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Optimizing Understory Management in Northwest Orchards

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Center for Sustaining Agriculture & Natural Resources

TOPICS

- Introduction
- Weed control
- Mulching
- Soil impacts
- Rodents, bugs
- Summary

Photo: B. Barritt

PNW Tree Fruit

- National leader in organic apple, pear, cherry
- Orchards reliant on irrigation water from snowpack; global warming influence
- Weed control, tree nutrition are costly in organic systems
- Downward pressure on price, need to cut costs
- Must maintain or improve soil quality – NOP
- Goals for understory management – control weeds, provide N, conserve water, improve soil, enhance biocontrol, reduce costs, ease of management

Orchard Floor Options

Tillage – costly in young orchards; can degrade soil quality

Flaming – uses fossil fuel; potential tree injury

Inert mulches (e.g. wood chips, fabric) – costly to apply; availability?

Living mulch, cover crops – competition with tree, rodents

Organic herbicides – e.g. acetic acid, clove oil, Brassica meal – marginal effectiveness; costly

How to combine strategies? Change system with the age of the orchard?

Weed control (WW) trial 2004-2005

- 6 treatments, 5 reps: control (mow), wood chip mulch, Weed Badger, Wonder Weeder (2x, 3x, 4x)
- Less tree growth with tillage; more tree leaning?
- No clear soil quality impacts
- Wood chip mulch increased fruit size, increased gross fruit value ~$600-3000/acre over WW 4x, cost ~$900/acre to apply
- Wonder Weeder 440'/min vs. Weed Badger 20'/min
- Tillage provides adequate weed control, but stimulates more seed germination

Weed Badger
20’/min

Wonder Weeder
440’/min

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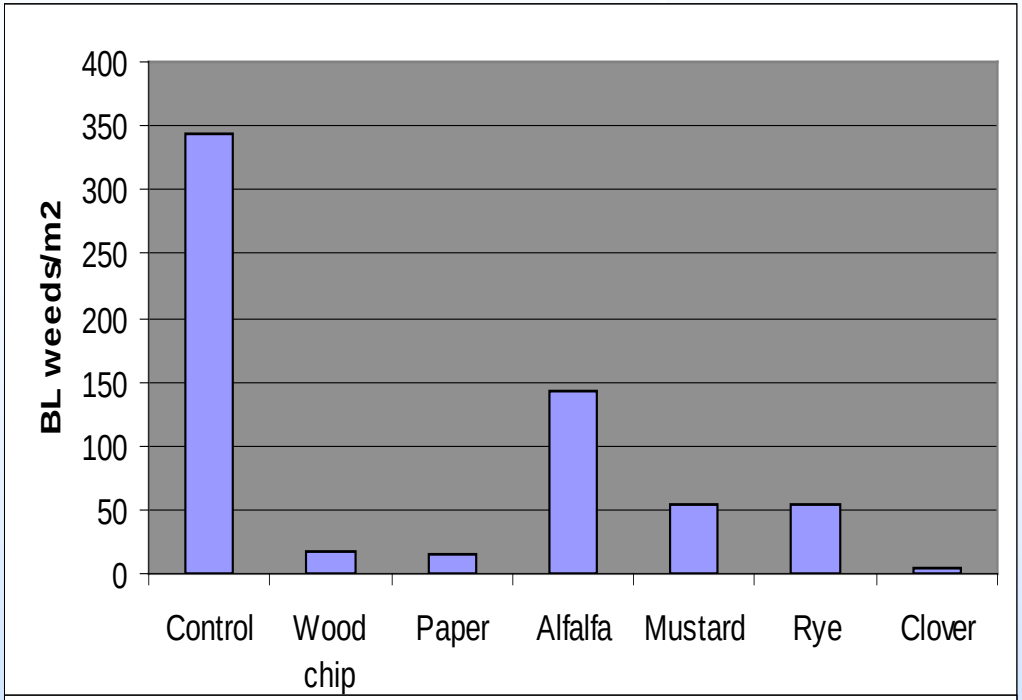
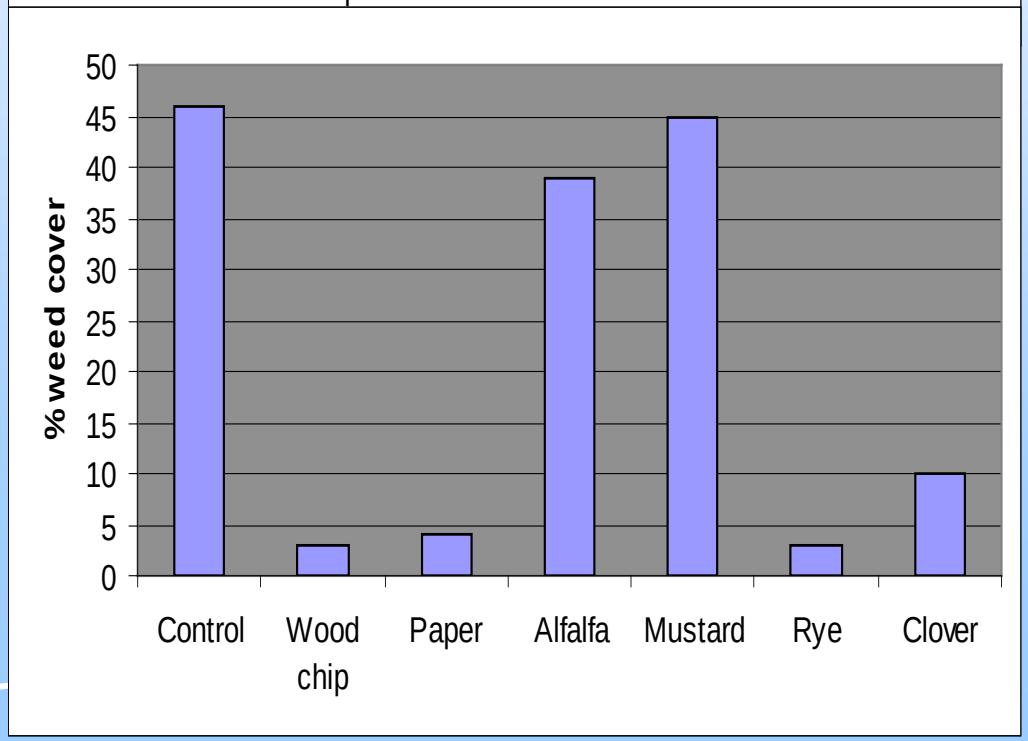
WVC Mulch Trial

Weed control by mulches – June 2000





Orchard Mulching Trials – Summerland, BC


Spray-on paper mulch

6th Leaf Spartan / M.9

	TCSA (mm^2)	Roots ($g/0.018m^3$)	Yield (kg/tree)
1. Check (glyphosate)	1011 b	11.3 c	10.3 c
2. Biosolids (Vancouver)	1052 b	16.9 bc	11.2 bc
3. Paper mulch	1565 a	28.7 abc	13.0 ab
4. 2 + 3	1490 a	41.8 a	13.9 a
5. Composted biosolids + 3	1406 a	38.7 a	14.9 a
6. Alfalfa hay	1203 b	35.2 ab	14.0 a
7. Geotextile	1125 b	19.1 bc	12.7 abc

(Hogue et al., 2000)

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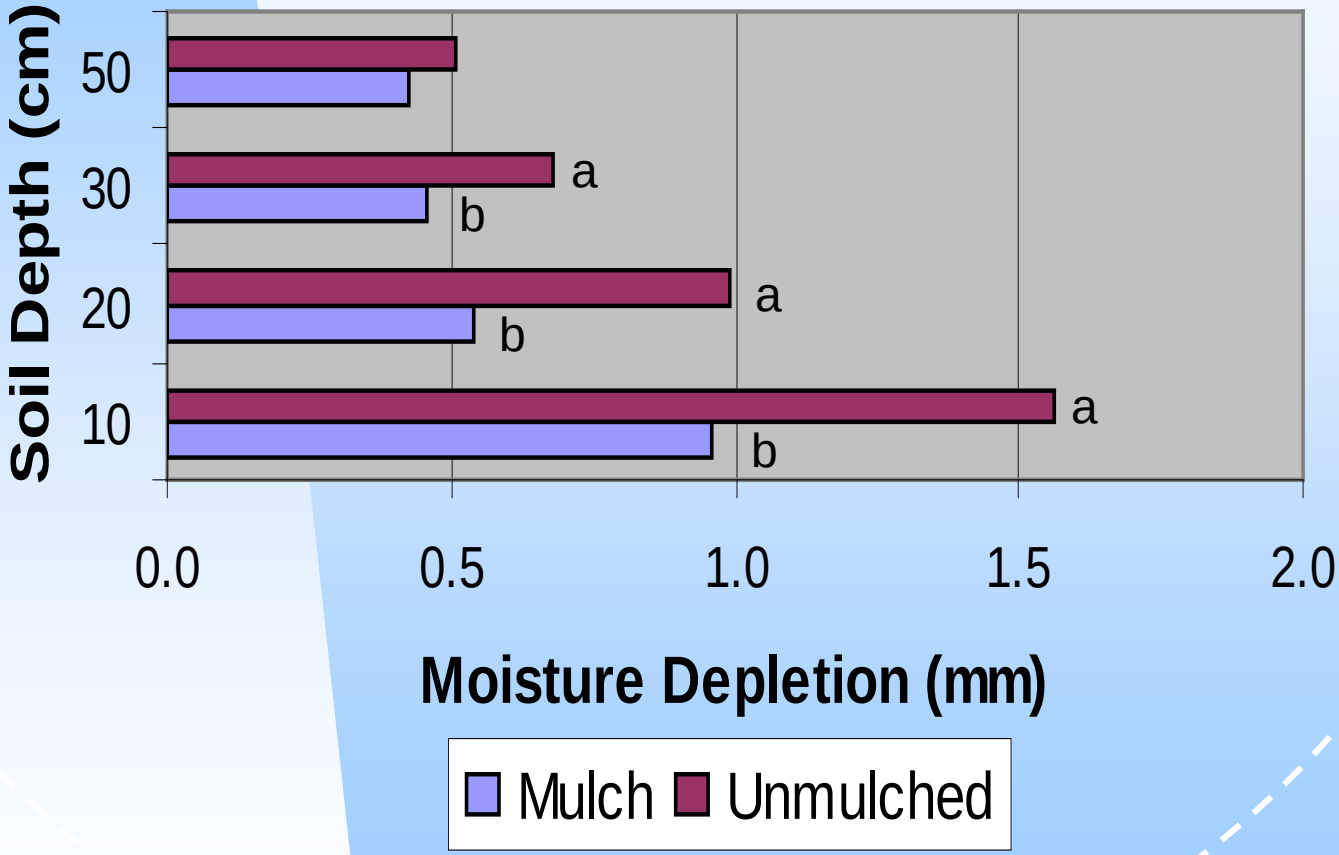
Effect of Orchard Mulching on Soil Moisture Depletion



10 cm: WC < Clover = Bare
30 cm: WC = Clover < Bare

Integrated mulch (IMM) trial

New planting: Pinata/M7

Goal: optimize weed control, soil quality, tree health

COVER / RHIZOSPHERE

DISTURBANCE

Control

WC mulch

Living mulch

Legume **Non-legume**

‘Sandwich’

Legume **Non-legume**

WW

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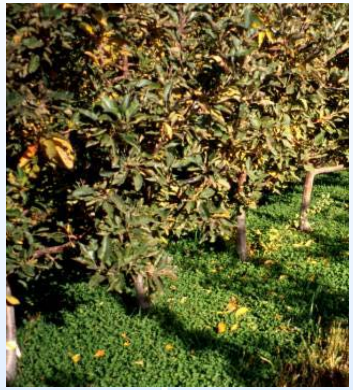
Integrated mulch (IMM) trial



New planting: Pinata/M7

Goal: optimize weed control, soil quality, tree health

COVER / RHIZOSPHERE →

DISTURBANCE ↓

Control 0 Control 1x Brassica 1x	WC mulch 1x, 1.5x	Living mulch Legume 0.5x, 1x
		Non-legume 0.5x, 1x, 1.5x

‘Sandwich’

Legume	Non-legume
1x	1x

WW 0.5x, 1x, 1.5x

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‘Sandwich’ system


Living mulch non-legume


‘Green islands’ from fertilizer injection


Subclover


Thyme

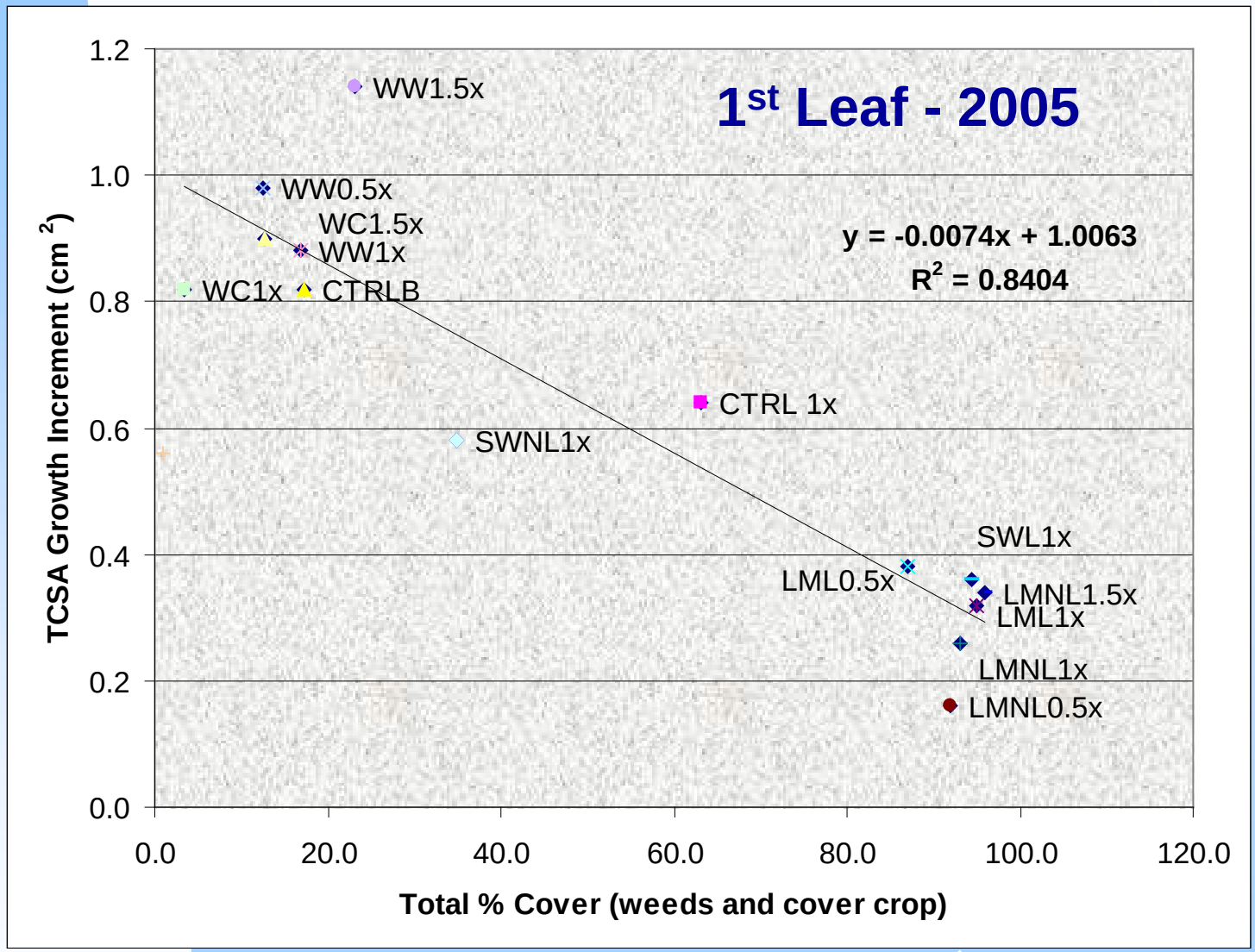

Alyssum


'Sandwich'
Woodruff
Mint

Living Mulch (LM) trial

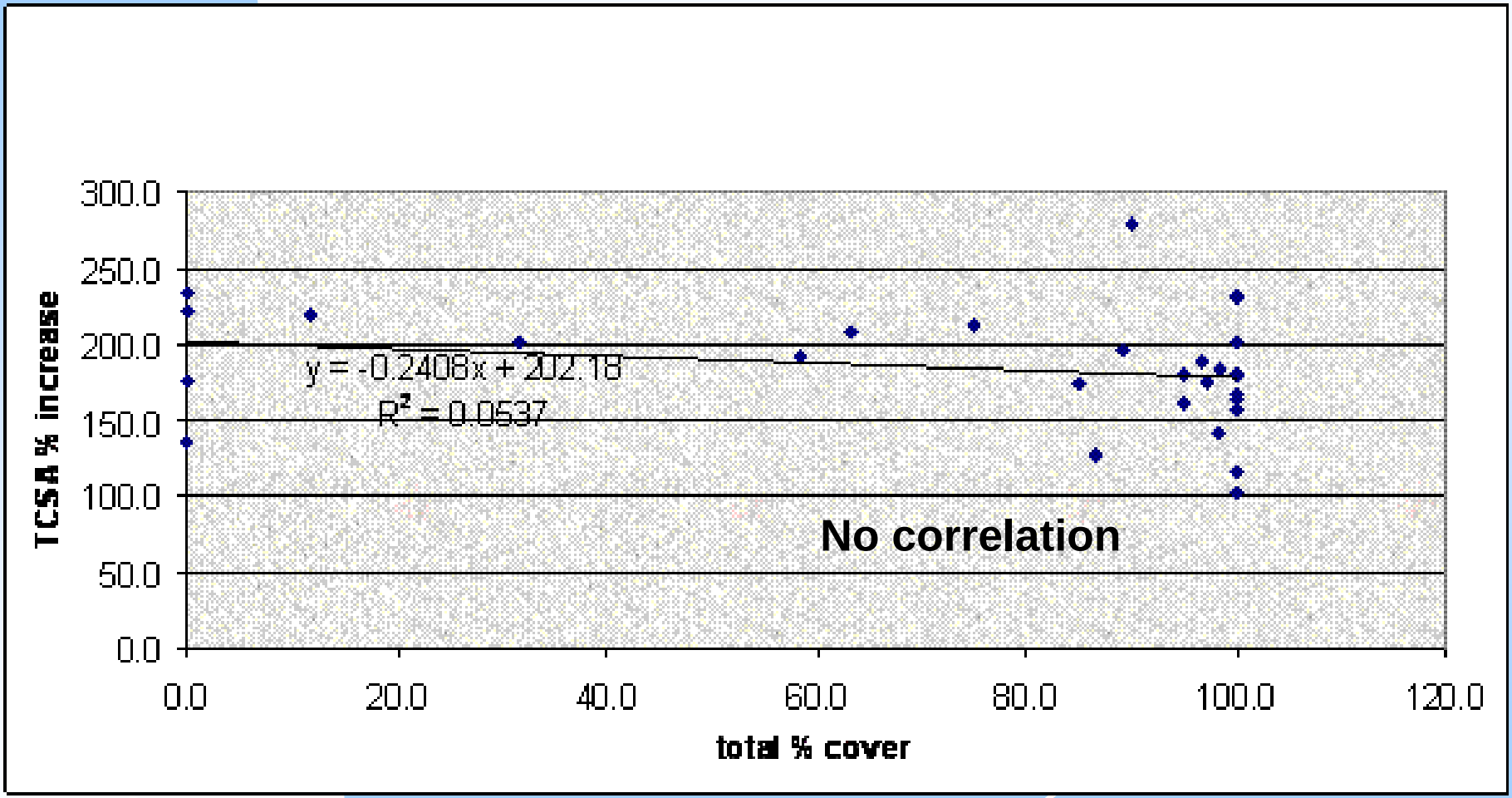
Perennials, biennials, annuals. 3 reps.
Original trial: 26 entries New trial: 32 entries

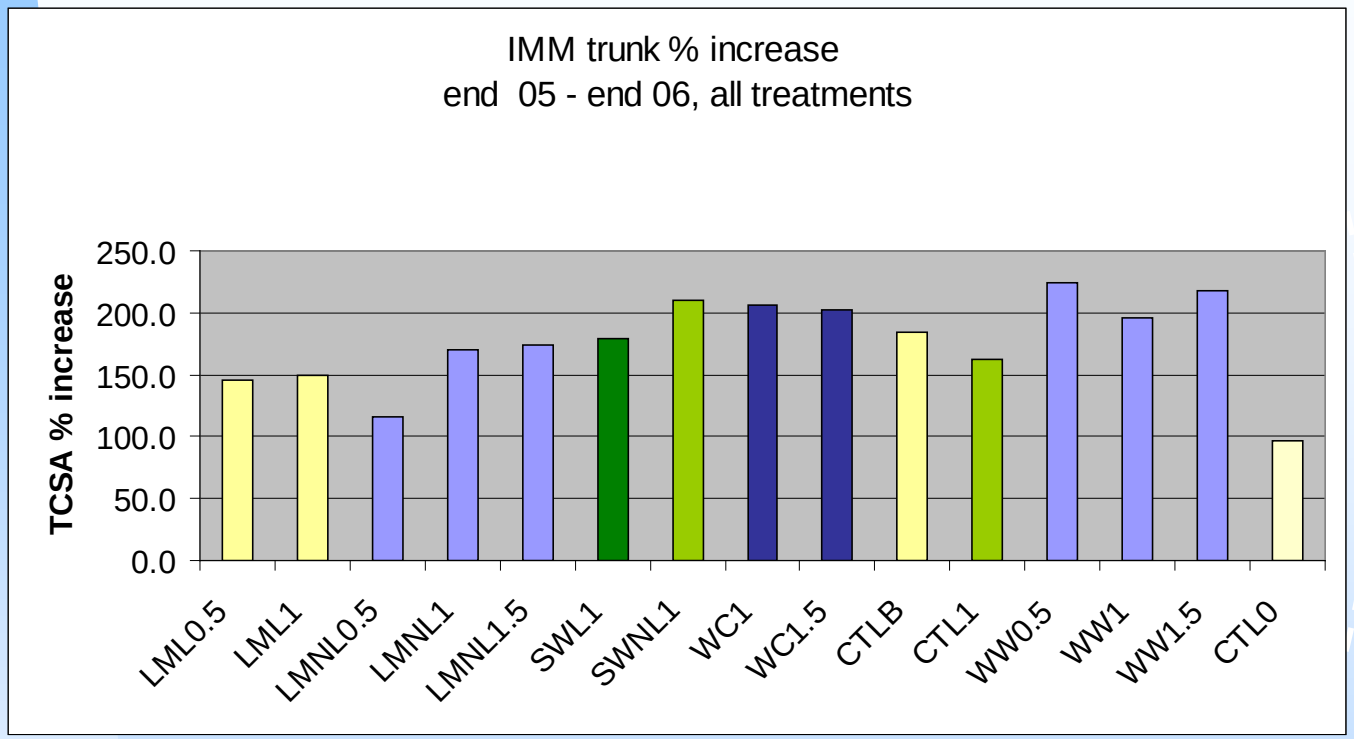
- **Better seed establishment in new planting**
- **Severe annual grass infestation in both trials**
- **Definite presence of voles; legumes, grass**
- **Bentgrass too competitive**
- **Adequate LM for weed control competes with young trees in Yr 1**

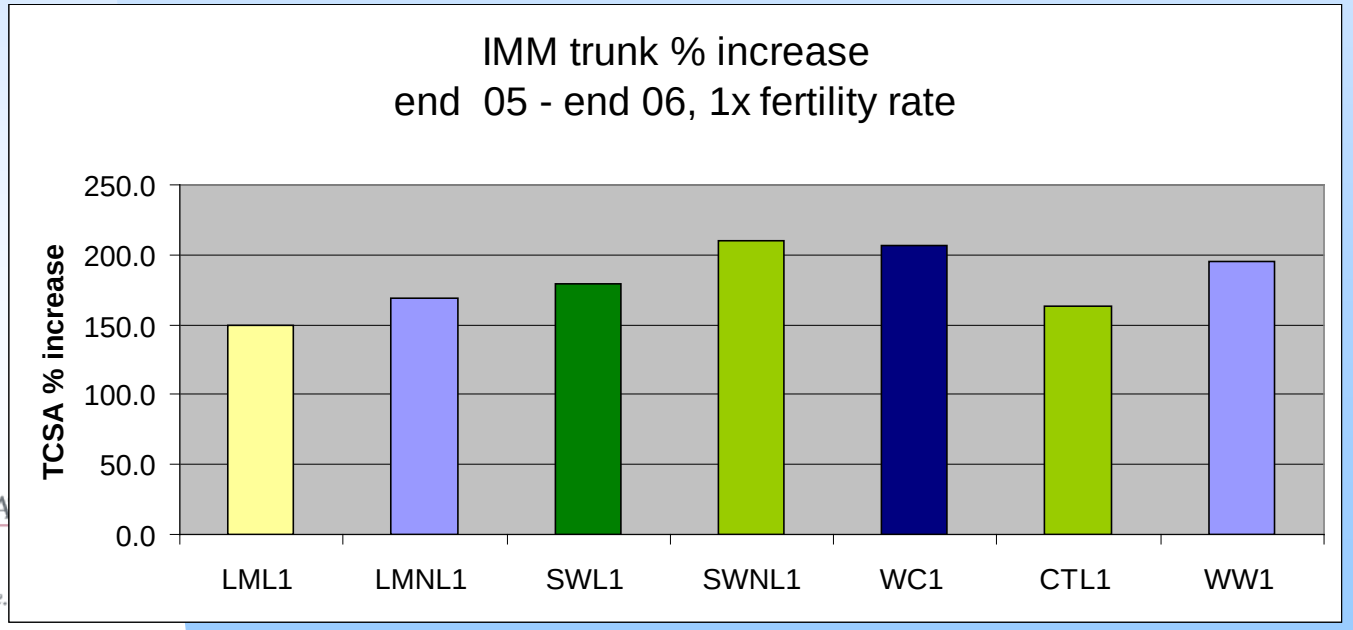


Correlation of TCSA growth increment (cm^2) and total understory competition (total % cover of weeds and cover crop).

2nd Leaf – TCSA vs. % cover







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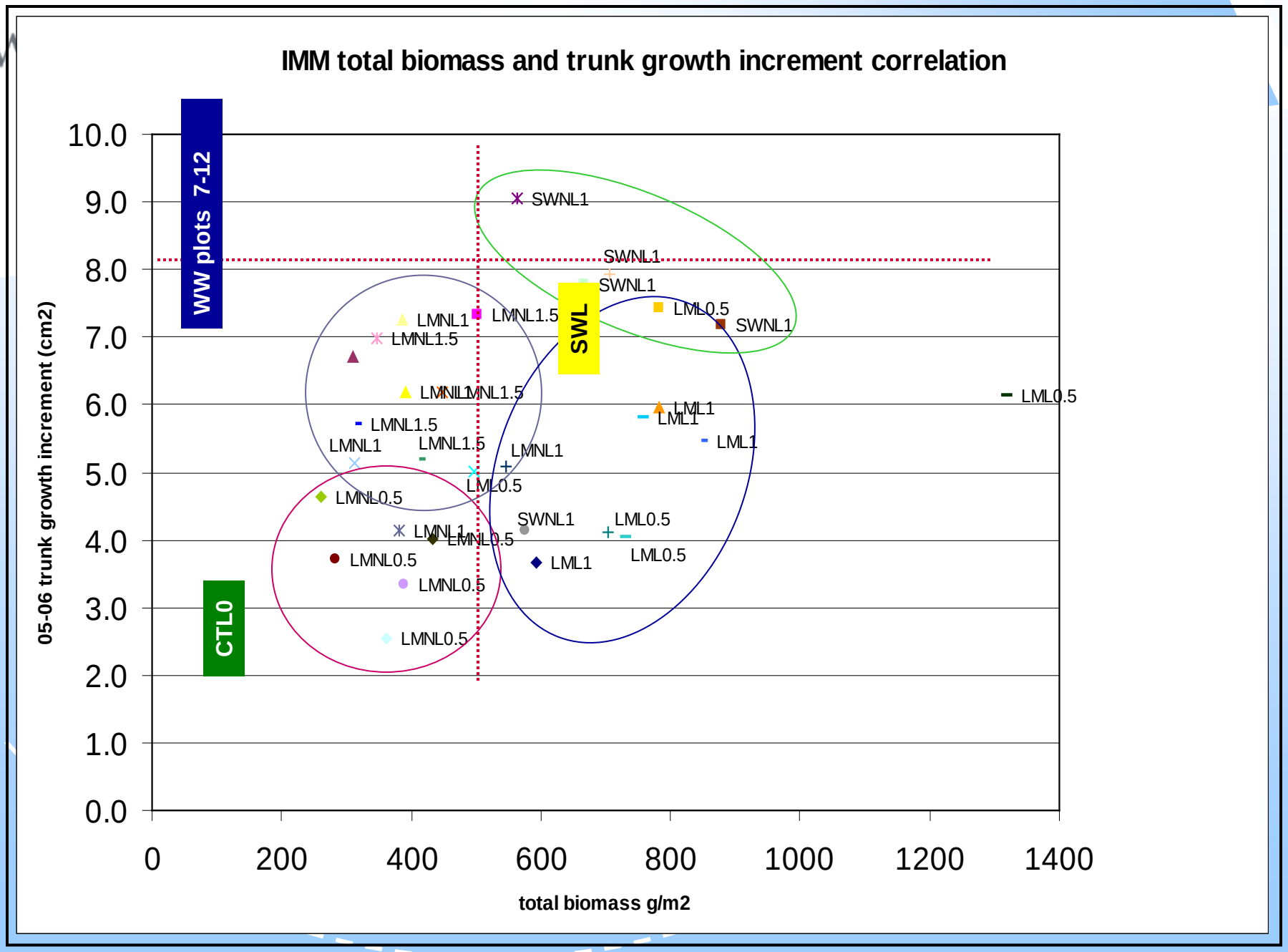
IMM total biomass and trunk growth increment correlation
WW plots 7-12
SWL
CTL0
05-06 trunk growth increment (cm2)
total biomass g/m2
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
200
400
600
800
1000
1200
1400
SWNL1
SWNL1
SWNL1
SWNL1
LML0.5
LML0.5
LMNL1
LMNL1.5
LMNL1.5
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LMNL1.5
LMNL1
LMNL1.5
LMNL1
LML0.5
LMNL0.5
SWNL1
LML0.5
LMNL1
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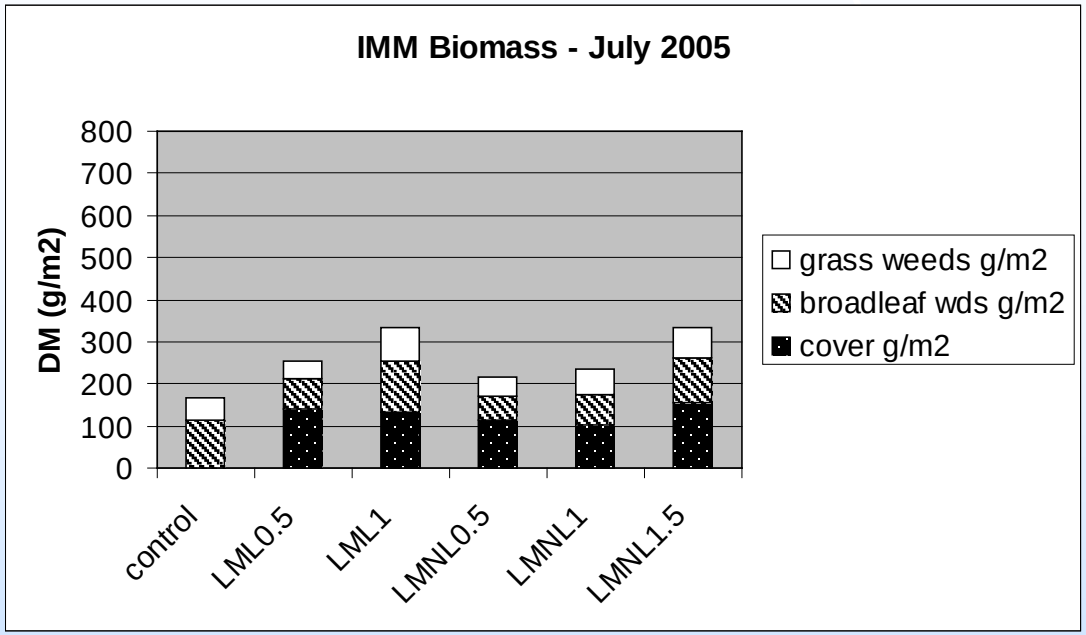
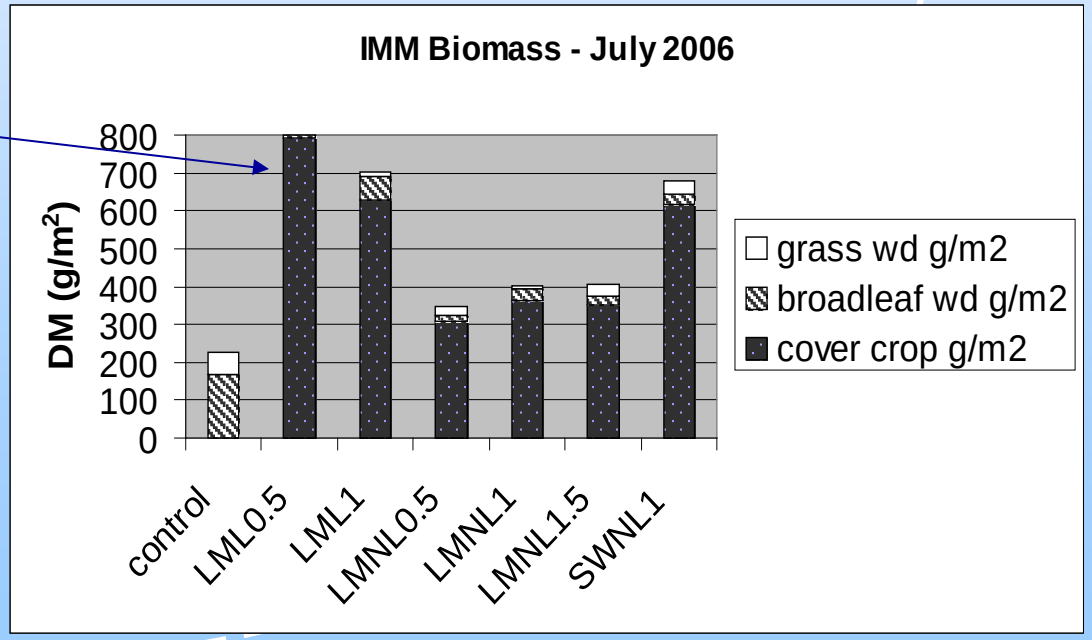
LMNL0.5

Living Mulch and Weed Dry Matter



~1.5T DM / ac; 55 lb N



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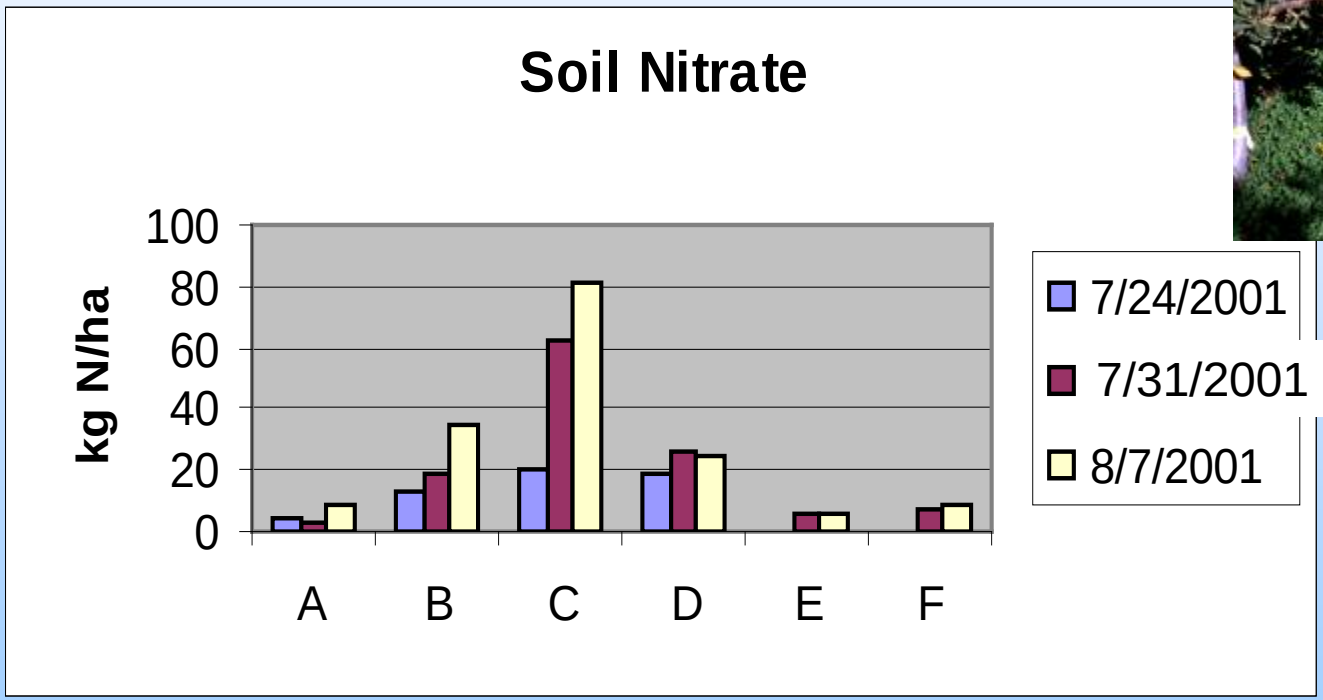
Grow Your Own N

Nitrogen release over 2 weeks from ambient soil with and without clover, root exclusion tubes, and tube covers.



46% of clover N mineralized

A – control plot; tube + cover; no clover

B – control plot; tube + cover; clover clippings added.

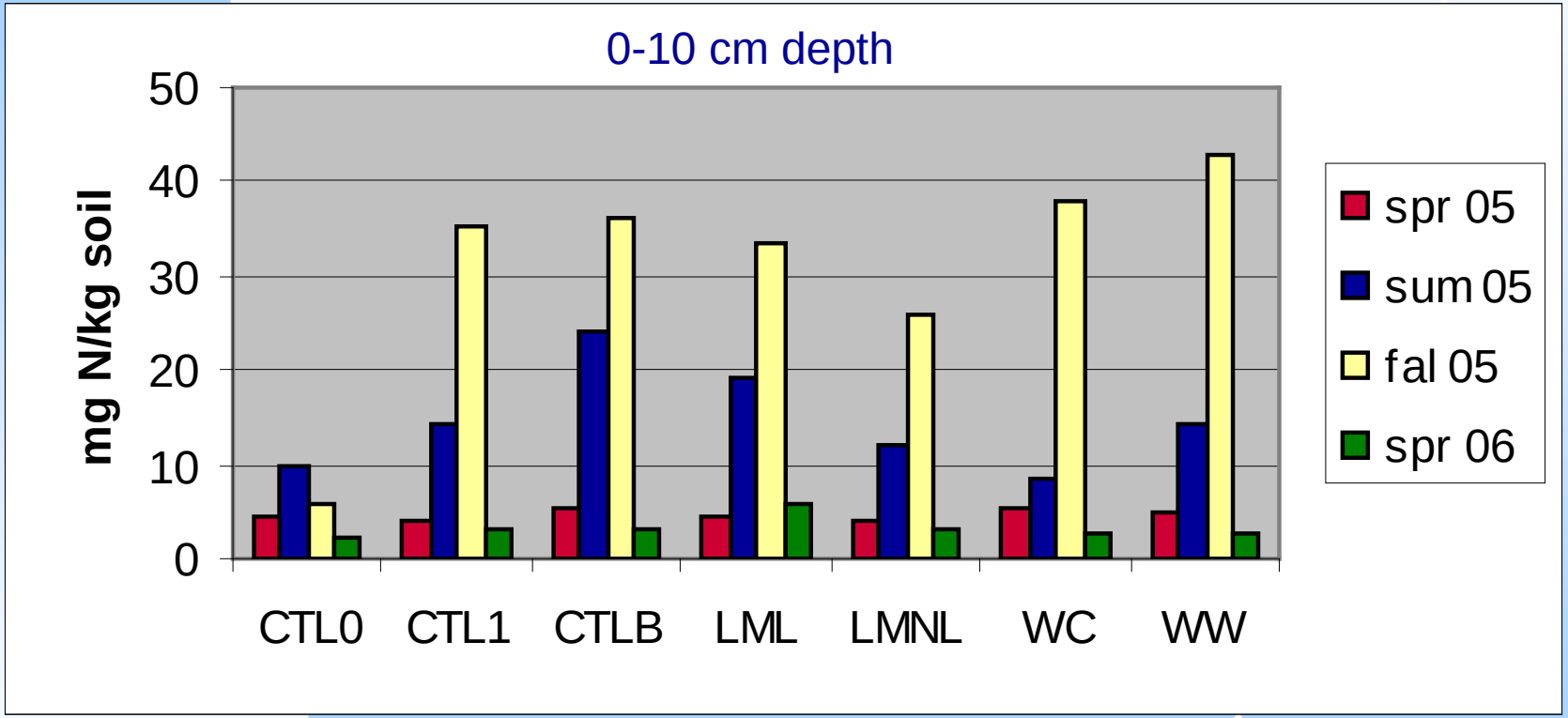
C – clover plot; tube + cover, clover clippings added

D – clover plot; tube – cover, clover clippings added

E – control plot; no tube

F – clover plot, no tube

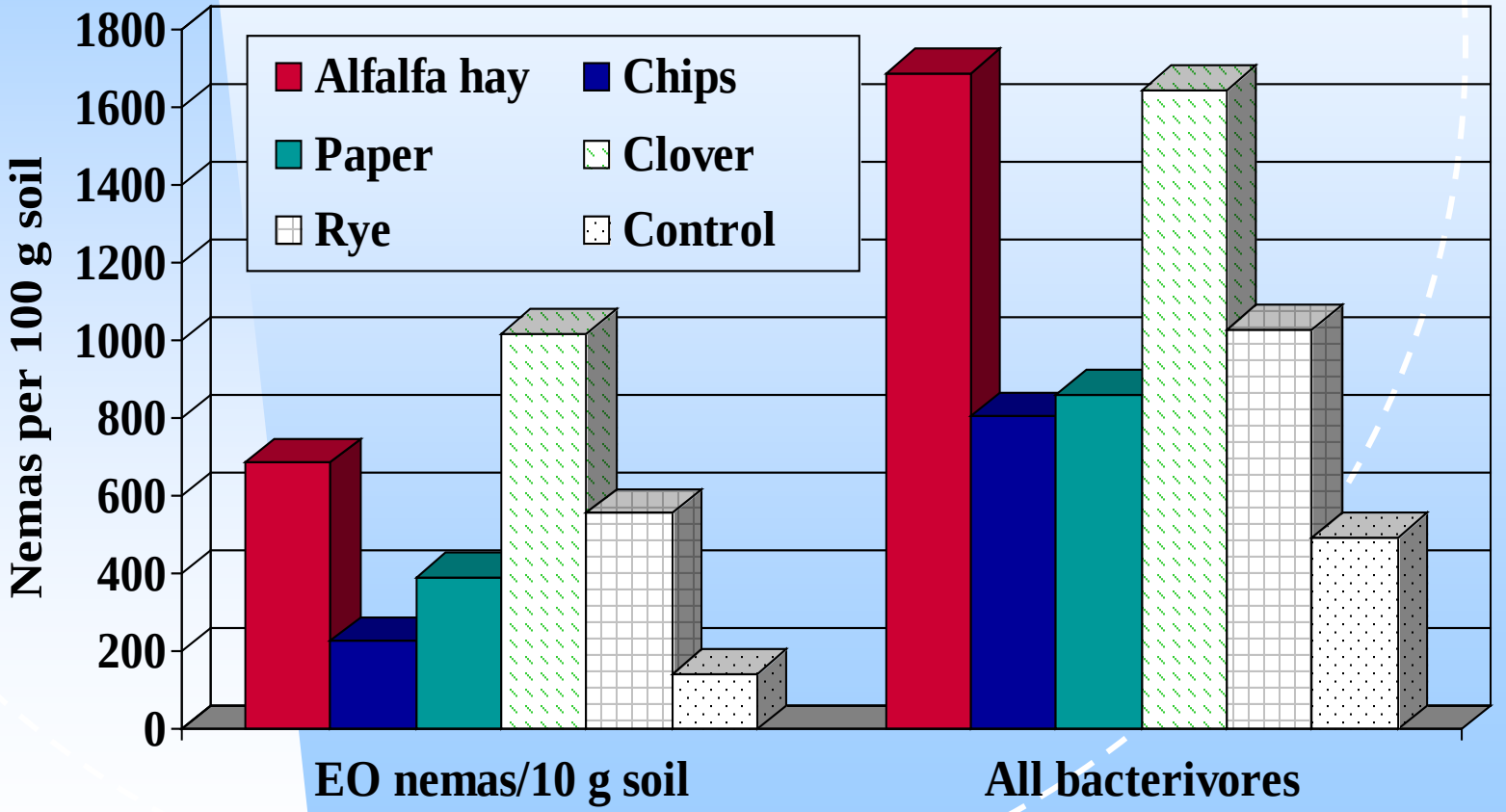
Soil Nitrate



(Courtesy L. Hoagland)

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Wenatchee Valley College:
Alfalfa mulch and clover cover crop increased indicators of enhanced nutrient turnover



(T. Forge, PARC)

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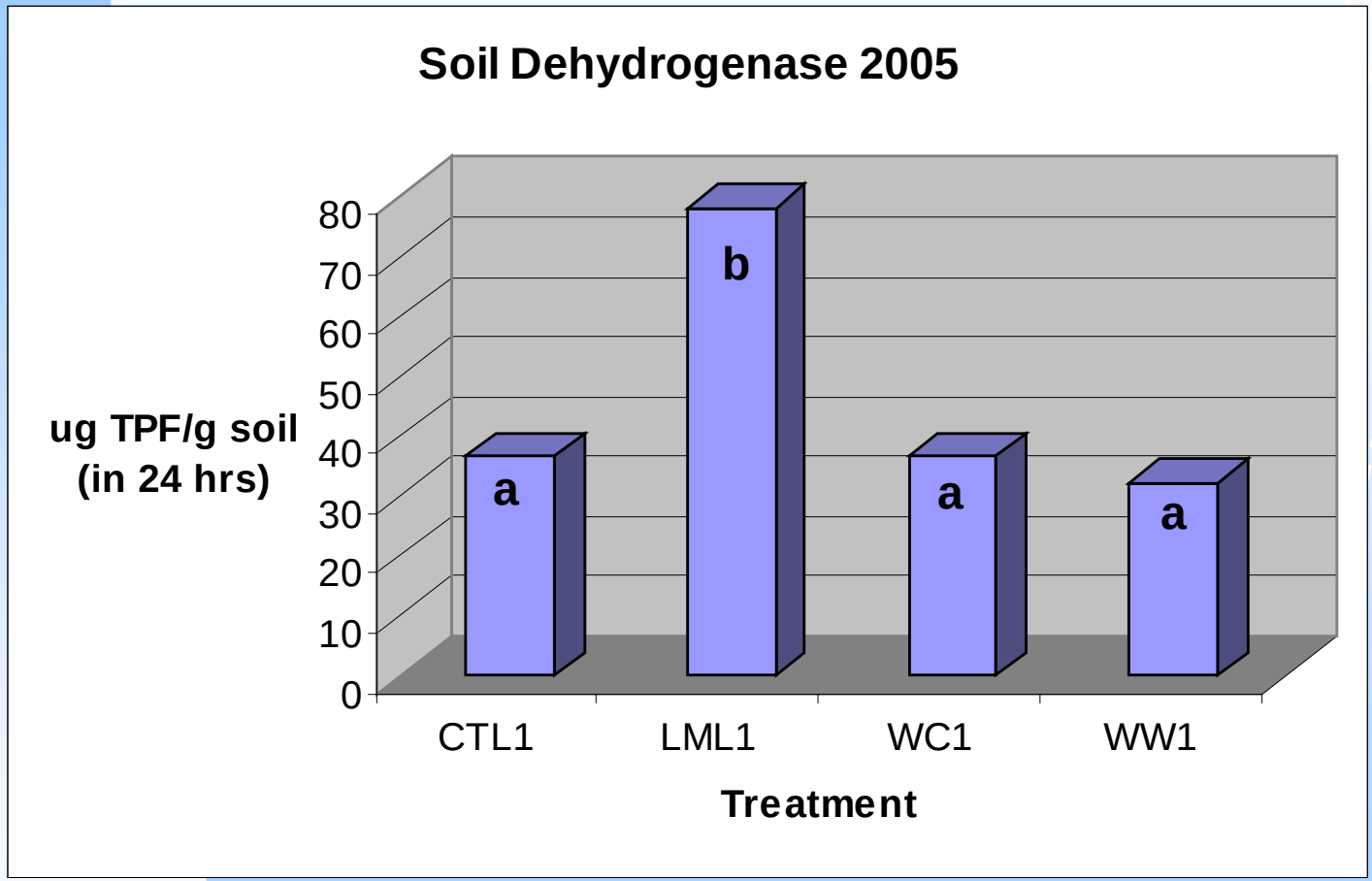
Soil Quality



CTL = control **LML = living mulch legume**

WC = wood chip mulch **WW = Wonder Weeder tillage**

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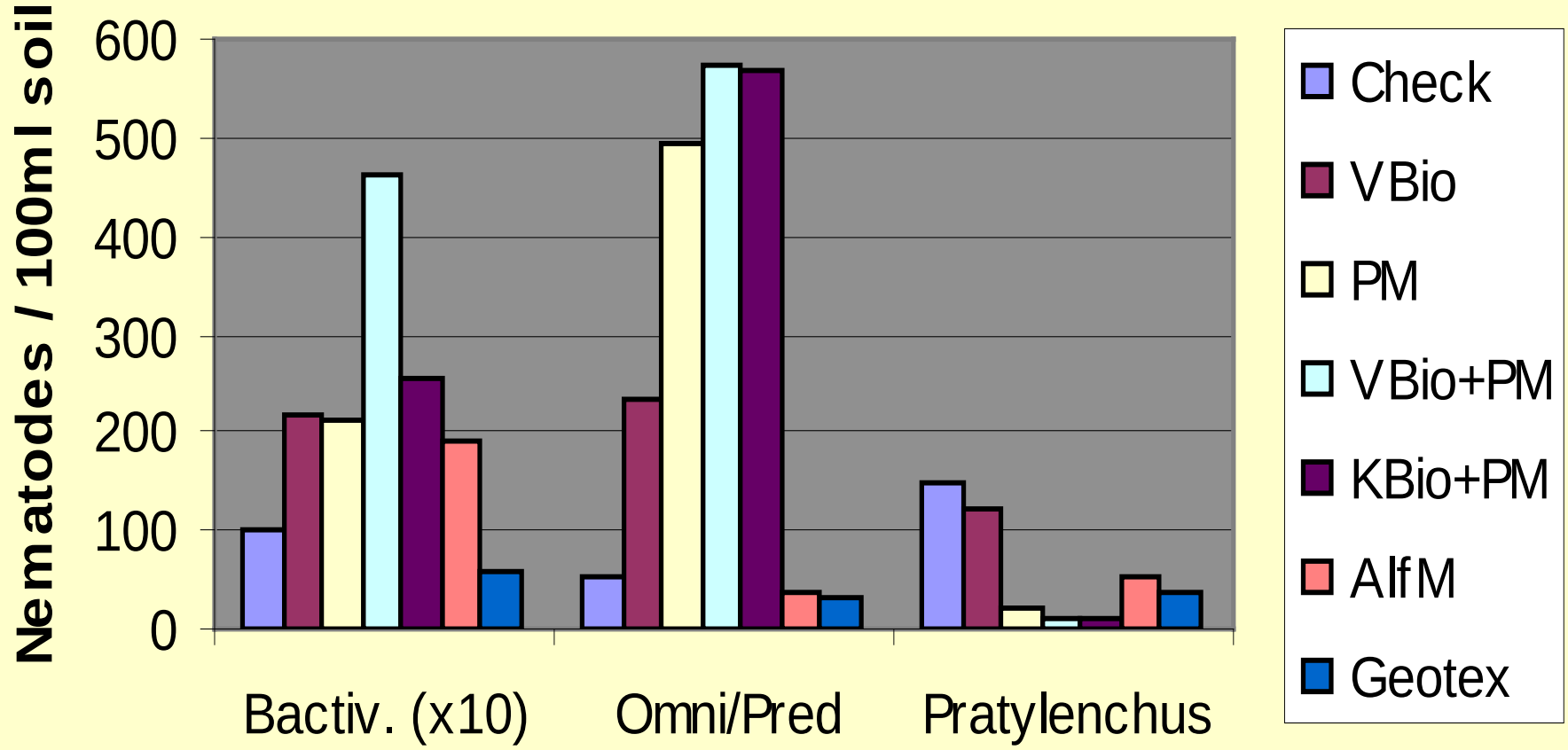
(Courtesy: L. Hoagland)

Effect of Mulches on Nematodes in Orchard Soil - Summerland, BC



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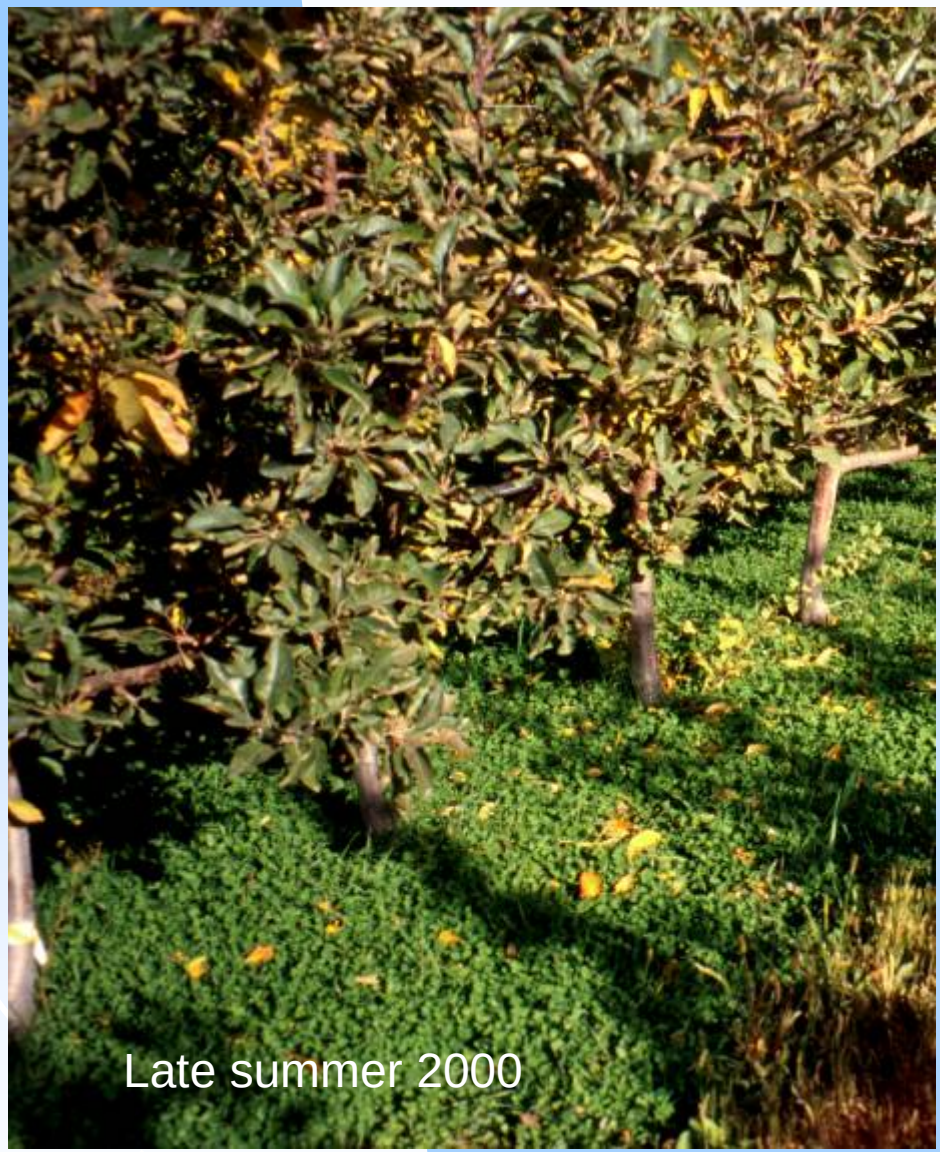
(T. Forge, PARC)



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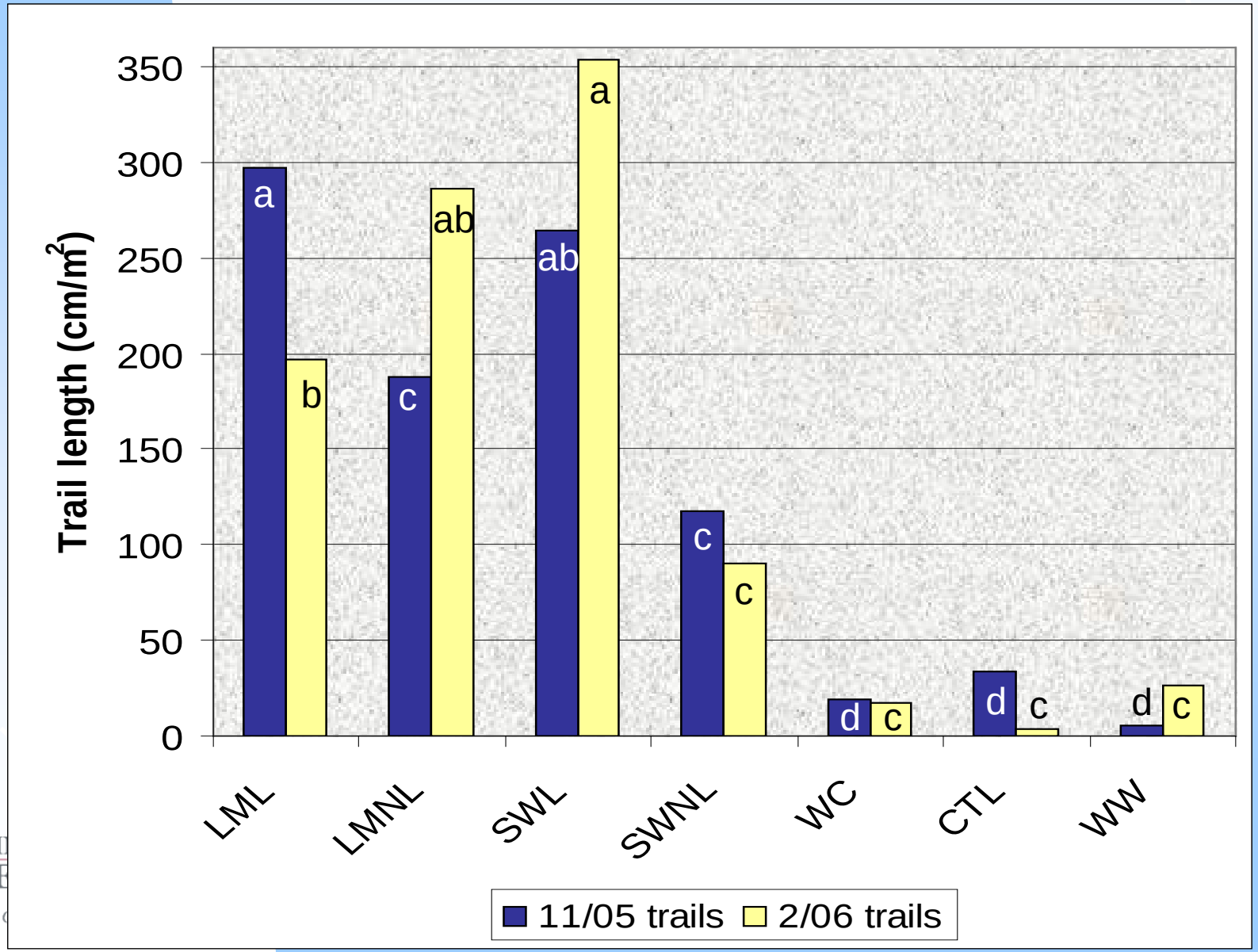
Rodents – the weak link for clover.

Vole Activity

IMM Trial, 11/05 & 2/06

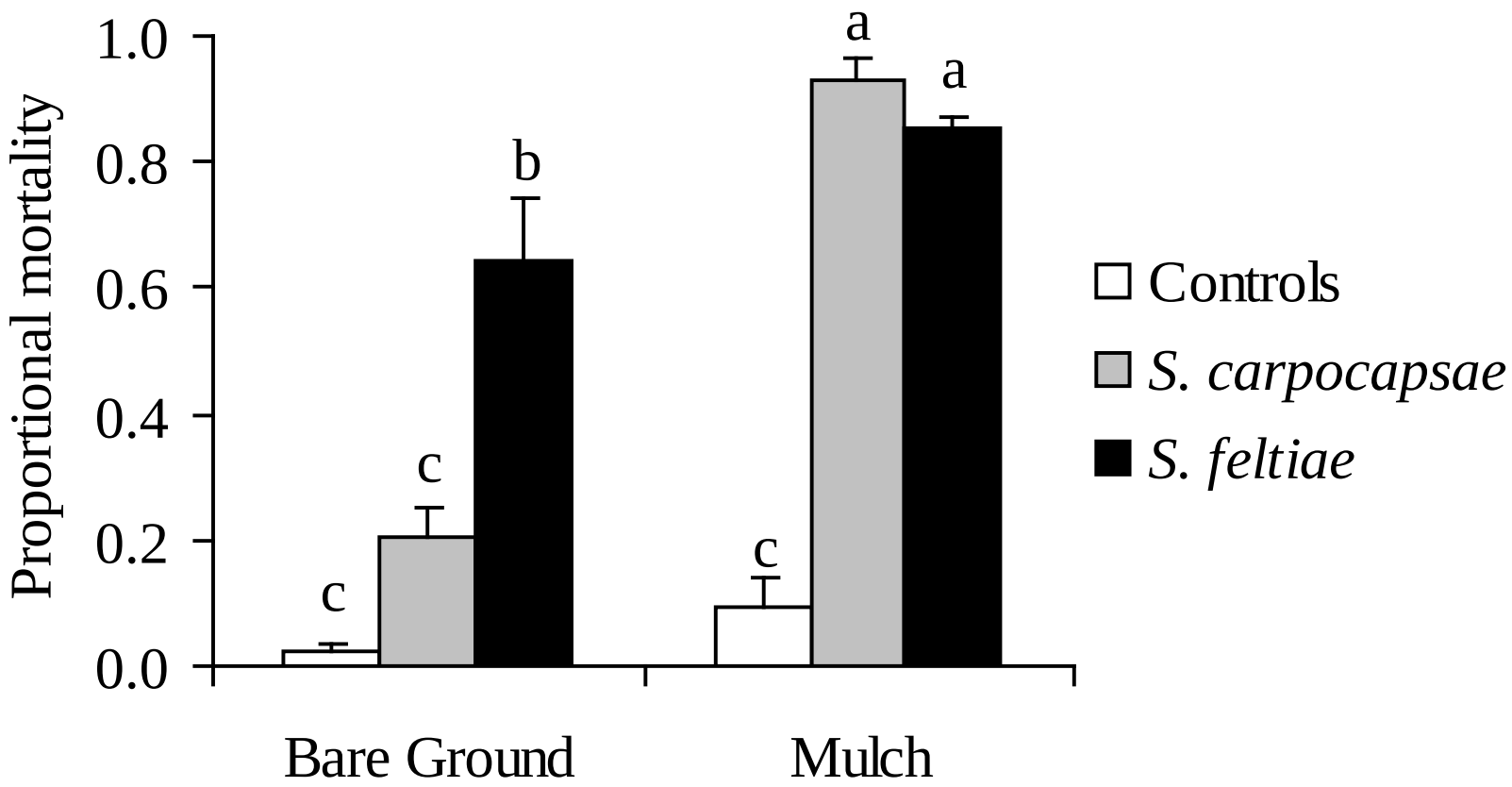


Nematode Trial

Hypothesis: wood chip mulch will enhance survival of EPNs and their predation of codling moth larvae (overwintering)

Two species – *Steinernema carpocapse, S. feltiae*; with and without wood chip mulch; 5 reps

Effect of wood chip mulch and nematode species on codling moth larvae mortality - September 2004



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Letters indicate differences between treatments; Fishers LSD at P < 0.05

Going Forward

Mulches show real promise – both living and inert can help soil quality

Herbicides an important alternative to tillage

Matching legume N to time of tree need

Will need multiple benefits for economics – e.g. clover for weed control, water conservation, nitrogen

Thanks for technical support: M. Wiman, E. Kirby, K. Lorentz, A. Kukas, R. Fritts, L. Hoagland

http://www.tfrec.wsu.edu/OrganicIFP
http://organicfarming.wsu.edu