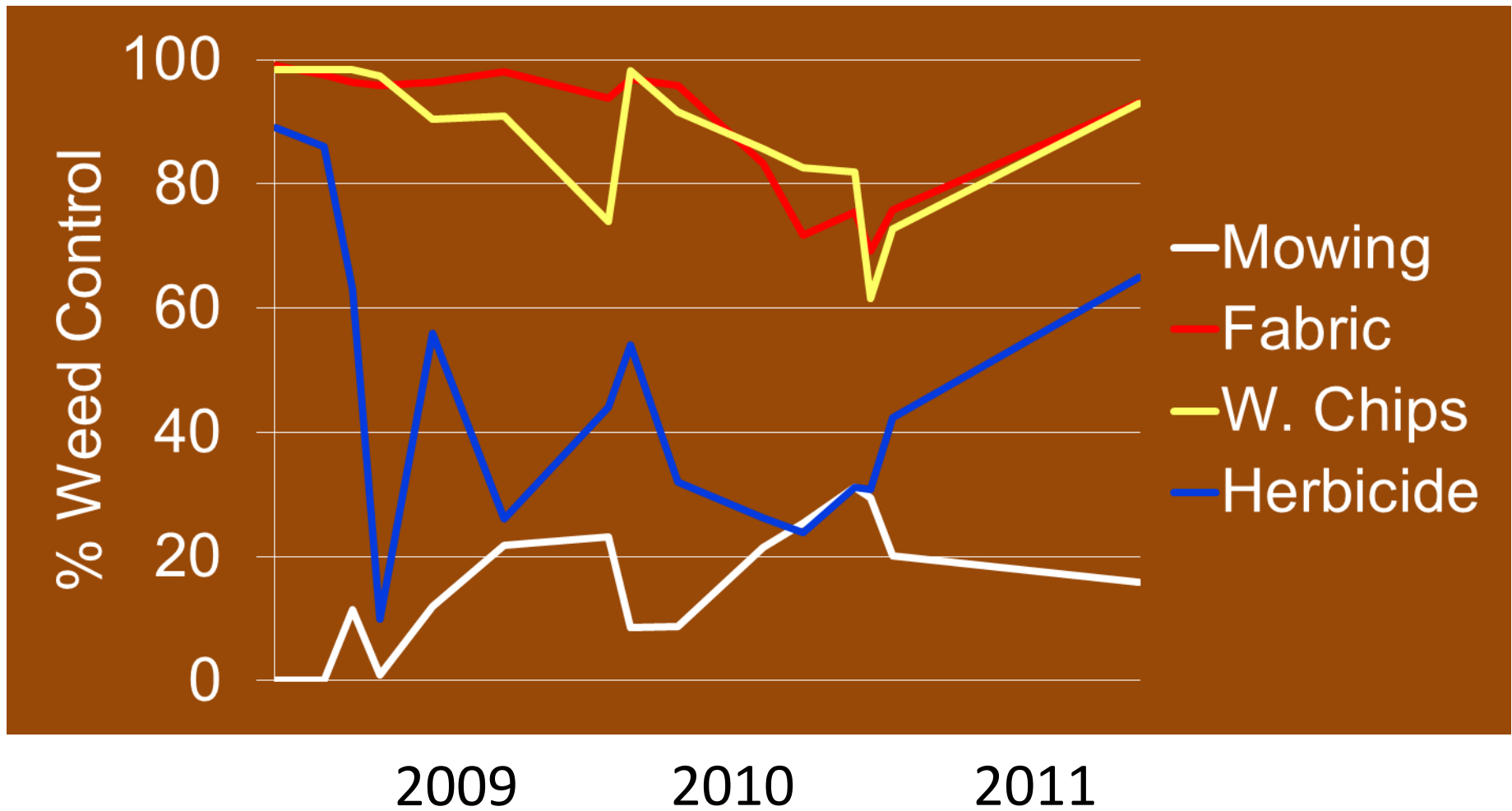
- **No incorporation**

Selected Results – 2009-11

Few or no significant differences for these

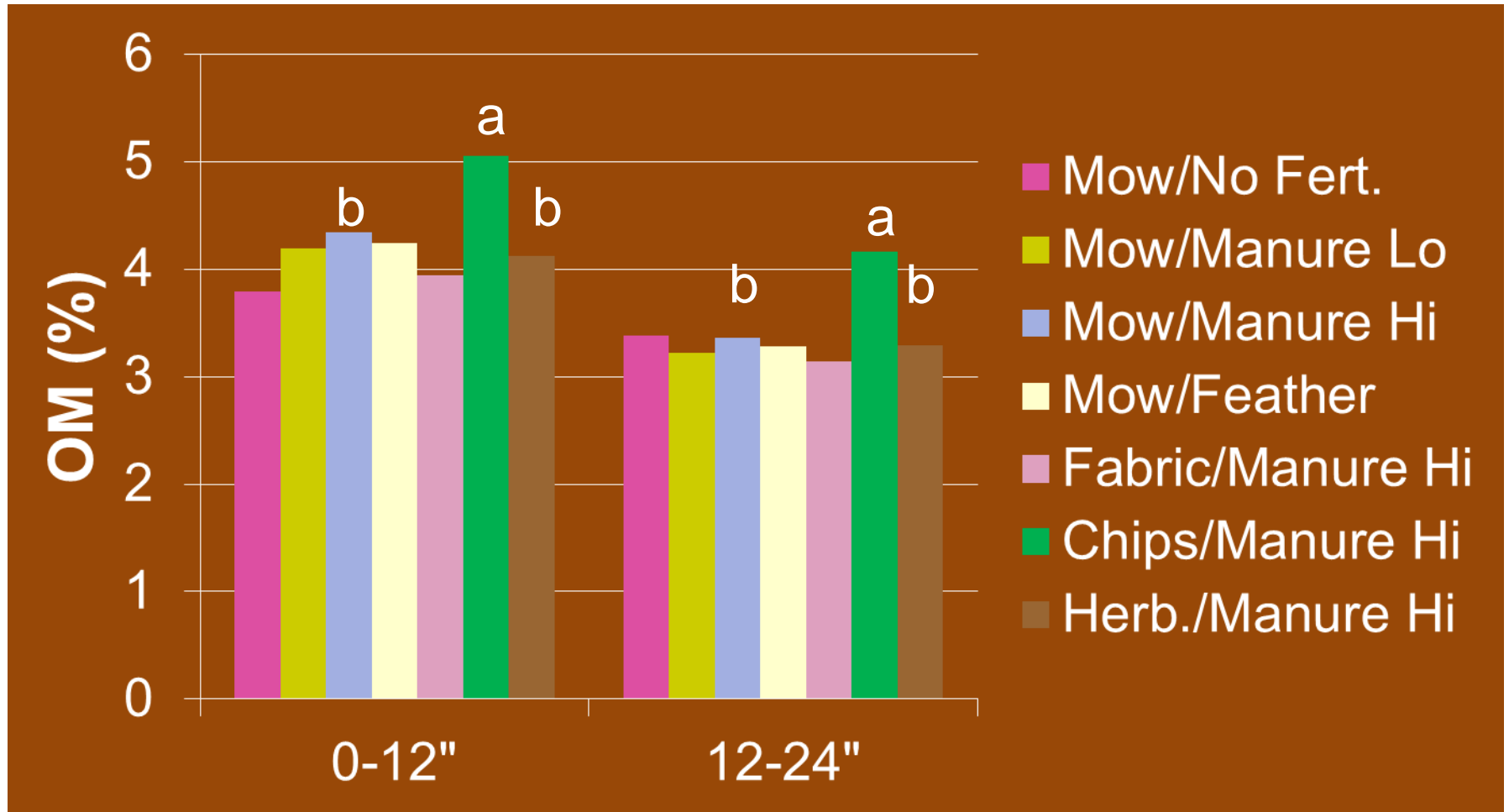
- Yield (30, 26, 39 T/A)
- Fruit diameters (2.8, 2.7, 2.5 in.)
- Trunk cross-sectional area
- Leaf K, Ca, Mg content
- Soil N

% Control of Weeds



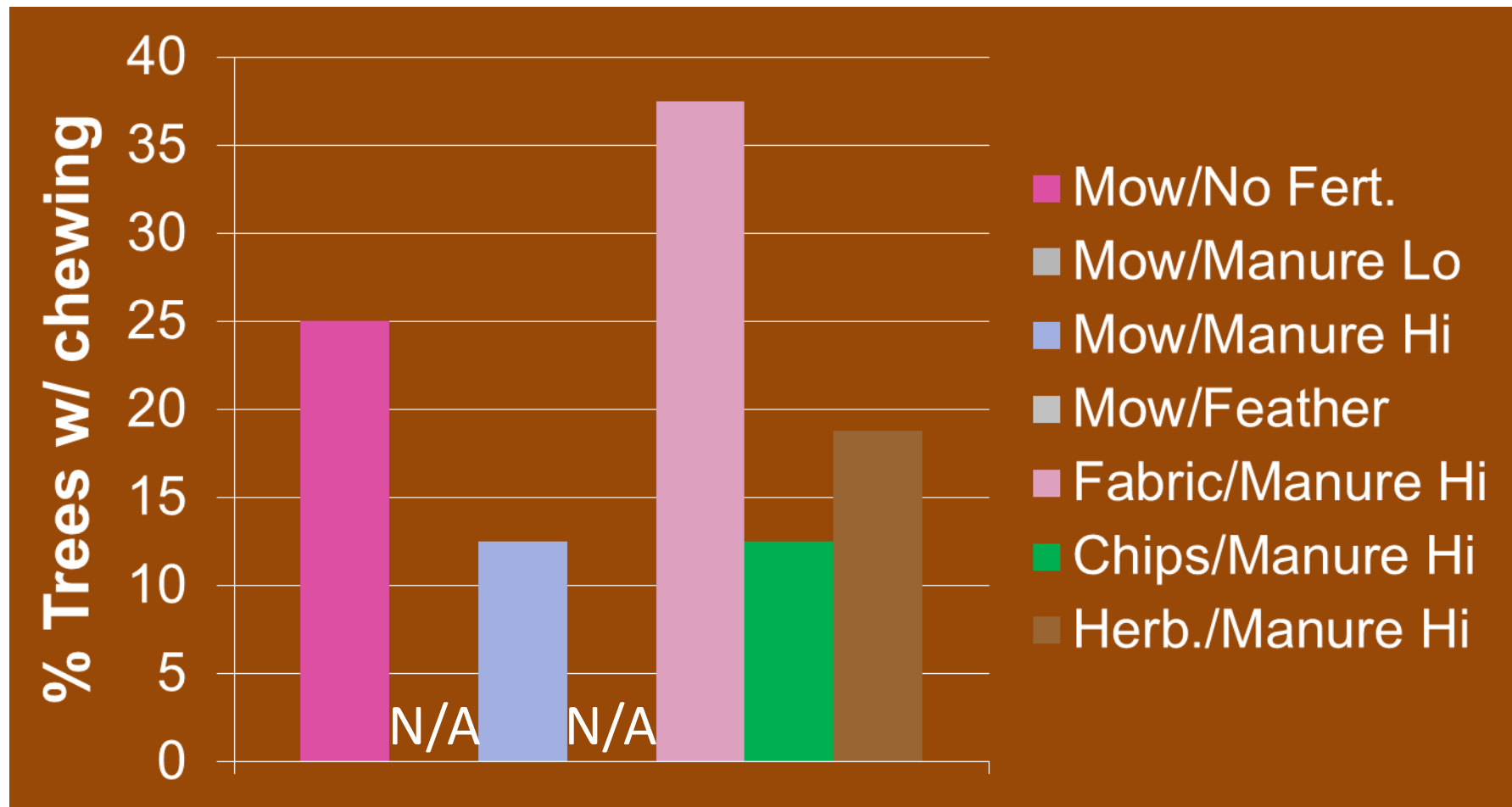
Soil Organic Matter Content

2011



Vole Damage

2011



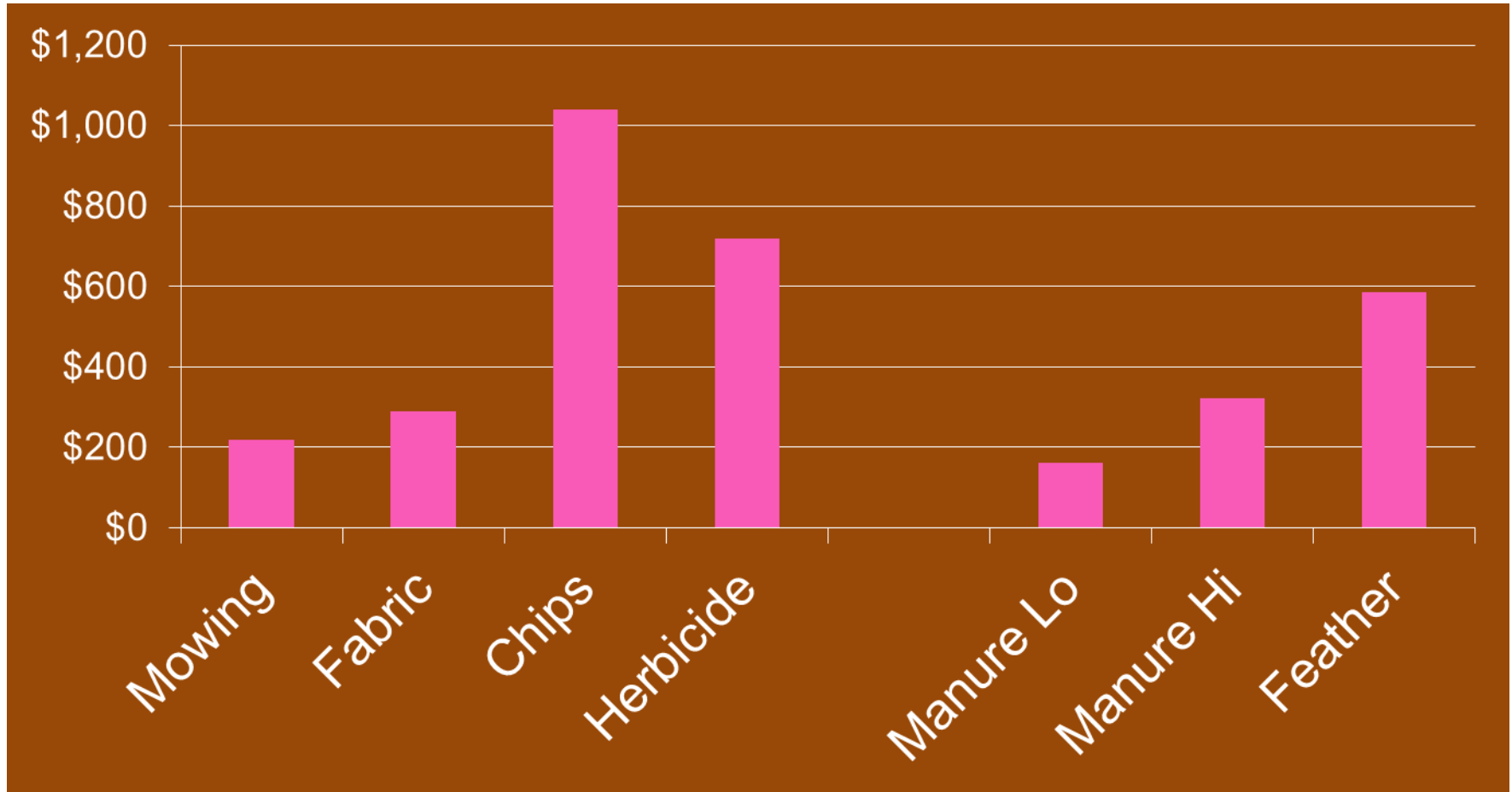
Economics

Assumptions Used

- In-row mowing 5 times per yr. (2 passes)
- GreenMatch herbicide applied 5 times
- Wood chips – Year 1: 6 in., Year 2: 3 in.
- Fabric longevity: 8 yrs.
- Chicken manure – 2 vs. 4 T/A
- Feather meal – 0.5 T/A

Economics

Total Costs/Acre/Year



Thank you! Questions?

cesacramento.ucanr.edu

