Sustainable Vineyard Floor Management

Justin Scheiner, Ph.D.

Assistant Professor and Extension Viticulture Specialist

Sustainability

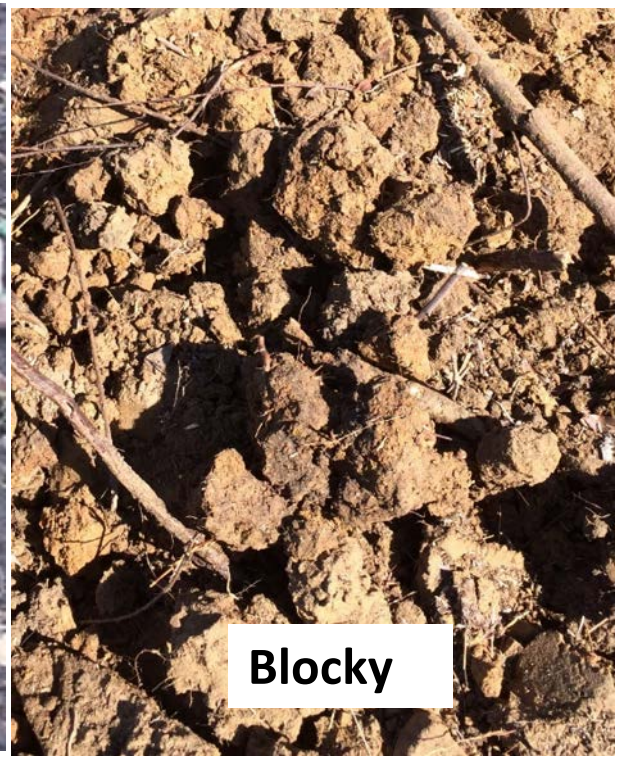
- the ability to be maintained at a certain rate or level.
- avoidance of the depletion of natural resources in order to maintain an ecological balance.

Impact of Floor Management

- Erosion potential
- Soil structure
- Soil moisture
- Nutrition
- Vigor
- Pests and disease

Soil Structure

The arrangement of primary particles into naturally formed secondary particles (aggregates) due to the particles tendency to stick together.



Water Holding Capacity

Textural Class	Plant Available Water*
Clay	2.0
Clay Loam	2.4
Loam	2.1
Sandy Loam	1.8
Loamy Sand	1.2
Sand	0.5

*inches of water per foot of soil

Nutrients Removed with Harvest

Nutrient	Pounds removed per ton of fruit	Pounds removed per 5 ton crop
Nitrogen	6.6	33
Phosphorous	0.88	4.4
Potassium	8.8	44
Calcium	2.2	6
Magnesium	0.44	2.2

From: M. Keller, Science of Grapevines

Nutrient	Useable Form(s)	Mobility in Soil
Nitrogen	NH_4^+ (ammonium) and NO_3^- (nitrate)	Slightly mobile, mobile
Phosphorous	$H_2PO_4^-$ (dihydrogen phosphate) and HPO_4^{-2} (hydrogen phosphase)	Immobile
Potassium	K^+	Slightly mobile
Calcium	Ca^{+2}	Slightly mobile
Magnesium	Mg^{+2}	Immobile
Sulfur	SO_4^{-2}(sulfate)	Mobile
Iron	Fe^{+2} (ferrous) and Fe^{+3} (ferric)	Immobile
Manganese	Mn^{+2} and chelates	Mobile
Copper	Cu^{+2}	Immobile
Boron	$H_2BO_3^-$ (boric acid)	Mobile
Zinc	Zn^{+2} and chelates	Mobile

Impact of Floor Management on Vigor

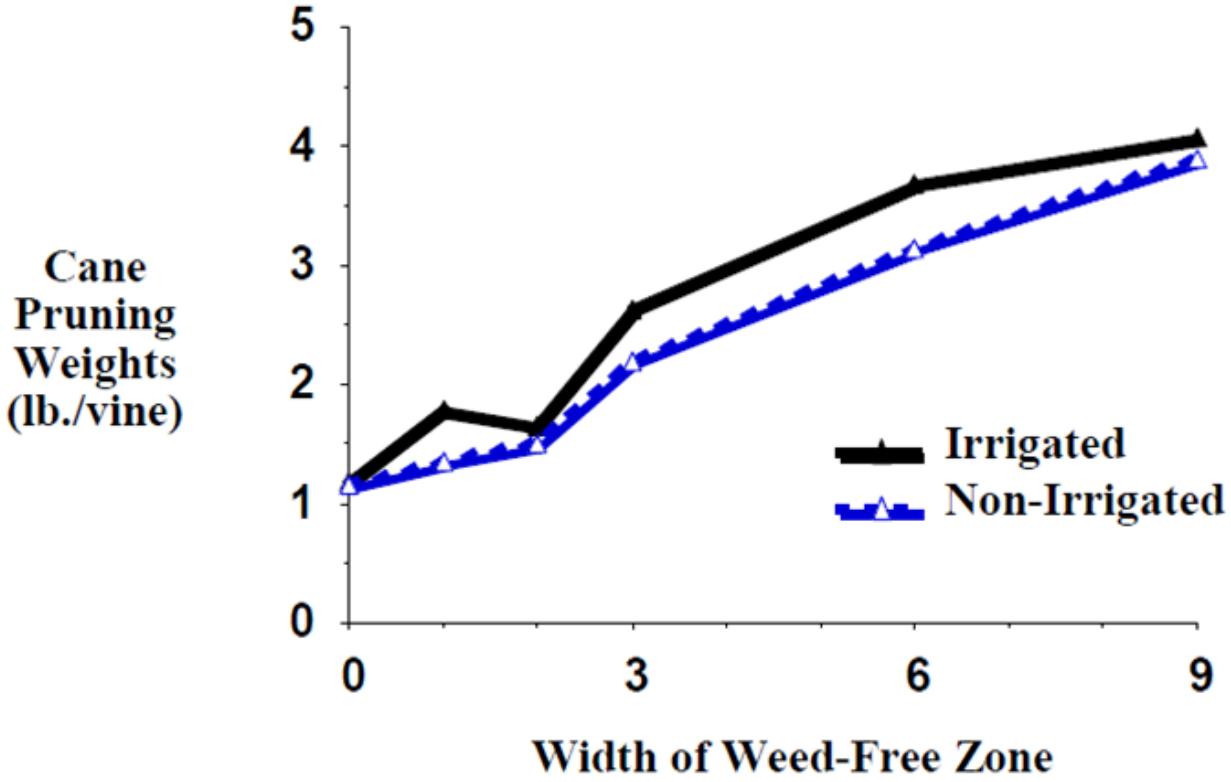


Figure 2. Effect of width of weed-free zone and irrigation on 1998 cane pruning weight (courtesy Alan Lakso, Cornell University).

Closely Mowed Vegetation in Vineyard Row Centers Deters Sharpshooters, Prevents Erosion and Supports Equipment Movement

J. Kamas, Pierce's Disease Overview and Management Guide

Row Middle Management

- Resident vegetation
- Cultivated
- Planted groundcover



Under-vine Management

- Herbicide
- Cultivated
- Mown
- Mulched



Water Use

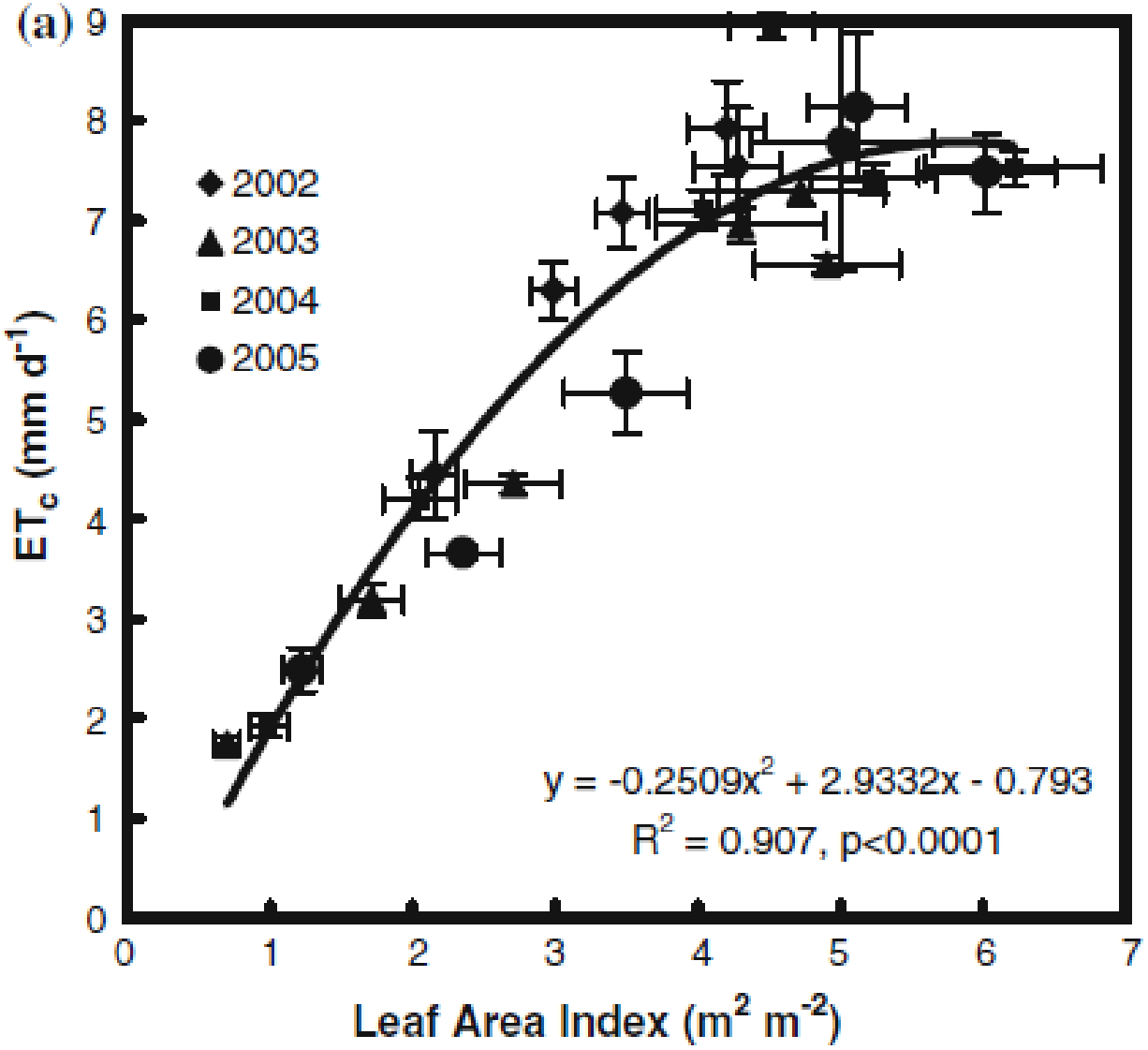
Water using

Water conserving

Water requirements for Warm-season and Cool-season Turfgrasses

Type	Common name	Optimal Irrigation* (% ET_0)	Deficit Irrigation** (% ET_0)
Warm season	Common bermudagrass	60	40
	Hybrid bermudagrass	60	40
	St. Augustinegrass	60	40
	Seashore paspalum	60	40
	Zoysiagrass	60	40
	Buffalograss	60	40
	Kikuyugrass	60	40
Cool Season	Tall fescue	80	60
	Perennial ryegrass	80	60
	Kentucky bluegrass	80	60
	Fineleaf fescues	80	60
	Creeping bentgrass	80	60
	Rough bluegrass	80	60

University of California Division of Agriculture and Natural Resources



From: Netzer et al. 2009

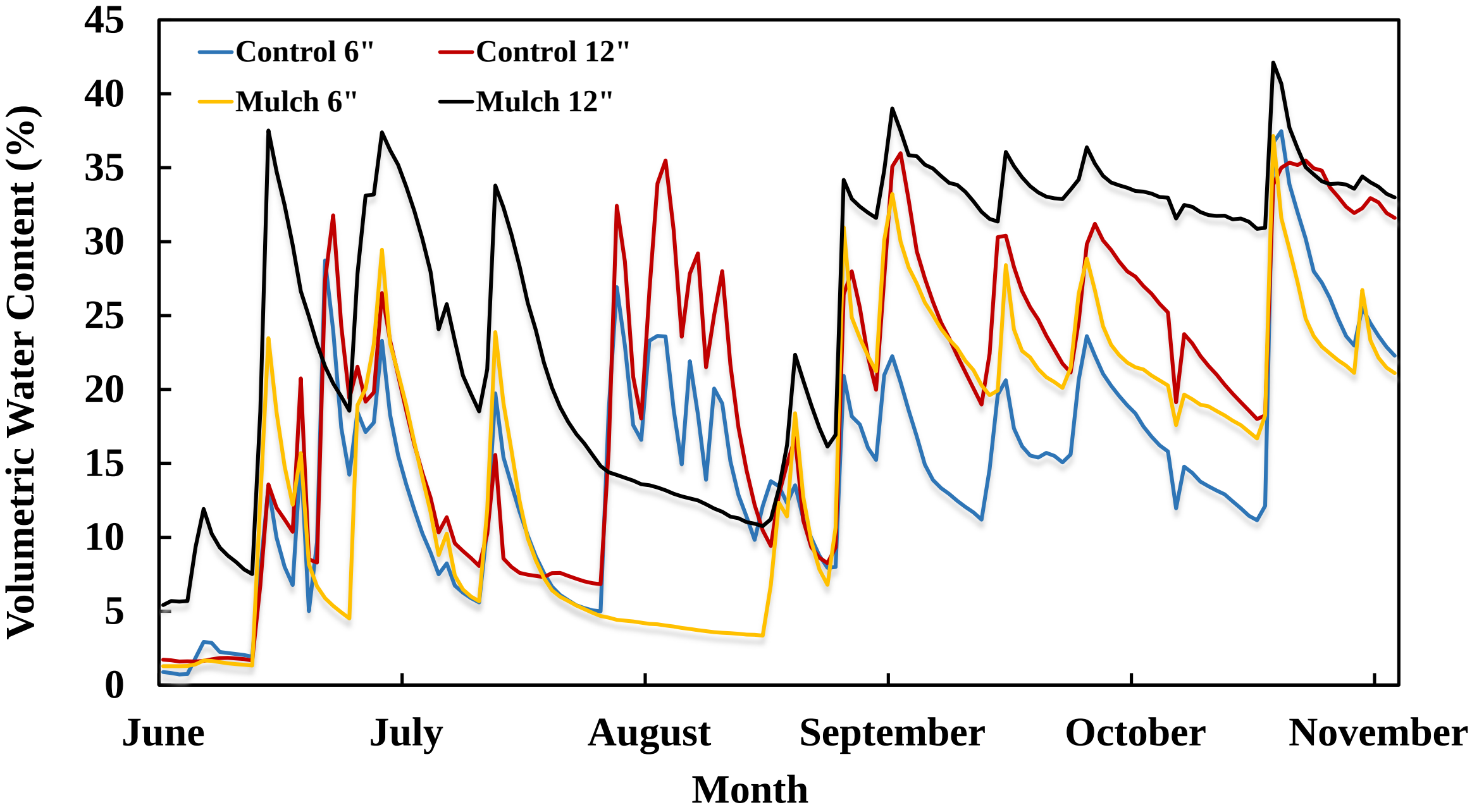
Yesterday's Weather Summary

Station	ETo (in)	Max Temp (f)	Min Temp (f)	Min RH (%)
				Coastal Bend
Dickinson	0.20	87	78	74
Houston	0.20	90	75	76
Richmond	0.21	91	74	75
Spring	0.26	92	78	67
				East Texas
Conroe	0.20	92	76	63
Overton	0.14	89	73	84
				South Central
Austin (LCRA Redbud)	0.29	98	78	60
Bryan	0.26	91	76	68
Cedar Park	0.27	94	74	66
Dripping Springs	0.28	94	73	72
Lakeway	0.20	95	74	68
Marble Falls	0.32	97	74	65
Pfugerville	0.33	96	76	73
Winedale	0.28	94	76	68

Texas ET Network

Mulching

- **Benefits:** soil moisture preservation, temporary weed control, organic matter
- **Disadvantages**: cost, soil moisture preservation, nutrients?

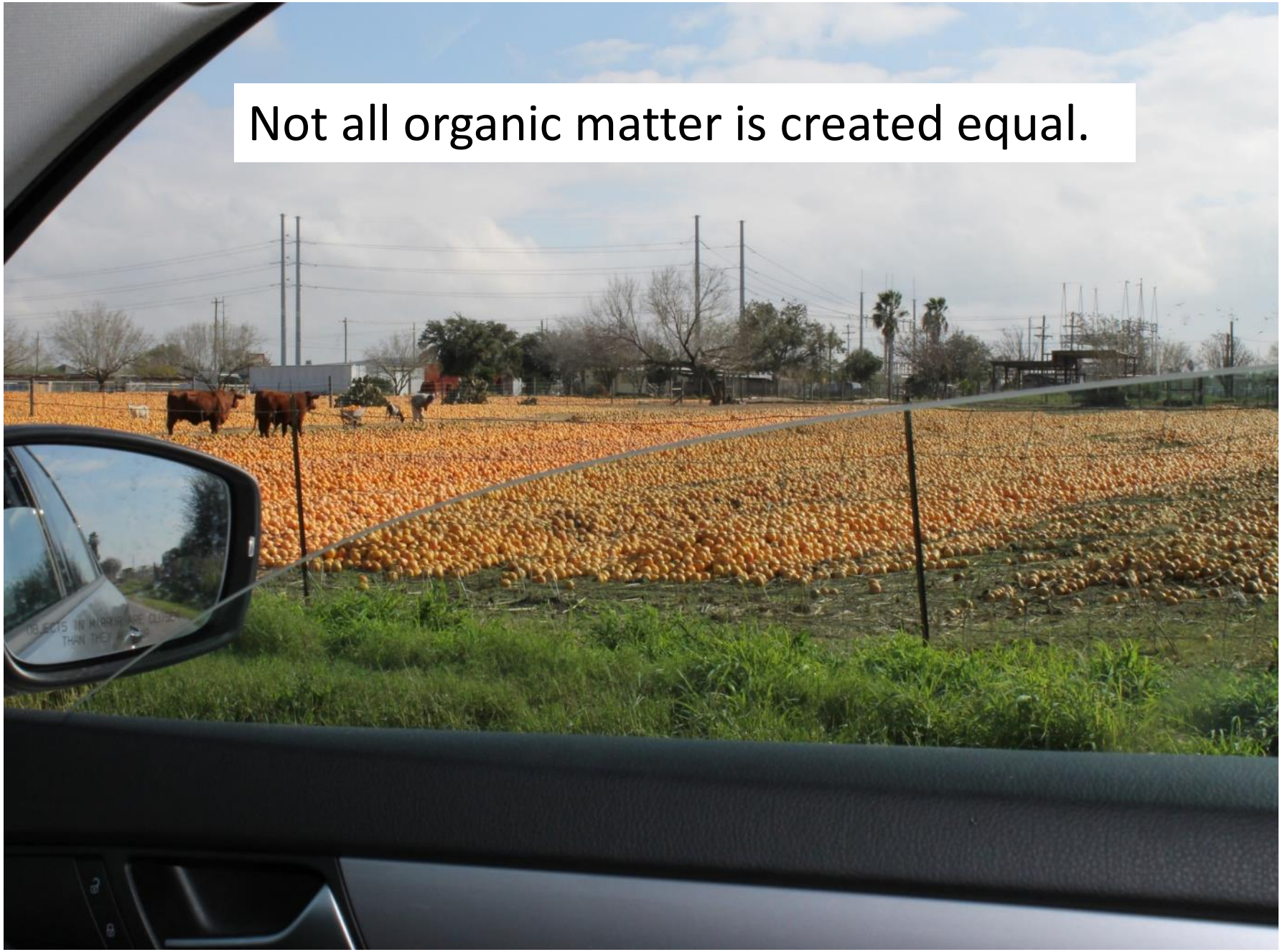

Control 6"
Control 12"
Mulch 6"
Mulch 12"
Volumetric Water Content (%)
45
40
35
30
25
20
15
10
5
0
June
July
August
September
October
November
Month

Organic Matter

- Decomposed plants, animals, and microbes
- Slow release of nutrients
- Variable composition

Benefits

- Improved soil structure
- Increased cation exchange capacity
- Increased water holding capacity
- Increased microbial population


Not all organic matter is created equal.

Organic Matter Composition

Organic Matter Source	Nitrogen*	Phosphorus	Potassium	C:N Ratio
Cotton seed meal	7.7	2	1	7
Dry Chicken Litter	2.0-4.5	4.6-6	1.2-2.4	12-15
Dry Steer Manure	0.6-2.5	0.7-1.1	2.4-3.6	11-30
Poultry Compost	0.9	1.95	1.15	11
Wood Chips	0.1-0.5	-	-	80-400
Grape Pomace**	1-2	2-3	0.1-0.3	<30

*percent by weight

**from: Patti et al., 2004

Cation Exchange Capacity

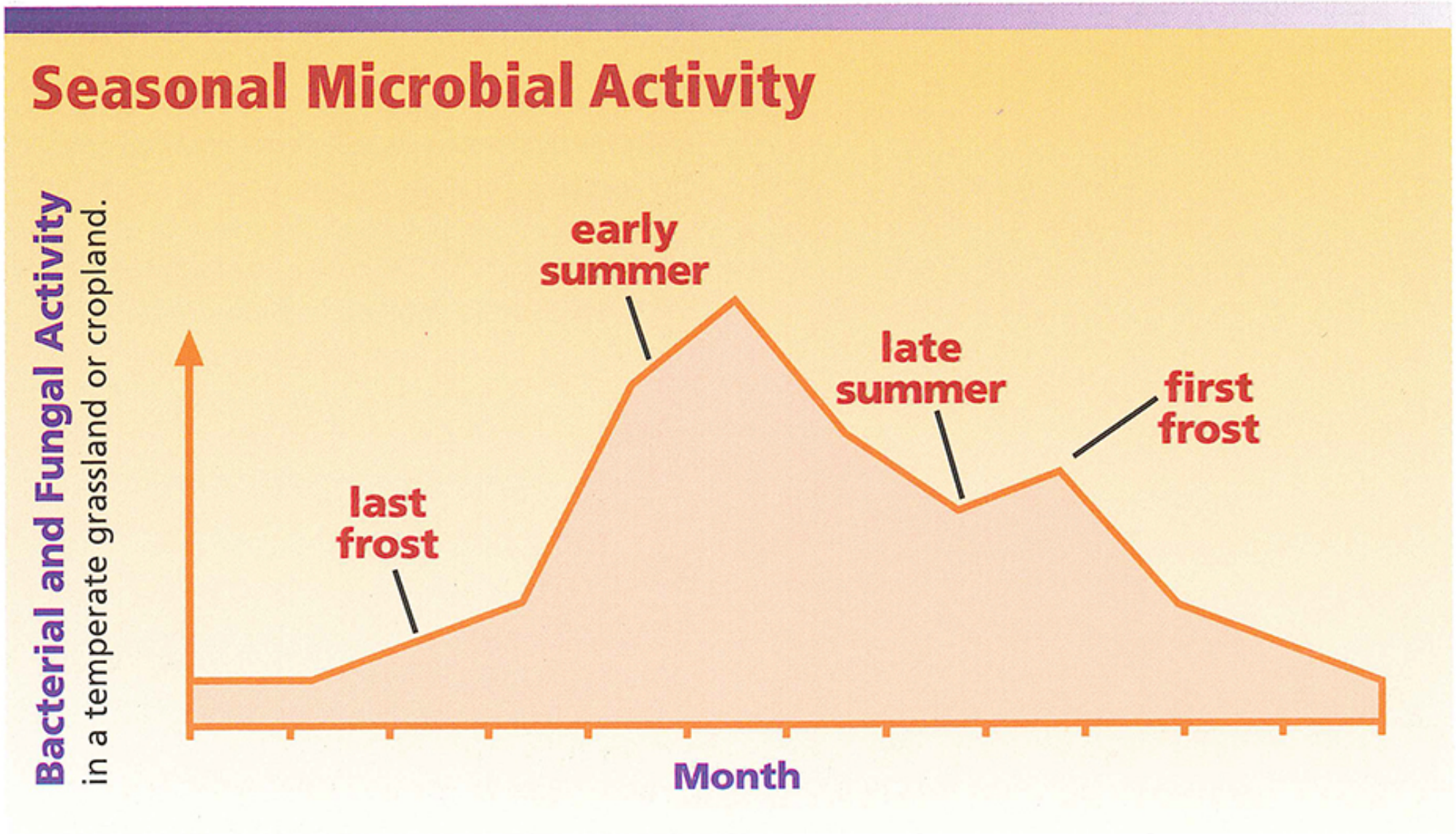
Texture	Cation Exchange Capacity (cmol/kg)
Organic matter	40-200
Sand	1-5
Sandy loam	2-15
Silt loam	10-25
clay loam/silty clay loam	15-35
Clay	25-60

Composting

- Carbon to nitrogen ratio of material
- Maintain moisture level of a well-squeezed sponge
- Microbes are required
- Finer particles are broken down faster
- Turn pile periodically (once a month)

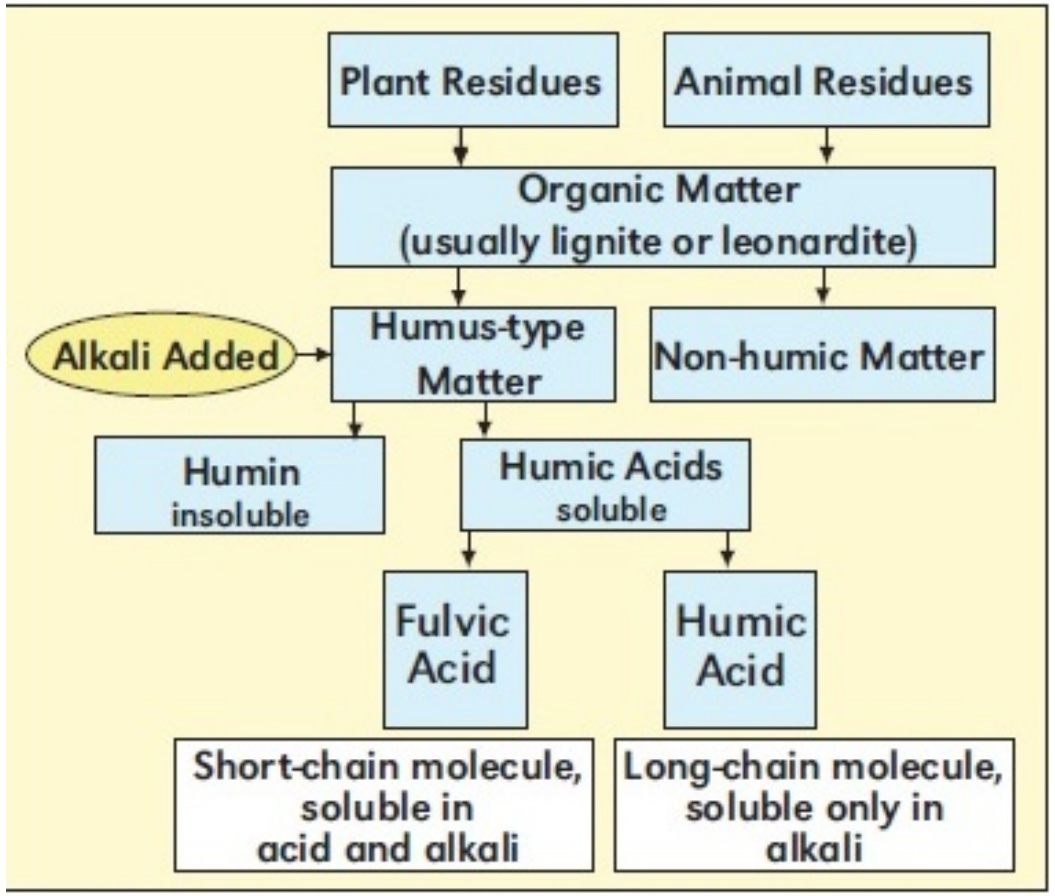
Soil Health

"There are more soil microorganisms in a teaspoon of healthy soil than there are people on the earth" -USDA-NRCS



USDA-NRCS, Soil Food Web

Humates



Slide credit: Jim Kamas

Benefits of Humic Acids?

- Soil physical benefits: benefits of organic matter are well documented
- Soil chemical benefits: sequestering agent
- Soil biological benefits?
  - Increased food source for microbes?
    - App of 5-20 gal/acre of humic material provides 3-15 lbs of c/acre
    - Typical corn stubble residue provides > 4000 lbs c/acre

The addition of 2 tons per acre of humates would increase the organic material of a soil by 0.1%

Slide credit: Jim Kamas

Biological Soil Conditioners

Examples:

- **Mycorrhizae**: fungi that live either on in or plants roots and effectively extend the reach of the root hairs
- **Rhizobia** (fix nitrogen from the air) only in legumes
- **Trichoderma:** free living fungi that serves as plant symbionts

Nitrogen Fixation and Cycling

Table 1. Dry matter (DM) & nitrogen (N) yield of crimson clover & hairy vetch over a 3-year period at Overton, TX [1]

Species	Avg DM Yield (lbs/ac)	DM Yield Range (lbs/ac)	Avg N Yield (lbs/ac)	N Yield Range (lbs/ac)	Avy Recovery[2] (%)	Range Recovery (%)
Crimson clover	4092	3943-4356	90.6	83.3	44.0	15.8-63.6
Hairy Vetch	3196	2549-3548	111.5	92.2-122.5	55.3	29.7-70.6

[1]Smith, 1986 [2]Recovery is the amount of N contained in subsequent non-N fertilized warm-season annual grass, pearlmillet

Plowed Row Middles

- Loss of fertility over time
- Loss of organic matter over time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Herbicides

- Preemergence: kills weeds just after germination

- Postemergence

✓contact

✓systemic

✓selective

✓nonselective

Types of Weeds

- Monocots (grasses)
- Dicots (broadleaves)
- Annuals (1 season)
- Perennials (2+ seasons)
- Biennials (2 seasons)
- Summer
- Winter

Postemergence Herbicides	
glyphosate (Roundup, etc.)	nonselective, systemic, PHI = 14
glufosinate (Rely)	nonselective, contact (limited systemic), PHI = 14
paraquat (Gramoxone)	nonselective, contact
carfentrazone-ethyl (Aim)	nonselective, contact, PHI = 3
perlargonic acid (Scythe)	nonselective, contact, PHI = 1
fluazifop-p-butyl (Fusilade)	selective (grasses), bearing and non bearing vineyards, PHI = 50
sethoxydim (Poast)	selective (grasses), PHI = 50


JOHN DEER
ENVIROMIST
UNDAVINA 600
ENVIROMIST

Chemical Suckering

- paraquat (Gramoxone)
- carfentrazone-ethyl (Aim EC)
- pyraflufen (Venue)

Organic Herbicides

- Contact only, and most active against young weeds
- Weed Pharm (20% acetic acid)
- C-Cide (5% citric acid)
- GreenMatch (55% d-limonene)
- Matratec (50% clove oil)
- WeedZap (45% clove oil + 45% cinnamon oil)
- GreenMatch EX (50% lemongrass oil)

No Synthetic Auxin Herbicides!

2,4-D Symptoms

Dicamba Symptoms

Preemergence Herbicides	
simazine (Princep)	vines at least 3 years old
diuron (Karmex)	vines at least 3 years old, >1% OM
flumioxazin (Chateau)	non-bearing and bearing vines
napropamide (Devrinol)	non-bearing and bearing vines
oxyfluorfen (GoalTender)	non-bearing and bearing vines
pendimethalin (Prowl H_2O)	non-bearing and bearing vines
oryzalin (Surflan)	non-bearing and bearing vines
rimsulfuron (Matrix)	non-bearing and bearing vines, > 1 yr old
isoxaben (Trellis, Gallery)	non-bearing vines only

Table 2. Time required to activate pre-emergent herbicides after treatment

Common name	Trade name	Maximum time to incorporate
diuron	Karmex, Direx, etc.	< 28 days
isoxaben	Gallery T&V (NB)	< 21 days
napropamide	Devrinol	< 5 days
norflurazon	Solicam	< 28 days
oryzalin	Surflan, etc.	< 21 days
oxyfluorfen	Goal, etc.	< 21 days
pendimethalin	Prowl (NB)	< 7 days
pronamide	Kerb	< 24 hours
simazine	Princep	< 28 days
thiazopyr	Visor (NB)	< 21 days
trifluralin	Treflan, etc.	< 24 hours

NB = non-bearing only

From: Hembree, 2002

Poor Herbicide Performance

Most common causes:

1. Wrong herbicide for the type(s) of weeds present
2. Wrong application timing (growth stage and climatic conditions)
3. Poor coverage

Herbicide Fates

- microbial degradation
  - repeated use can lead to a shift in microbial populations
  - after 14 annual applications of diuron, the half-life was reduced from 81 days to 37 days
- volatility (loss to the atmosphere)
- sunlight degraded (photodecomposition)
- bound to soil particles (sorption)

Summary

Determine the goal(s) of your floor management system

- soil moisture
- nutrition
- economics