RODALE INSTITUTE

"Improved Sustainability Through Organic Production Strategies"

By Jeff Moyer
Farm Director

“Healthy Soil = Healthy Food = Healthy People”

J.I.Rodale

Our Broken Food System
When Only Yields Are Considered

Dead Zones Continue To Expand

2008 Soil From Iowa in the Gulf of Mexico

Over 2 million acres lost 20 tons or more of top soil

Parkinson's disease and exposure to agricultural work and pesticide chemicals

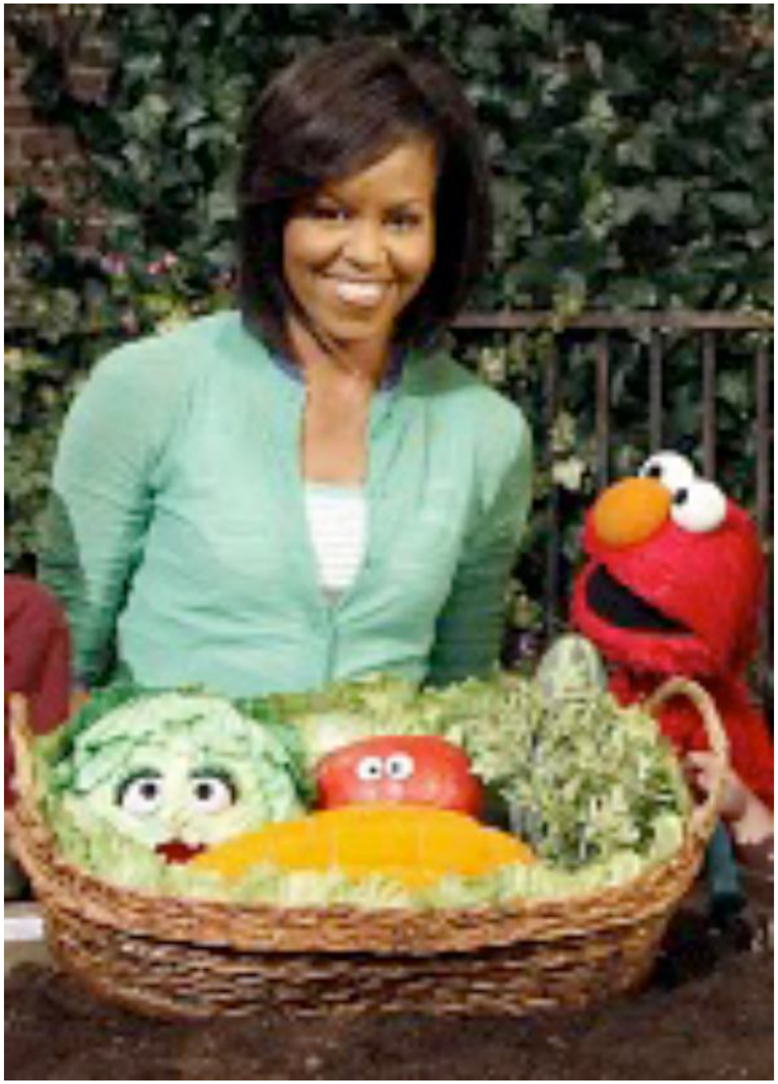
Karen M. Semchuk, PhD; Edgar J. Love, MD, PhD; and Robert G. Lee, MD, FRCP(C)

Article abstract—This population-based case-control study of 130 Calgary residents with neurologist-confirmed idiopathic Parkinson's disease (PD) and 260 randomly selected age- and sex-matched community controls attempted to determine whether agricultural work or the occupational use of pesticide chemicals is associated with an increased risk for PD. We obtained by personal interviews lifetime occupational histories, including chemical exposure data, and analyzed the data using conditional logistic regression for matched sets. In the univariate analysis, a history of field crop farming, grain farming, herbicide use, or insecticide use resulted in a significantly increased crude estimate of the PD risk, and the data suggested a dose-response relation between the PD risk and the cumulative lifetime exposure to field crop farming and to grain farming. However, in the multivariate analysis, which controlled for potential confounding or interaction between the exposure variables, previous occupational herbicide use was consistently the only significant predictor of PD risk. These results support the hypothesis that the occupational use of herbicides is associated with an increased risk for PD.

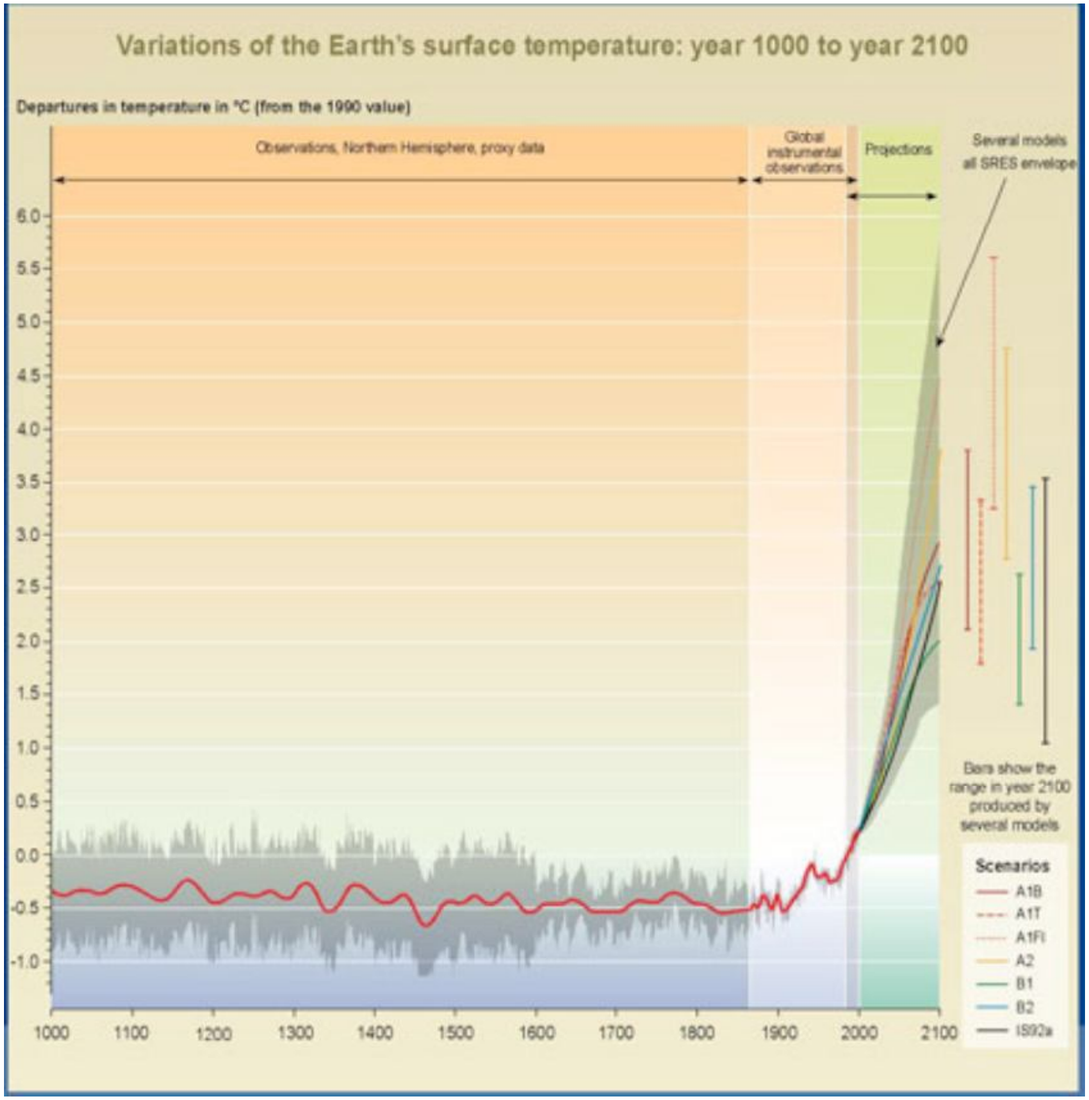
NEUROLOGY 1992;42:1328-1335

Childhood Obesity is Epidemic

High Yields With Low Nutrition



Change in Earth Temperature



SYSTEM

From Wikipedia, the free encyclopedia

- A **system** is a set of interacting or interdependent components forming an integrated whole

Livestock, Crop Rotations & Cover Crops in a Soil Management System

Start By Asking The Right Questions

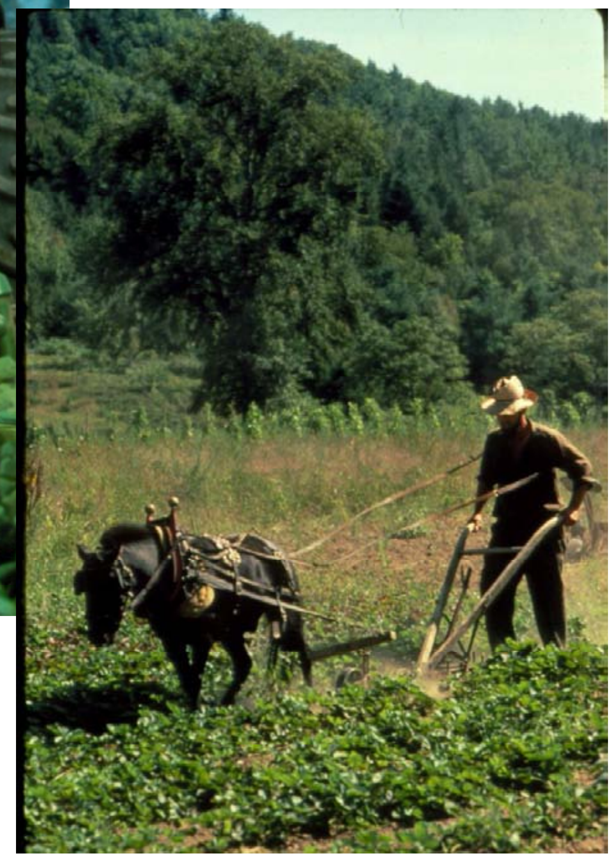
- What are our goals?
- What resources do we have access to? Tools?, Ideas?, Dollars?, Time?
- What do we want from our food system; Just yield or improved health?
- What is our starting point?
- Where do I want to end up?
- How will I get there?

Same Resources…… Different Philosophy

Tillage has it’s Drawbacks

Tillage Opens the System Up to Damage

Several Secondary Tillages



A Different Way of Farming

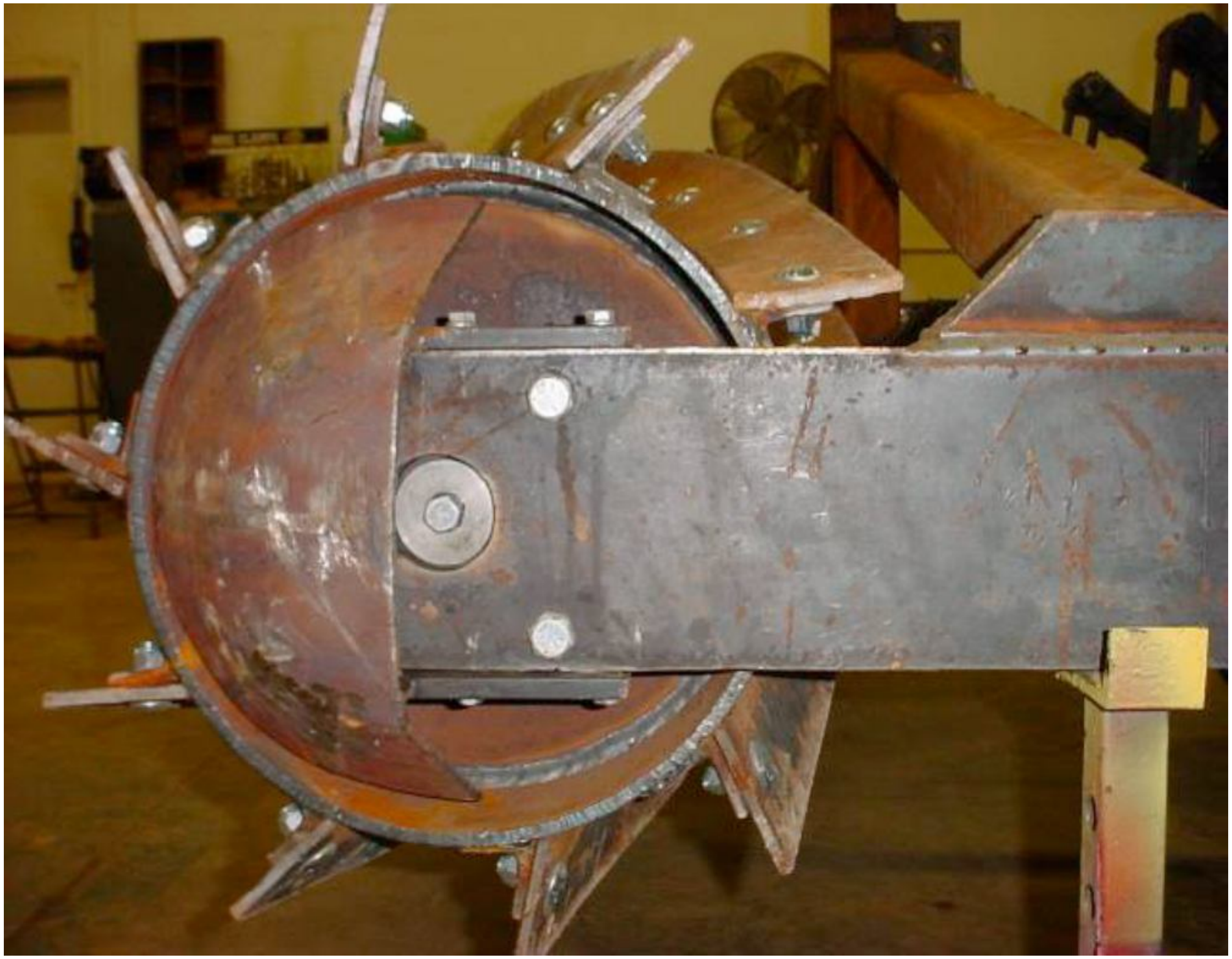
Past - equipment to kill cover crops

- Culti-packer
- Stalk chopper
- Flail mower

Increasing the Weed Free Zone

Tools That Make it Possible

16” Drum, (10) 4” Blades



Corn

PLOW TILL

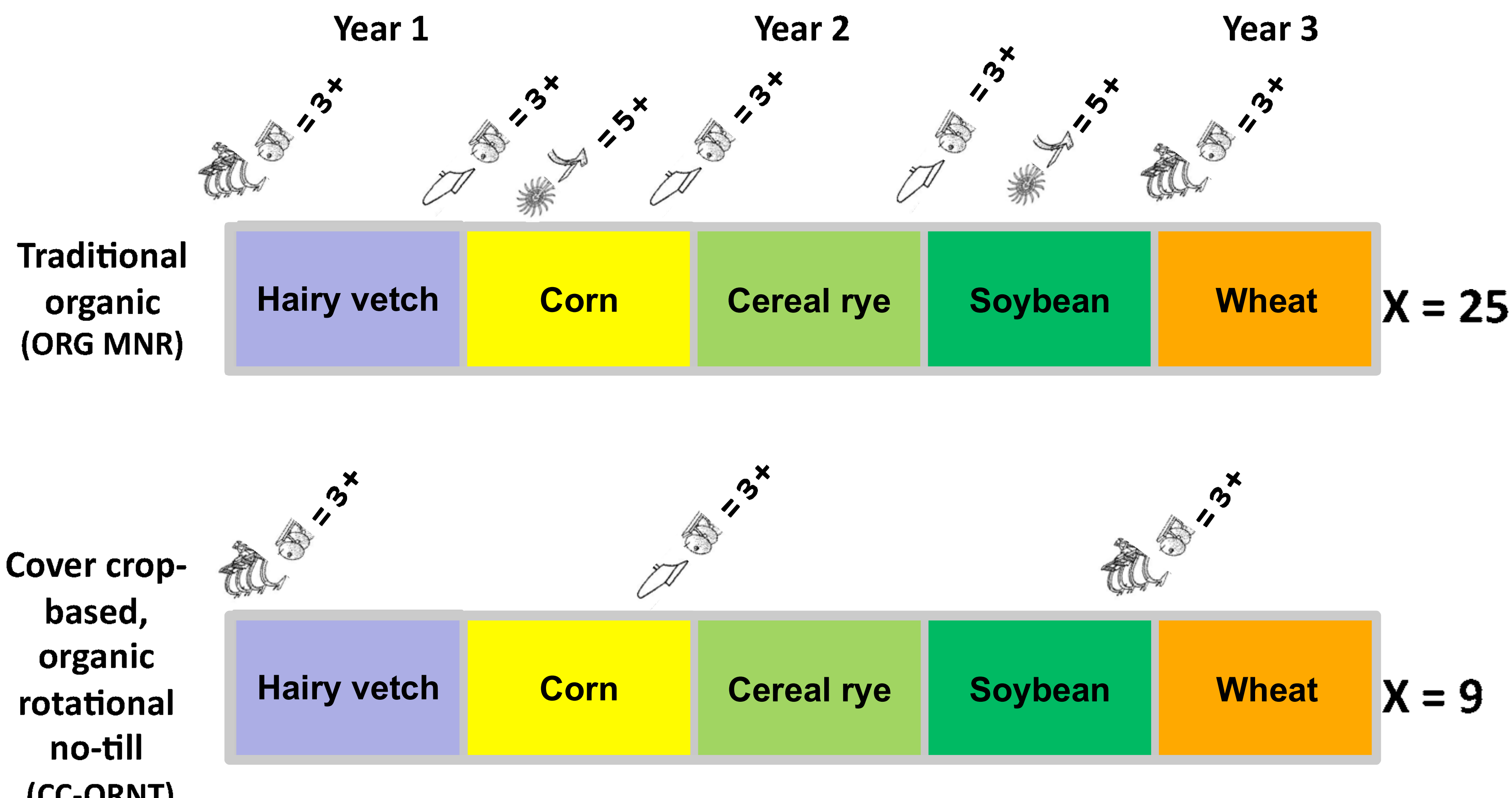
- **PLOW**
- **DISC**
- **PACK**
- **PLANT**
- **ROTARY HOE**
- **ROTARY HOE**
- **CULTIVATE**
- **CULTIVATE**
- **HARVEST**
- **(143 Bu/A)**

NO-TILL

- **ROLL/PLANT**
- **HARVEST**
- **(160 Bu/A)**

A two step organic production system Plant and Harvest!

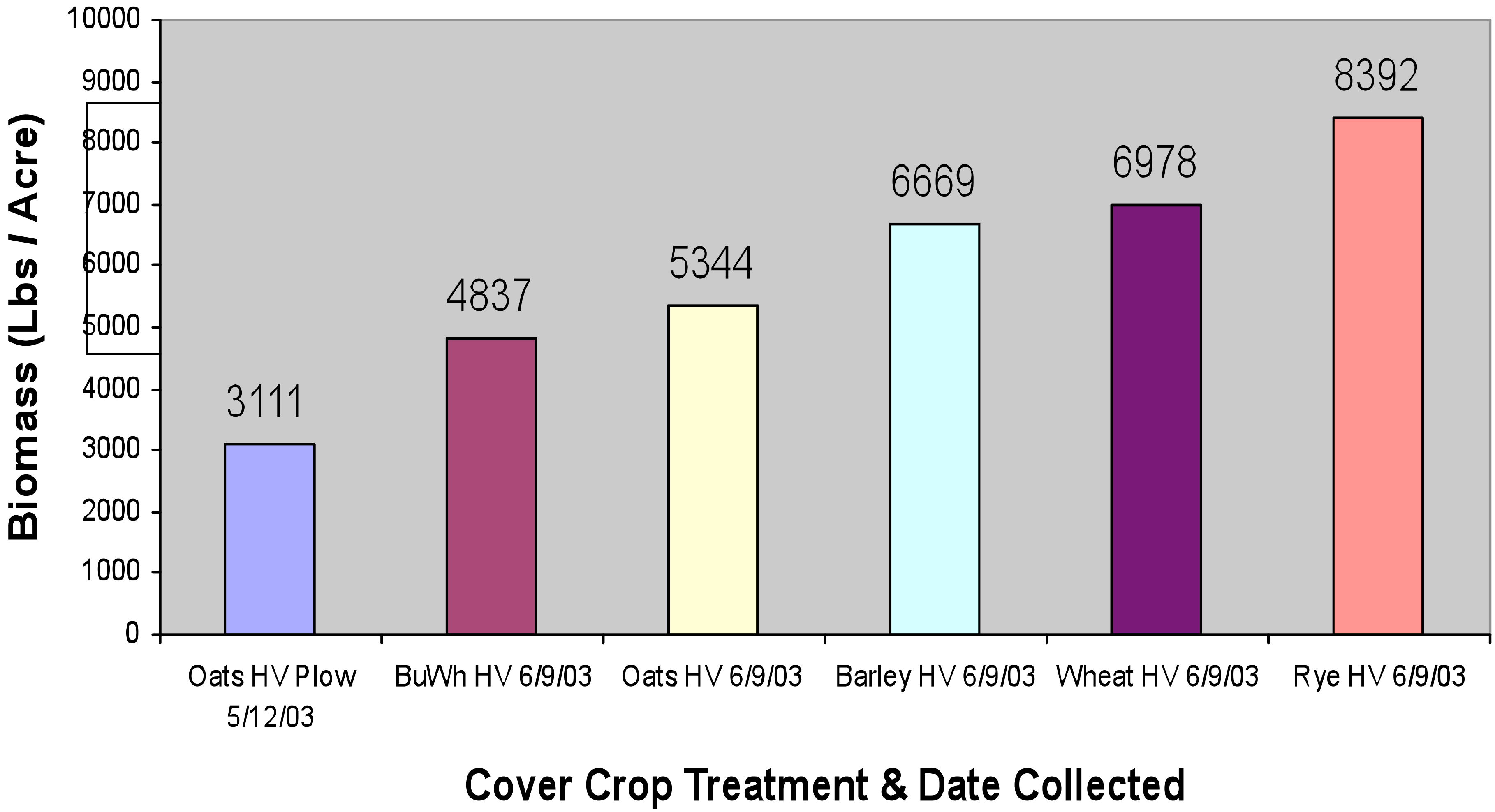
Tillage regimes based on management (3 yr rotation)



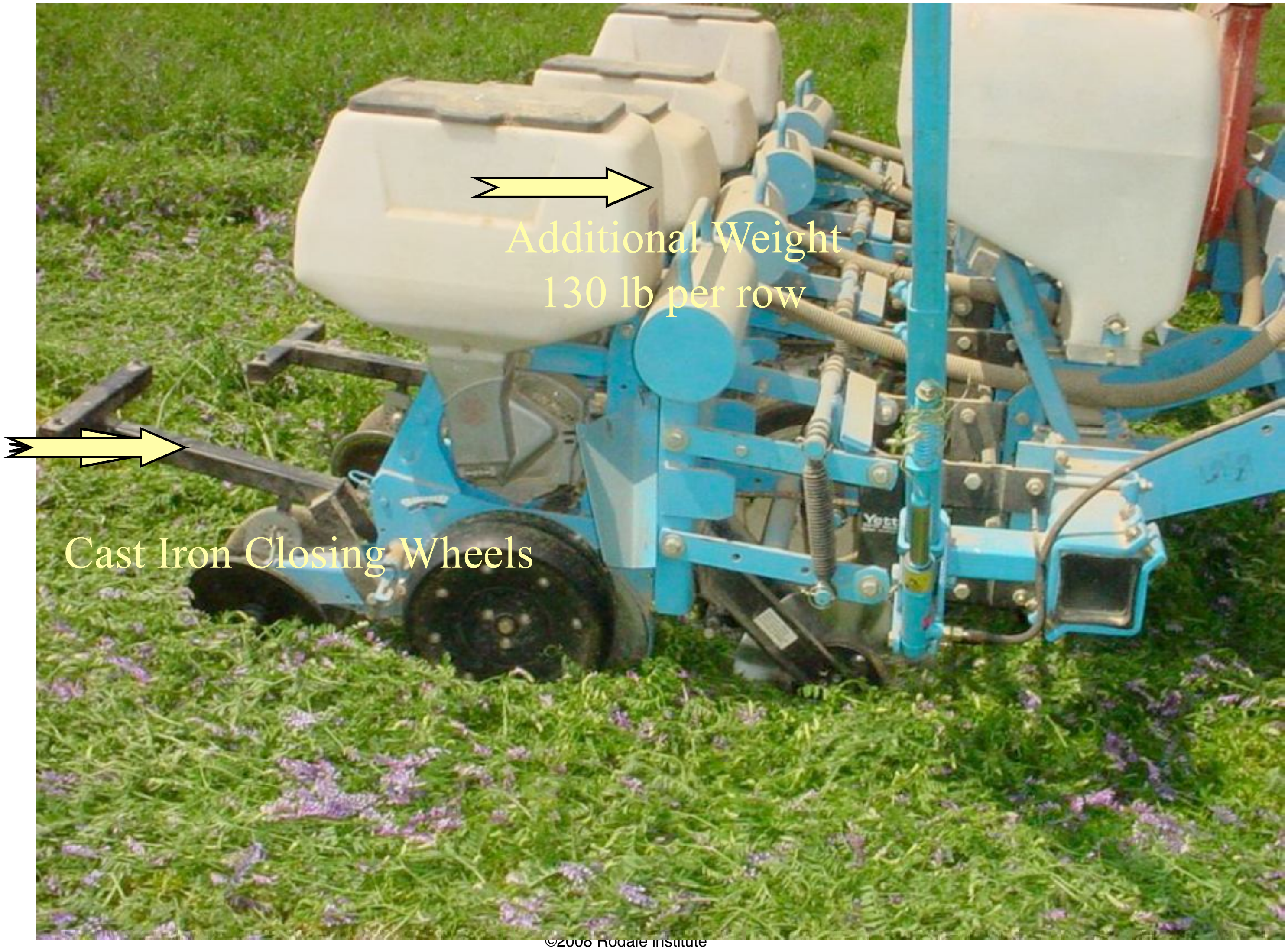
Dense Cover Crops

Prevent Weed Expression

Average Biomass (lbs/A) of Cover Crop Mixtures: 2003 Corn Cover Crop Trial



Planter Modifications



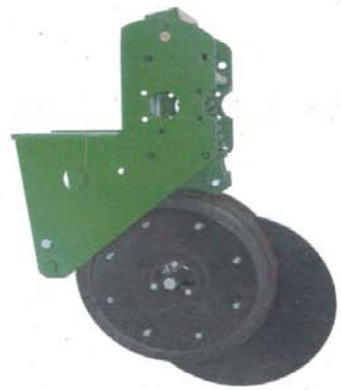
Mis-Planted Seed

Yetter Residue Managers

PEQUEA PLANTER

Residue Slicer

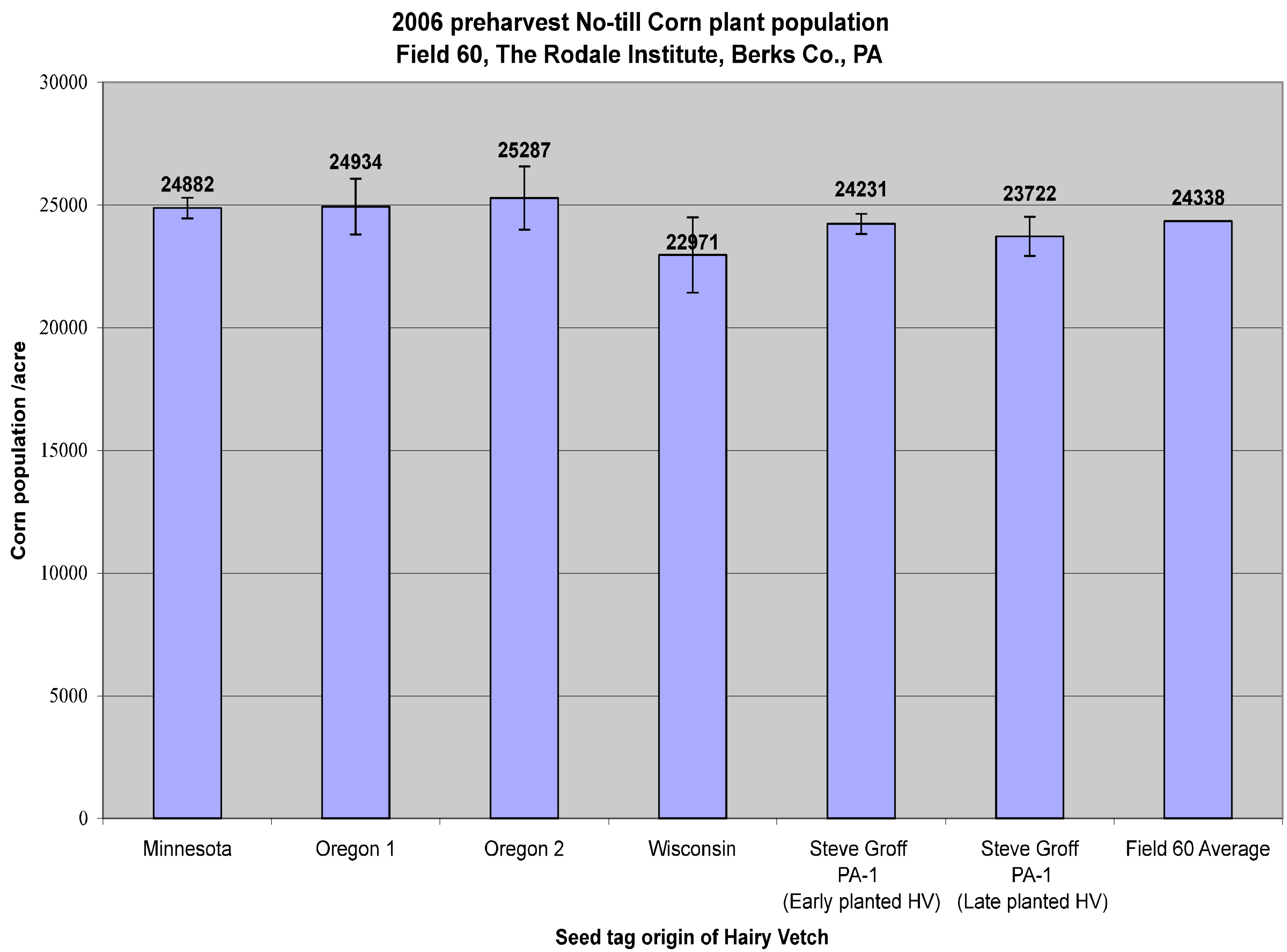
- The Residue Slicer is used in combination with the I&J Mfg Cover Crop Roller to plant organic corn, beans, and other crops into heavy cover crop, no-till conditions.
- Can be used for non-organic, no-till using less chemicals, or in extremely heavy residue conditions without installing row cleaners.



- With enough down spring pressure, a straight blade, in combination with the rubber wheels to hold the heavy residue, will make a clean cut. Without the rubber wheels, the residue may hair-pin into the seed trench.
- The Residue Slicer will also work well under general no-till conditions, with little or no residue.

- The Residue Slicer is compatible with John Deere 7000-7200-1750 planters.

2006 Pre-harvest No-Till Corn Plant Population



Corn 3 Days After Planting

Cover from Mechanical Kill

Thick Mat of Terminated Cover Crop

Corn Mid-Season

2010 Soybean Research Plots

2012 Termination Trials - Soybeans

Treatment #14 Planted May 23rd w/oShark Teeth

Cover Crop Removed

Yield 17 Bu/A

Treatment #11 Planted June 1st w/Shark Teeth

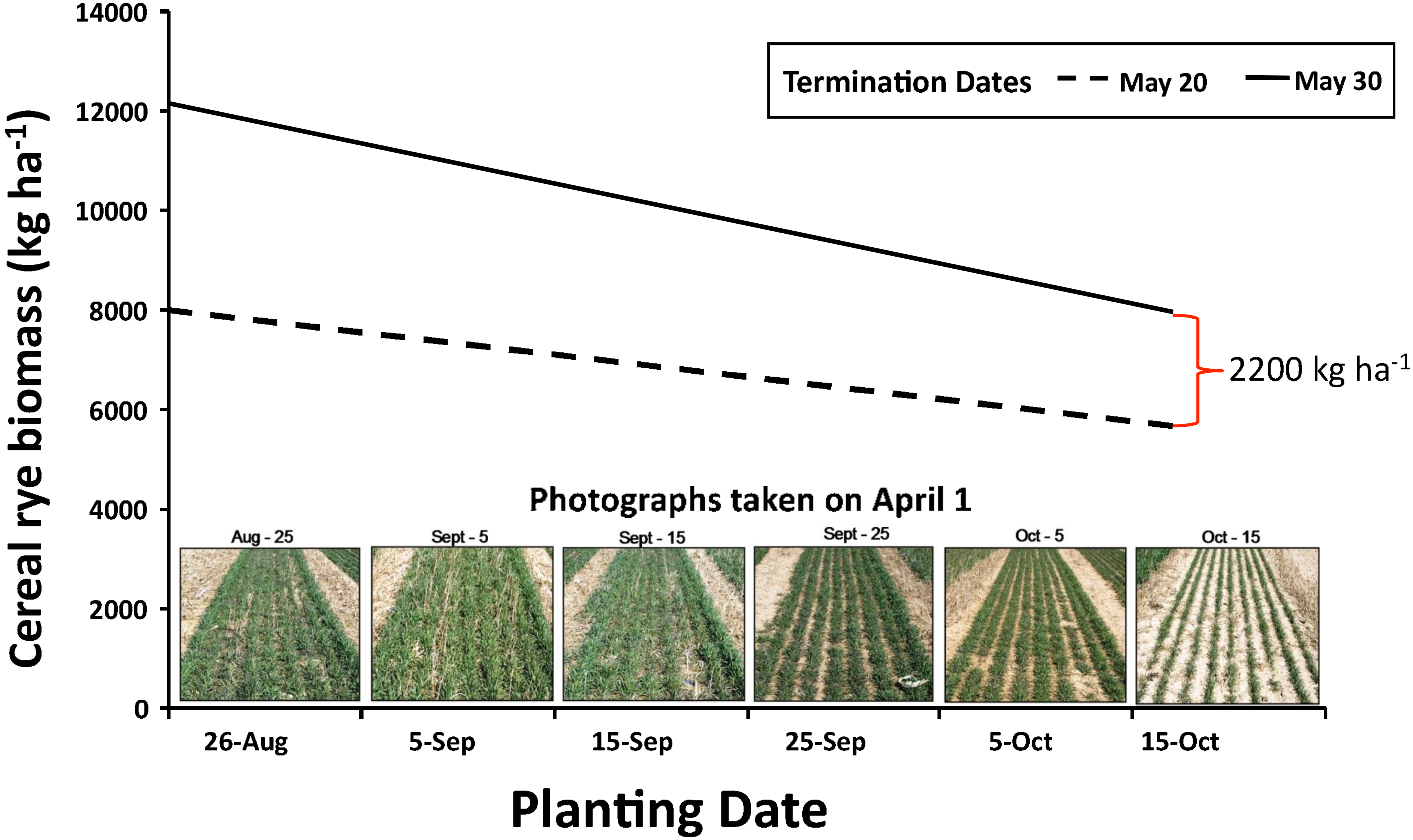
Yield 38 Bu/A

Treatment #2 Planted May 23rd w/Shark Teeth

Yield 59 Bu/A

Effects of planting and termination date on cereal rye biomass

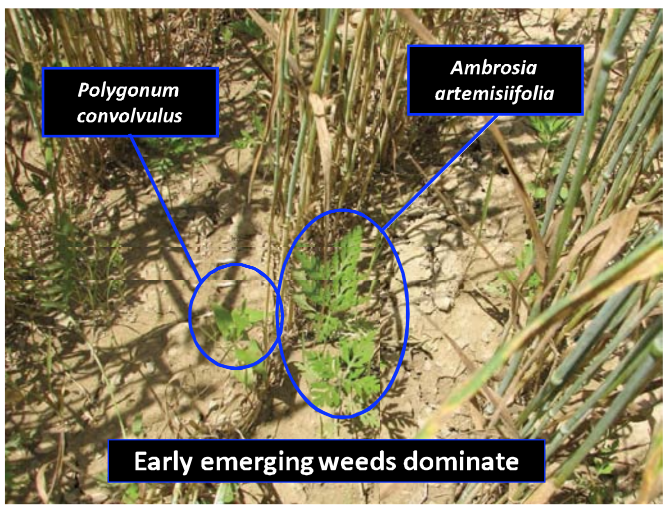
(Penn State University, Rock Springs, PA; Aroostook cereal rye)



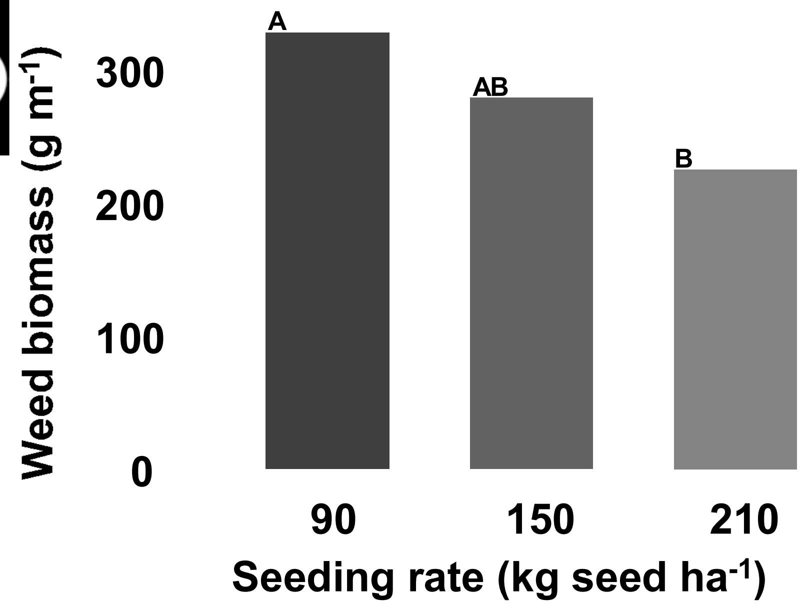
Mirsky, S.B., W.S. Curran, D.M. Mortensen, D.L. Shumway, and M.R. Ryan. 2011.
Timing of cover crop management effects on weed suppression in no-till planted soybean using a roller-crimper. Weed Science. 59:380–389.

Increasing seeding rate did not increase cereal rye biomass

[redacted]



However, it did decrease weed biomass

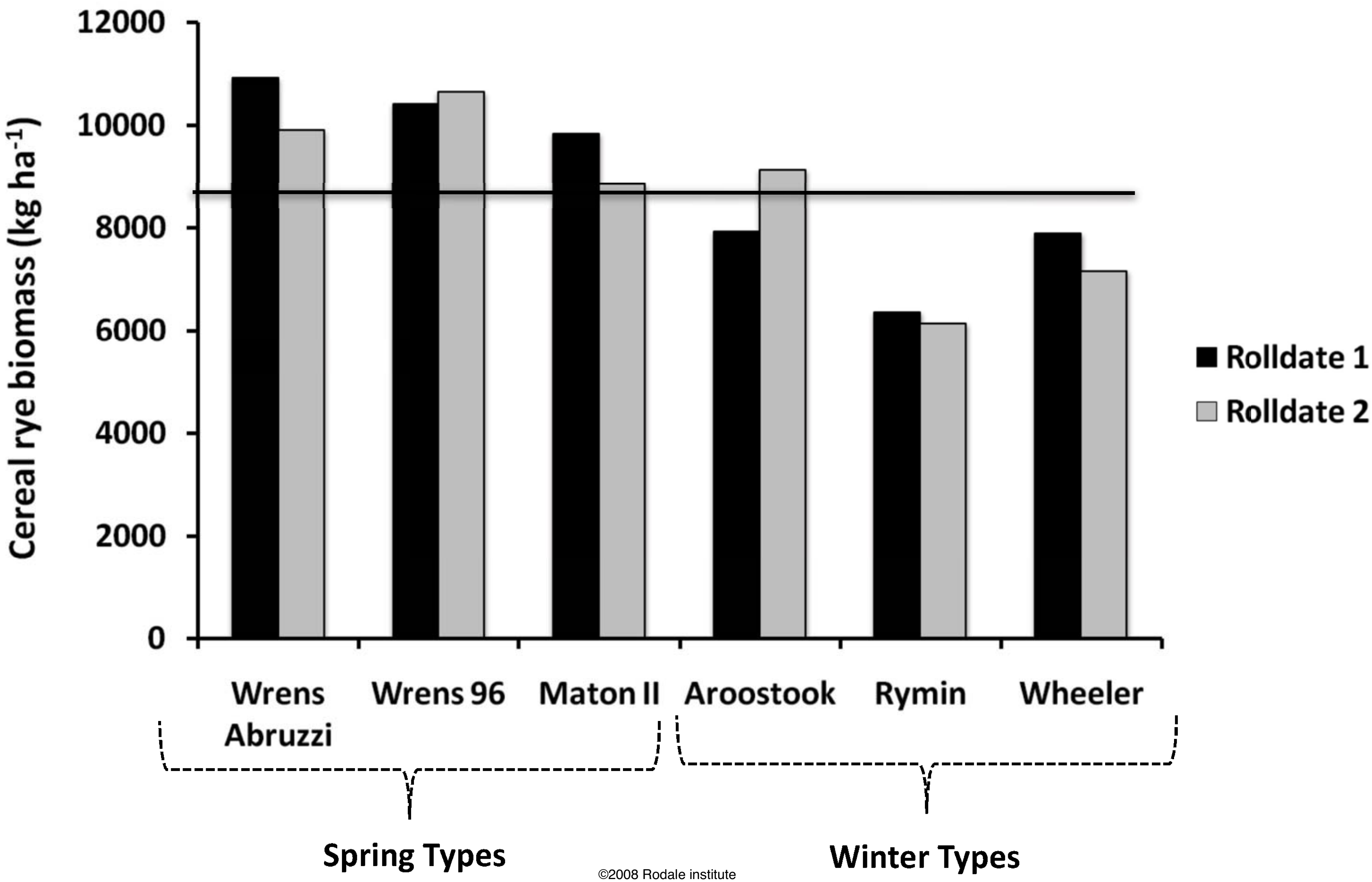


Ryan, MR, WS Curran, AM Grantham, LK Hunsberger, SB Mirsky, DA Mortensen, EA Nord, and DO Wilson. 2011. Effects of seeding rate and poultry litter on weed suppression from a rolled cereal rye cover crop. *Weed Science* 59:438–444.

3 bu ac^{-1} rye seeded on mid-September 50% broadcast 50% drilled

(Picture taken in late November)

Cereal rye cultivar biomass assessment (Kinston, NC 2010)



2009 Tomato

6 weeks after rolling

Here's a picture yesterday of seeding Sheyenne Organic Soybeans into rye about 5 feet high in Vermont. The fluted Yetter coulters worked great as did the I & M roller on the front of the tractor. JIM GEER

Wisconsin Dairy Farm

R & G MILLER & SONS, INC.

ORGANIC FAMILY FARMS

Who . . . What . . . When

- Certified through MOSA
- Started transitioning to organic production in 1994
- Certified crops in 1996 and milk in 1997
- Currently milking 320 cows
- Farming 1600 certified organic acres
  - 300 pasture
  - 300 corn
  - 200 soybeans
  - 400 alfalfa
  - 100 grass hay
  - 300 small grains (oats, spelt, rye)
- Added 93 transitional acres this year

R&G MILLER & SONS, INC
ORGANIC FAMILY FARMS

NO-TILL SOYBEANS 2007

2008

- plant date: June 2nd (drilled beans)
  June 19th (row beans)
- plant population: 250,000 and
  225,000 seeds/ac respectively

NO-TILL SOYBEANS

2008

- harvest date: November 4th
- yield: 32bu/ac (average)
- overall farm soybean yield: 24 bu/ac

September 11, 2008

Windy Acres Farm

Visit us at our farm store at:
5376 East Robertson Rd, Orlinda, TN 37141
615-654-FARM (3276) email us at
debbieatwindyacresfarm.com
Alfred & Carney Farris

Windy Acres Farm 2011

2009 New Hampshire

California Transplanted Eggplant

Sorghum Sudan Grass

No-Till Pumpkins into Rye – Long Island, NY

John Deere MaxEmerge

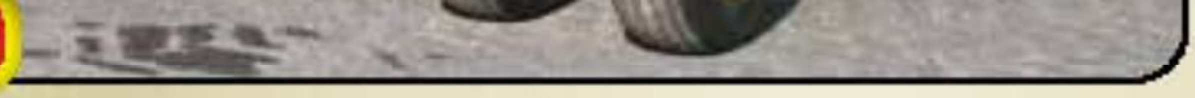
No-Till Grain Drill

No-Till Transplanters

Horse Drawn & Pull Type

30’Roller – West Africa

Roller/Crimper for Raised Beds



ed Model

ing and crimping action of the blades will transform a field of
or other cover crops into a thick, weed suppressing mulch.

60' of Rollers Mounted on a John Deere Planter Frame

Raised Bed

or other liquid can be
r more weight, which
r better performance
oil. Weight of the
er Crop Roller is 1680
y and 2470 lbs. filled
.

Cover Crop Roller benefits

- Cover crop management without herbicides or tillage
- Reduced herbicides in conventional no-till systems
- Mulching effects and barrier attributes of cover crop are maximized
- Rolling and compressing improves the weed suppression of the cover crop
- Reduction of water evaporation from the soil
- Better incorporation of crop residue in organic farming
- Can be built from 6' wide (2 rows) to 30' wide (10 rows) and up to 60' wide on planter frames
- Roller is ground dri
- Blades are arrange pattern to prevent
- Blades are welded ment blades can b as needed
- Can either be mou on tractors or hors

The Concept is Scale Neutral

DeWit

Hand Forged
& Professional
Garden Tools

Earth Tools

Walk-Behind Tractors & Compatible Implements

(502) 484-3988

BCS

Grillo


Clove Oil:
Application

High Residue Cultivator

High Residue Cultivation

Future Research Needs

- Full cropping system integration
    1) Crop maturity
    2) Insect dynamics
    3) Whole system weed seedbank management
    4) Nitrogen cycle impacts

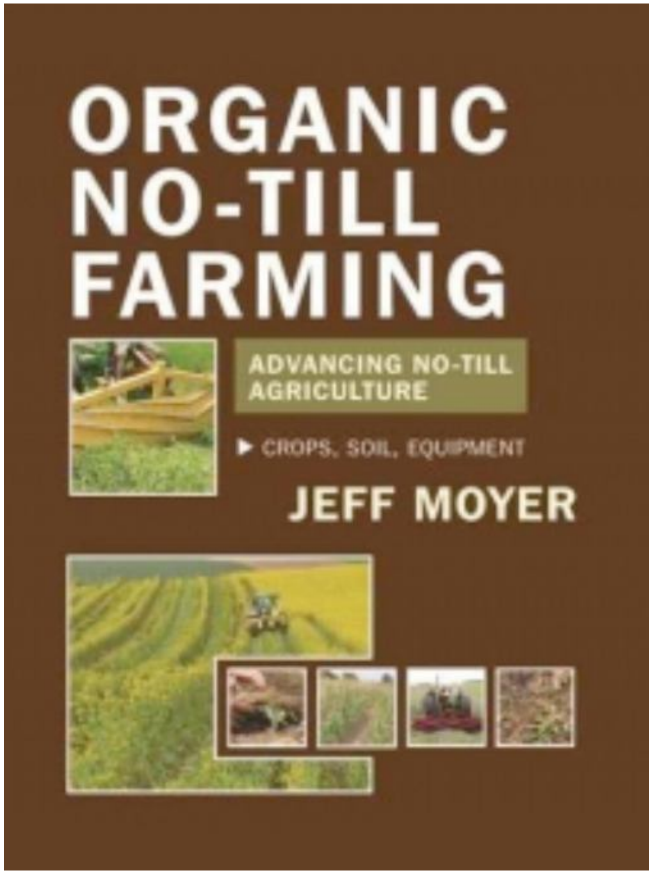
- Optimal high residue cultivation timing

- Develop better understanding of timing

- Rye biomass (decision tool)

- Enhance equipment for seed placement
- Identification of improved varietal traits in both cover crops and cash crops
- Spatial variability in cover crop performance

BOOK NOW AVAILABLE



Organic No-Till Farming

Author - Jeff Moyer

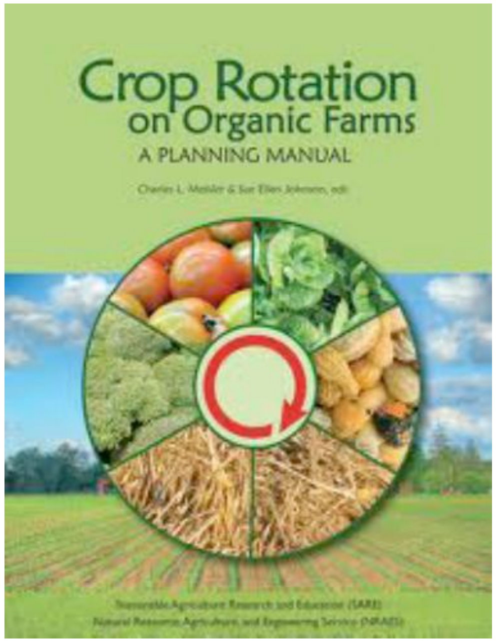
Publisher - Acres USA

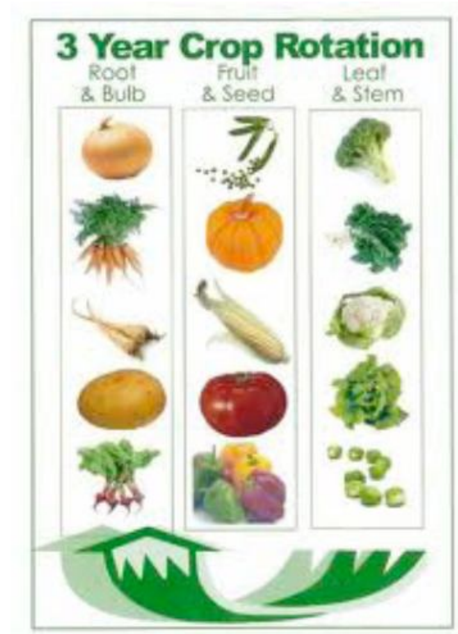
Call: 610-683-6009

Available at Amazon.com

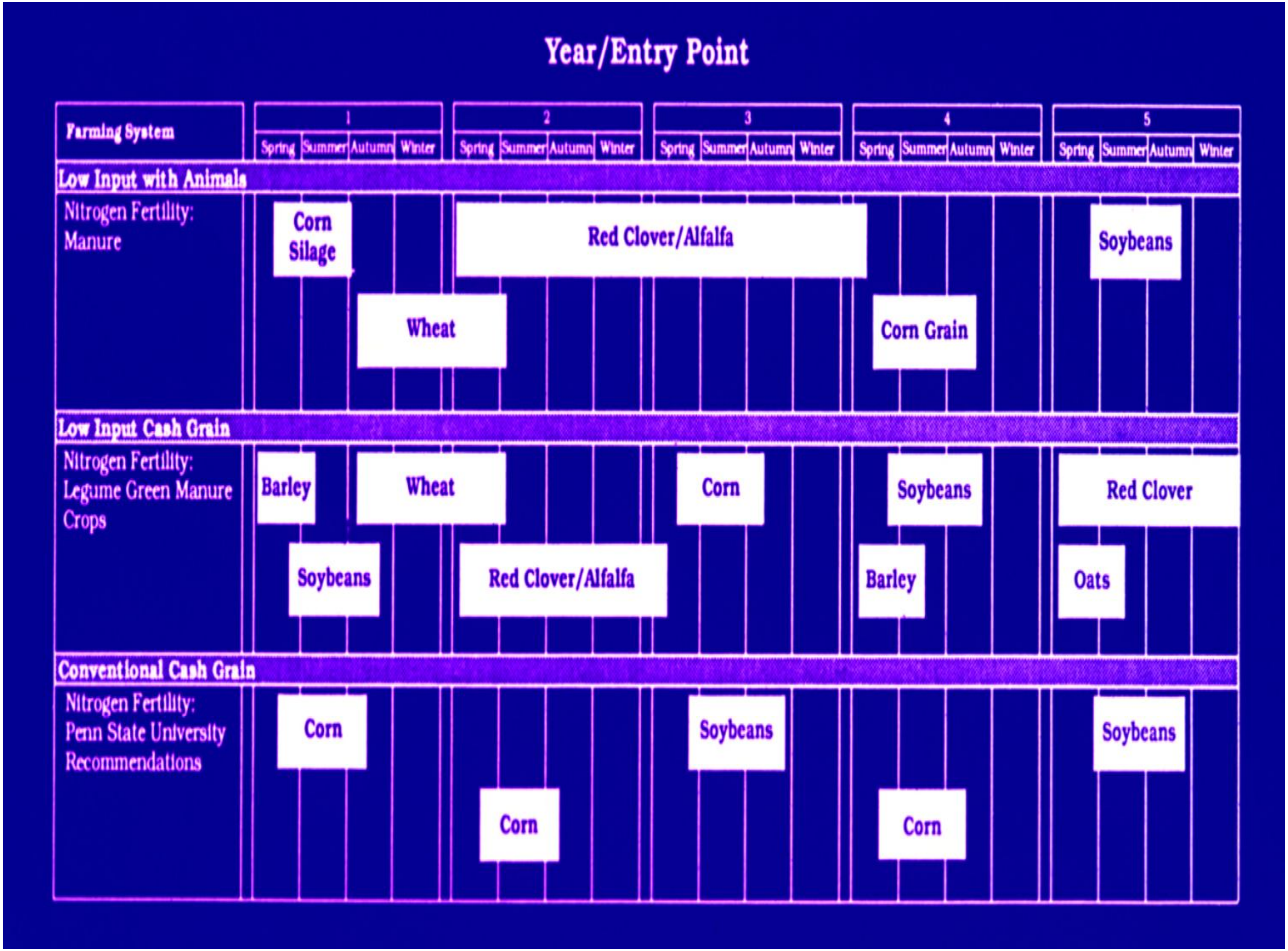
Price : $28.00

Crop Rotation Protocols

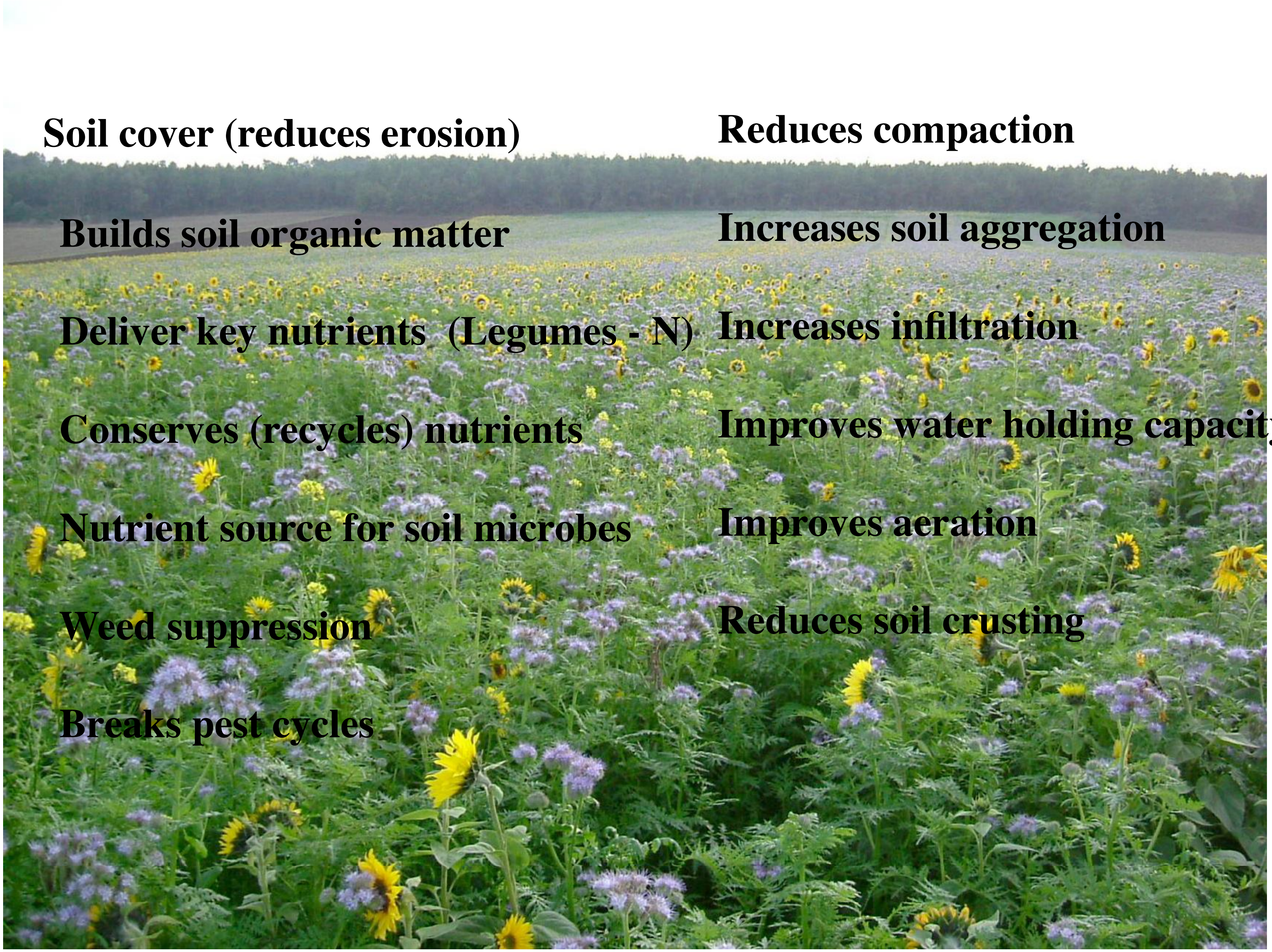




- By Plant Type
- To Build Pest Resistance
- To Improve Soil
- To Make More Money
- To Enhance Biodiversity


Year/Entry Point
Farming System
1
2
3
4
5
Spring
Summer
Autumn
Winter
Low Input with Animals
Nitrogen Fertility: Manure
Corn Silage
Red Clover/Alfalfa
Soybeans
Wheat
Corn Grain
Low Input Cash Grain
Nitrogen Fertility: Legume Green Manure Crops
Barley
Wheat
Corn
Soybeans
Red Clover
Soybeans
Red Clover/Alfalfa
Barley
Oats
Conventional Cash Grain
Nitrogen Fertility: Penn State University Recommendations
Corn
Soybeans
Soybeans
Corn
Corn

Cover Crops



Soil cover (reduces erosion)

Builds soil organic matter

Deliver key nutrients (Legumes - N)

Conserves (recycles) nutrients

Nutrient source for soil microbes

Weed suppression

Breaks pest cycles

Reduces compaction

Increases soil aggregation

Increases infiltration

Improves water holding capacity

Improves aeration

Reduces soil crusting

Typical Numbers of Soil Organisms in Healthy Ecosystems

	Crop Land	Prairie	Forest
	Organisms per gram (teaspoon) of soil		
Bacteria	100 mil. -1 bil.	100 mil. -1 bil.	100 mil. -1 bil.
Fungi	Several yards	10s – 100's of yds	1-40 miles (in conifers)
Protozoa	1000's	1000's	100,000's
Nematodes	10-20	10's – 100's	100's
	Organisms per square foot		
Arthropods	< 100	500-2000	10,000-25,000
Earthworms	5-30	10-50	10-50 (few in conifers)

ScienceDaily — Your source for the latest research news

December 8th, 2011

Fungi: Another Tool in Bacteria's Belt? Fungi and Bacteria Help One Another Stay Mobile, Say Researchers

- — Bacteria and fungi are remarkably mobile. Now researchers at Tel Aviv University have discovered that the two organisms enjoy a mutually beneficial relationship to aid them in that movement -- and their survival.

Beneficial Root Fungi

Dr. David Douds -

USDA-ARS Researcher, specializing in beneficial root fungi research for the last 28 years

Beneficial Root Fungi

- Extend plant root systems
- Produce erosion-resistant carbon enriched soil
- Provide mechanisms for soil biological carbon fixation
- Organic and no-till practices maximize

Plants Feed Fungi, Fungi Builds Organic matter

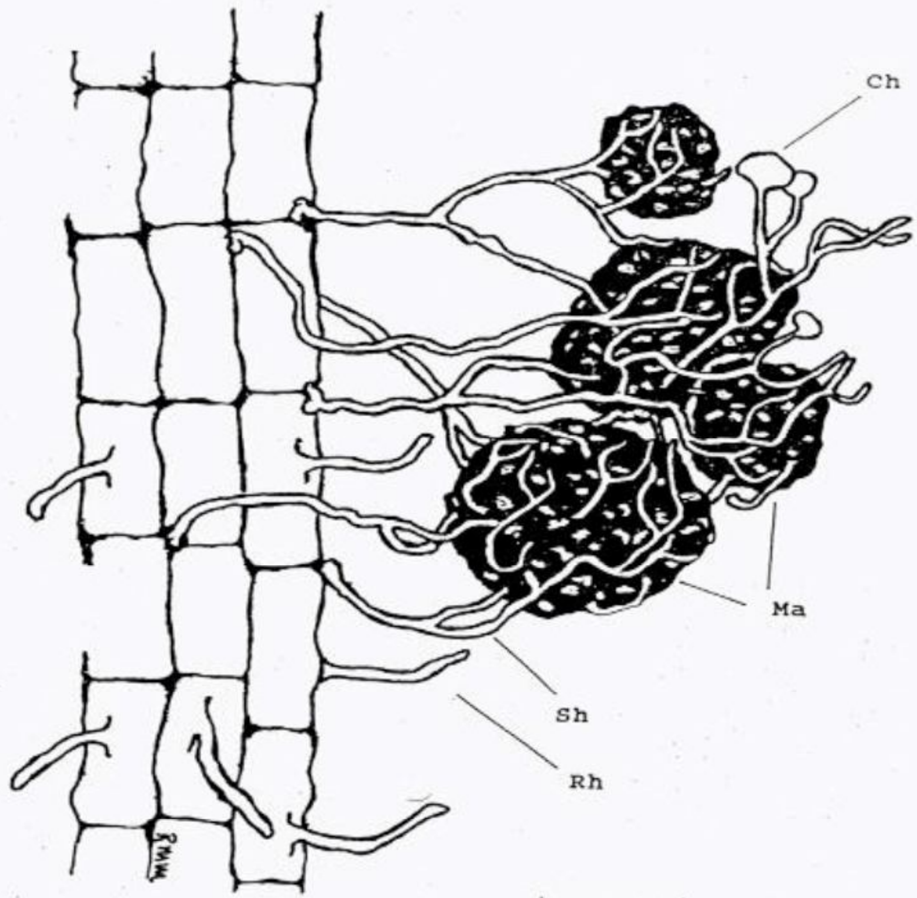
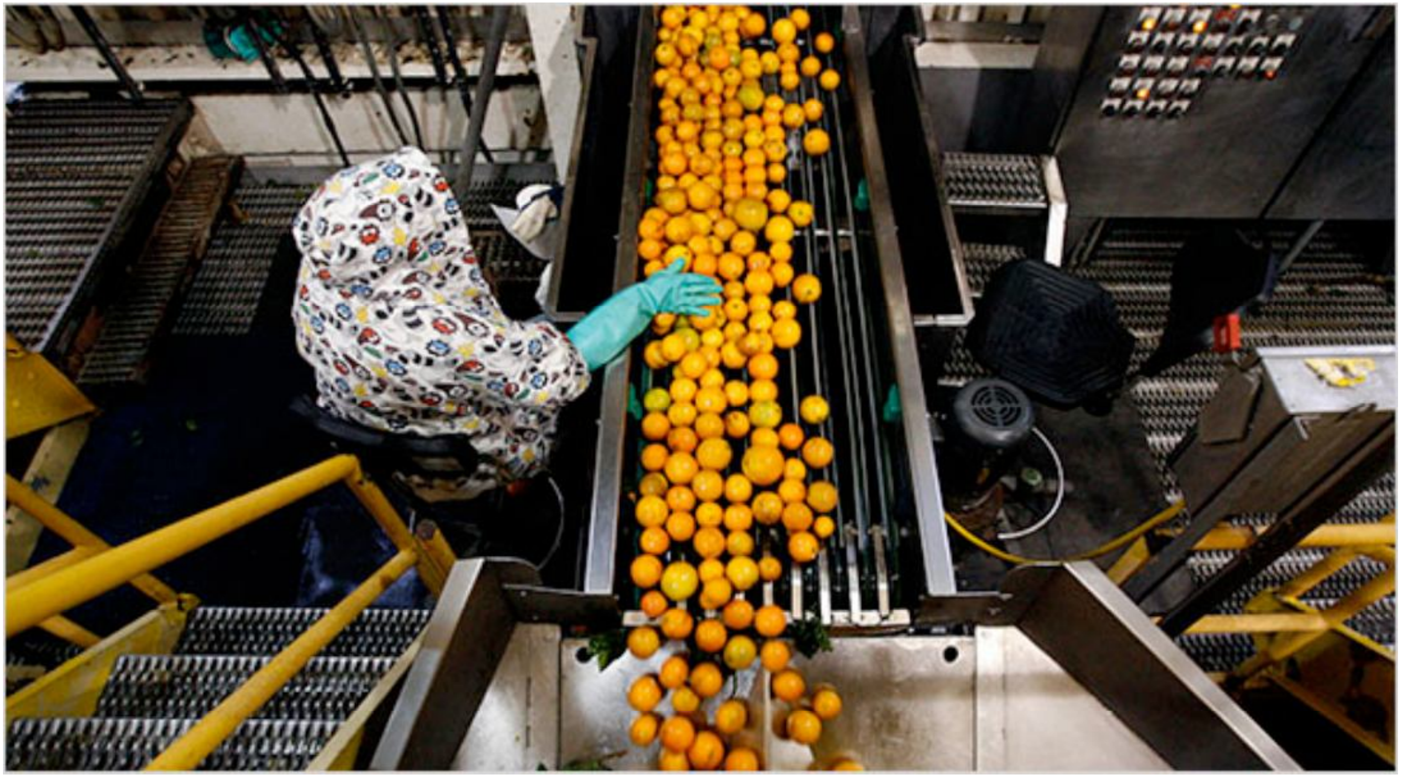


Fig. 2–1. Schematic diagram showing the enmeshment of soil microaggregates by extraradical mycorrhizal hyphae to create the conditions for macroaggregate formation and stabilization within the rhizosphere. *Rh* = root hair; *Sh* = soil hyphae; *Ma* = macroaggregate; *Ch* = chlamydospore. Scale = 0.25 mm.


Root nodules housing
Rhizobia bacteria
Tap root

How Green Is My Orange?



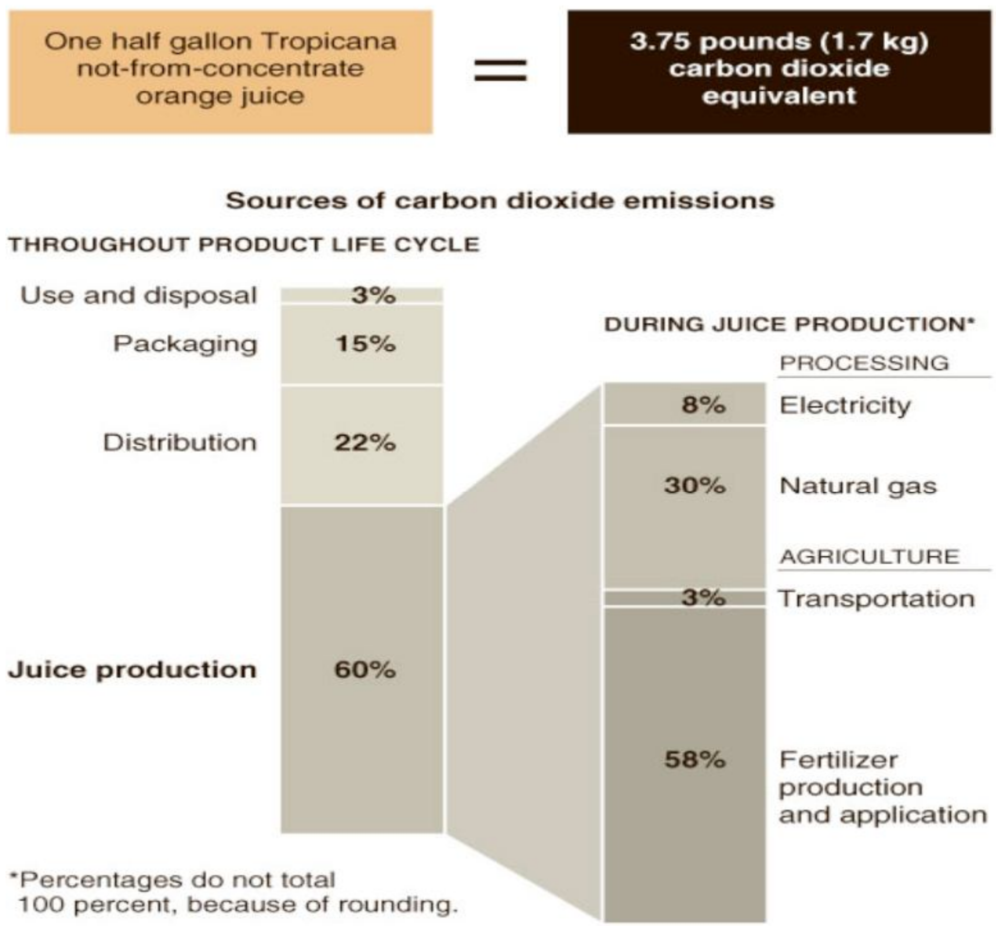
New York Times, Jan. 2009
PEPSICO/ Tropicana

Carbon Footprint

The Environmental Cost of Orange Juice

Tropicana has calculated the carbon footprint of its Pure Premium orange juice — that is, the amount of greenhouse gases produced in its manufacture and use.

Carbon footprint of Tropicana Pure Premium orange juice



Source: Tropicana

THE NEW YORK TIMES

Issues to Consider when Establishing Cover Crops

Seed Selection

Traditional Seed Sources

- Farm Grown
- Foundation Seed
- Registered Seed
- Certified Seed

Certified Organic Seed

- Not Transgenic seed Non-GMO
- Produced on certified organic farms
- Not treated with restricted materials

Seeding the cover crop …

- **Use proven seeding methods**
  - Broadcast seed on surface
  - Broadcast seed on surface, then incorporate with light tillage
  - Broadcast seed between rollers of cultipacker seeder
  - Drill seed
    - tilled soil
    - no-till system


solo


MF
MF

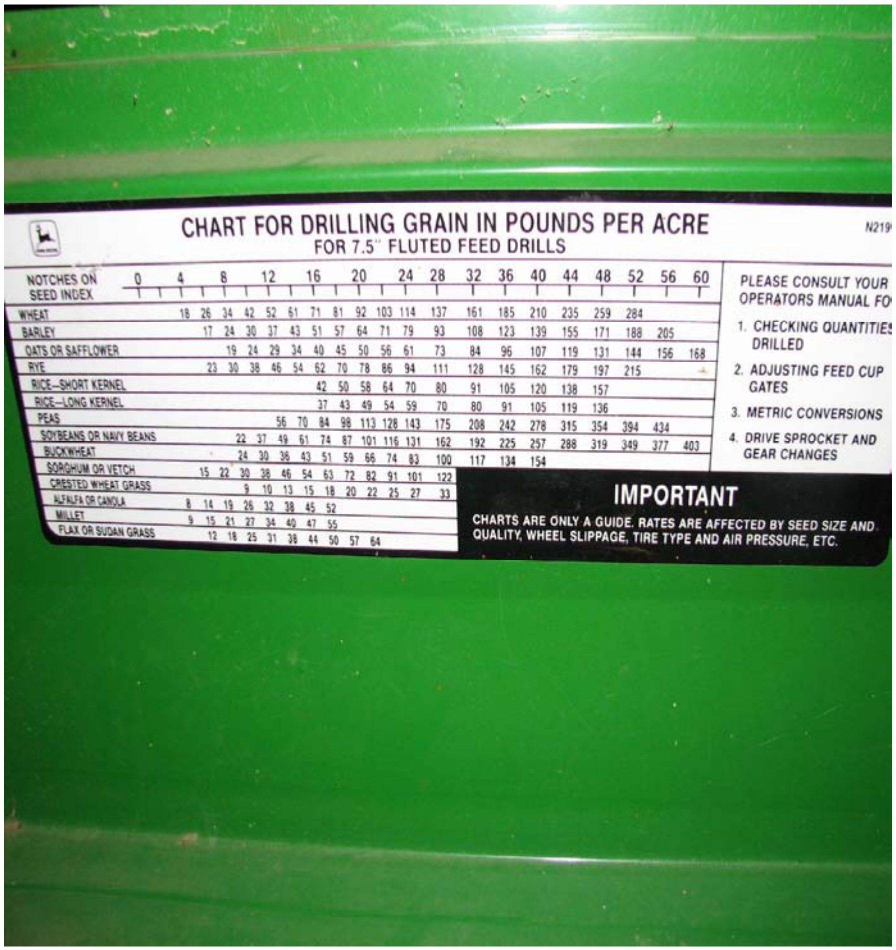
No-Till Drill

Aerial seeding

Comparison of Planting Methods

Planting Method	Seed Distribution	Seed Depth Control
Broadcast	Average (?)	Poor
Broadcast then tillage	Average (?)	Average (?)
Cultipacker seeder	Very good	Good
Conventional drill No-till drill	Very good Very good	Very good (?) Good-very good

Seeding rates

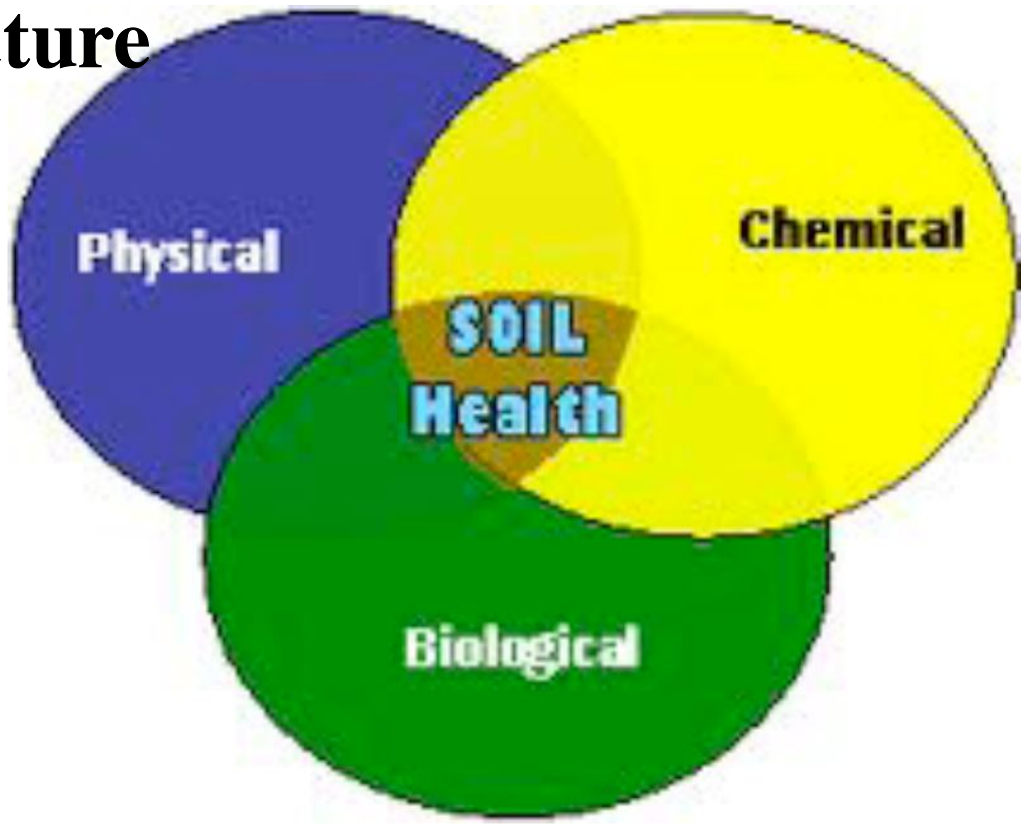


(3) Soil Health Parameters

1- Soil Tests: Chemical Analysis

2- Soil Physical Structure

3- Soil Biology



Published Research

The Myth of Nitrogen Fertilization for Soil Carbon Sequestration

S.A. Khan, R.L.Mulvaney, T.R.Ellsworth, and C.W.Boast Univ. of Ill

Conclusion: A half century of N fertilization has played a crucial role in expanding worldwide grain production, but there has been a hidden cost to the soil resource: a net loss of native SOC and the residue C inputs. This cost has been exacerbated by the widespread use of yield-based systems for fertilizer N management, which are advocated for the sake of short-term economic gain rather then long term sustainability.

Published in Journal of Environmental Quality (2007)

Published Research

Synthetic Nitrogen Fertilizers Deplete Soil Nitrogen: A Global Dilemma for Sustainable Cereal Production

R.L.Mulvaney, S.A. Khan, and T.R.Ellsworth, Univ. of Ill

Conclusion: There is a prevailing view that global food and fiber production will continue to expand …. dominated by synthetic ammoniated fertilizers. ….. *Overwhelmingly*, the evidence is diametrically opposed to the buildup concept and instead corroborates a view elaborated long ago by White (1927) and Albrecht (1938) that fertilizer N depletes SOM by promoting microbial C utilization and N mineralization. An inexorable conclusion can be drawn: The scientific basis for input-intensive cereal production is *seriously* flawed

Published in Journal of Environmental Quality (2009)

RODALE INSTITUTE

Farming Systems Trial (FST)

History and key findings

Initiated in 1981, the Farming Systems Trial (FST) is America's longest running, side-by-side comparison of conventional and organic agriculture.

The project documents the feasibility of transitioning to organic production, as well as its economic, environmental, and energy conservation impacts.

FST has shown the potential of organic agriculture to improve our soil and water, while producing crop yields and net returns that are comparable (and sometimes better) than conventional systems.

Main cropping systems in FST

Organic-manure based

Tilled manure system
No-till manure system (added in 2008)

Organic-legume based

Tilled legume system
No-till legume system (added in 2008)

Conventional-chemically based

Tilled conventional system
No-till conventional system (added in 2008)

2011 FST Field Map

Farming Systems Trial - Field Layout

Sys 1	No-till Manure System
Sys 1	Tilled Manure System
Sys 2	No-till Legume System
Sys 2	Tilled Legume System
Sys 3	No-till Conventional System
Sys 3	Tilled Conventional System

N
W---------E
S

rep/crop.sys/entry pt.

2010	plot no.		2011
rye/O-clv/B	221	o	B/SB/W
W/HV	223	o	HV/C/rye
B/SB/W	222	o	W/HV
C	231	o	SB
C	232	o	SB
SB	233	o	C
HV/C/rye	212	o	rye/O/rye
Hay	213	o	Hay/Csil/W
W/Hay	211	o	Hay

2010		plot no.	2011
rye/O-clv/rye	o	121	rye/SB/W
W/HV	o	123	HV/C/rye
rye/SB/W	o	122	W/HV
Hay	o	113	Hay/Csil/W
W/Hay	o	111	Hay
HV/C/rye	o	112	rye/O/rye
C/rye	o	133	rye/SB/W
W/HV	o	131	HV/C/rye
rye/SB/W	o	132	W/HV

Siegfriedale Road

2010	plot no.		2011
W/HV	323	o	HV/C/rye
rye/O-clv/rye	321	o	rye/SB/W
rye/SB/W	322	o	W/HV
W/HV	331	o	HV/C/rye
rye/SB/W	332	o	W/HV
C/rye	333	o	rye/SB/W
HV/C/rye	312	o	rye/O/rye
W/Hay	311	o	Hay
Hay	313	o	Hay/Csil/W
C	831		SB
SB	833		C
C	832		SB
rye/O-clv/B	821		B/SB/W
B/SB/W	822		W/HV
W/HV	823		HV/C/rye
HV/C/rye	812		rye/O/rye
W/Hay	811		Hay
Hay	813		Hay/Csil/W

2010	plot no.	2011
rye/O-clv/rye	421	rye/SB/W
rye/SB/W	422	W/HV
W/HV	423	HV/C/rye
HV/C/rye	412	rye/O/rye
Hay	413	Hay/Csil/W
W/Hay	411	Hay
C/rye	433	rye/SB/W
rye/SB/W	432	W/HV
W/HV	431	HV/C/rye
W/Hay	711	Hay
Hay	713	Hay/Csil/W
HV/C/rye	712	rye/O/rye
C	731	SB
SB	733	C
C	732	SB
rye/O-clv/B	721	B/SB/W
B/SB/W	722	W/HV
W/HV	723	HV/C/rye

2010	plot no.		2011
HV/C/rye	512	o	rye/O/rye
W/Hay	511	o	Hay
Hay	513	o	Hay/Csil/W
B/SB/W	522	o	W/HV
rye/O-clv/B	521	o	B/SB/W
W/HV	523	o	HV/C/rye
C	531	o	SB
SB	533	o	C
C	532	o	SB
rye/SB/W	622		W/HV
rye/O-clv/rye	621		rye/SB/W
W/HV	623		HV/C/rye
W/HV	631		HV/C/rye
C/rye	633		rye/SB/W
rye/SB/W	632		W/HV
Hay	613		Hay/Csil/W
HV/C/rye	612		rye/O/rye
W/Hay	611		Hay

Tree Line

---60 ft -----

|-----------------------------300 ft -------------------------------------|

NOTE: Plots 221, 223, 222, 231 were shortened to 180 feet
Plots 632, 613, 612, 611 were shortened to 200 feet

o =location of zero tension lysimeters

B = Winter barley
C = Corn
Csil = Corn silage
clv = clover mix

Hay = Alfalfa / orchard grass mix
HV = Hairy vetch
O = Oats

SB = Soybean
W = Winter wheat

compost is applied before oats and corn silage in the Manure systems

Areas of research in FST

- Yields
- Soil quality
- Water quality and quantity
- Energy analysis
- Economics

FST Soil Results

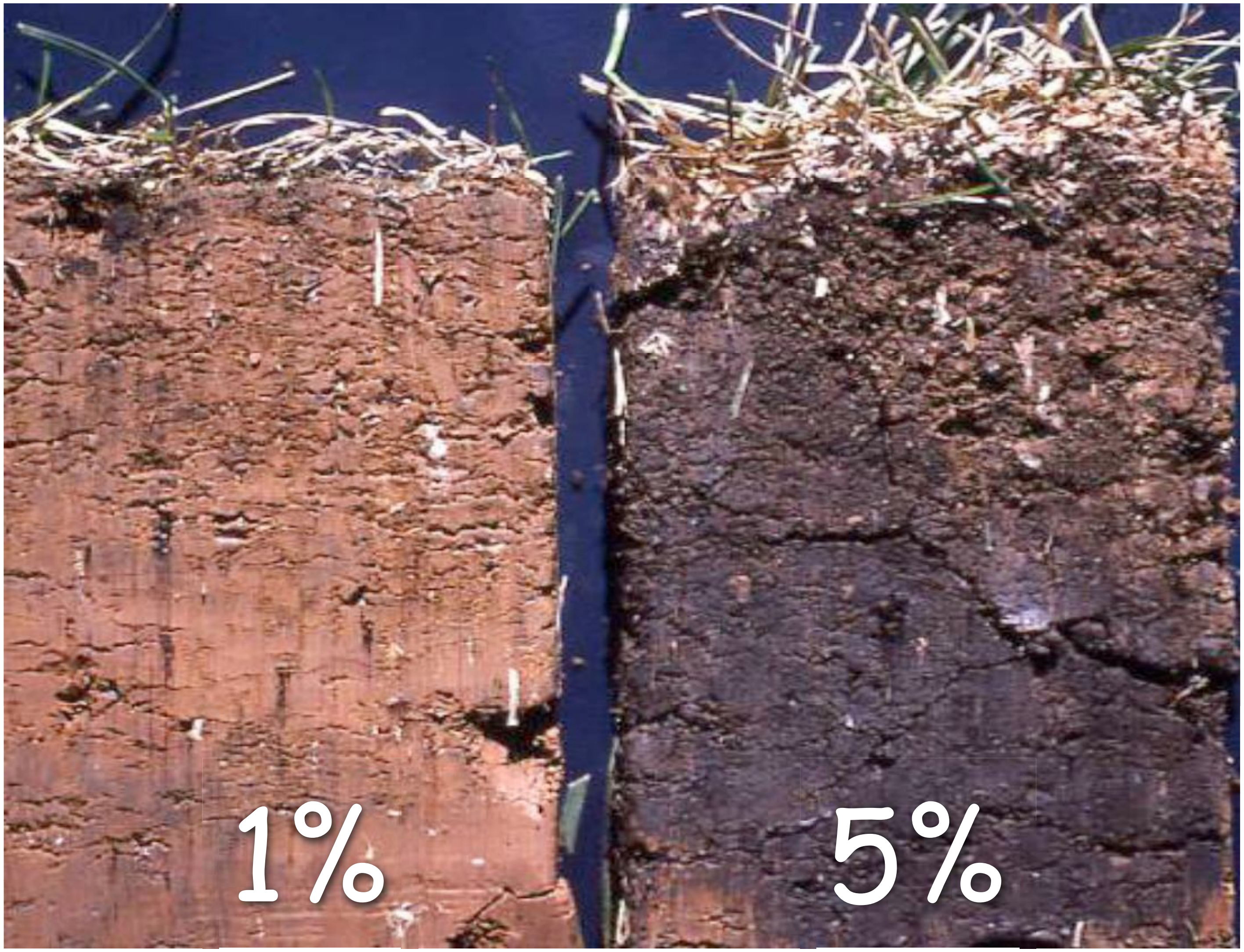
Soils of the organic systems have a more active soil biological community

→ higher levels of glomalin (a glycoprotein that acts like ‘glue’, binding organic matter to mineral particles),

→ greater populations of mycorrhizae (a fungus that forms a symbiotic relationship with its host plant: the fungus receives carbohydrates from the plant, which in return gains access to water and nutrients).

This leads to improved soil structure and enhanced carbon sequestration.

Soil Organic Matter



The RODALE INSTITUTE

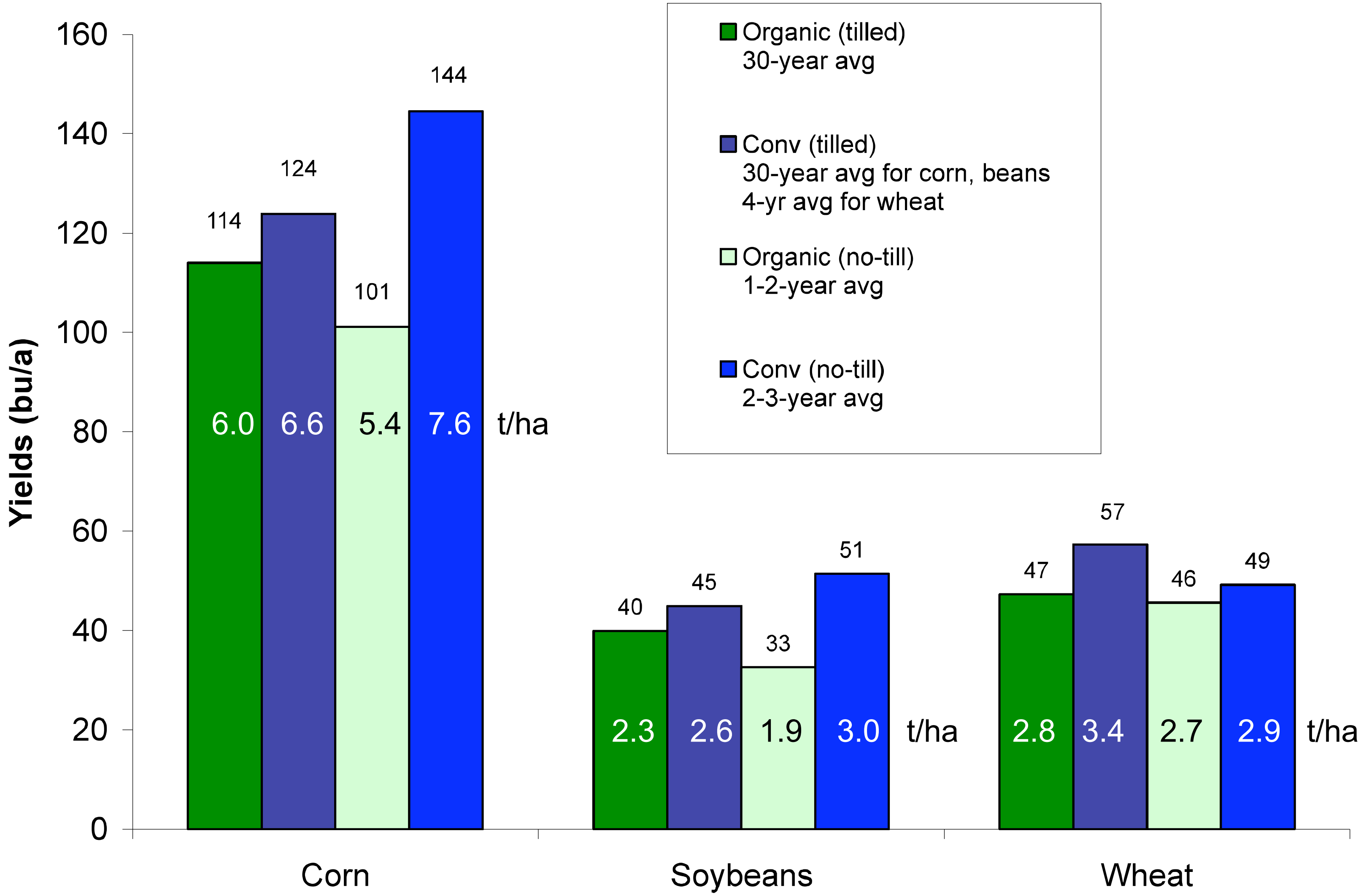
Equipment

iLAB

FTIR

Figure 2: Central FST Result: C increase has been significant in the Organic (Legume and Manure) systems, and not in the Conventional system

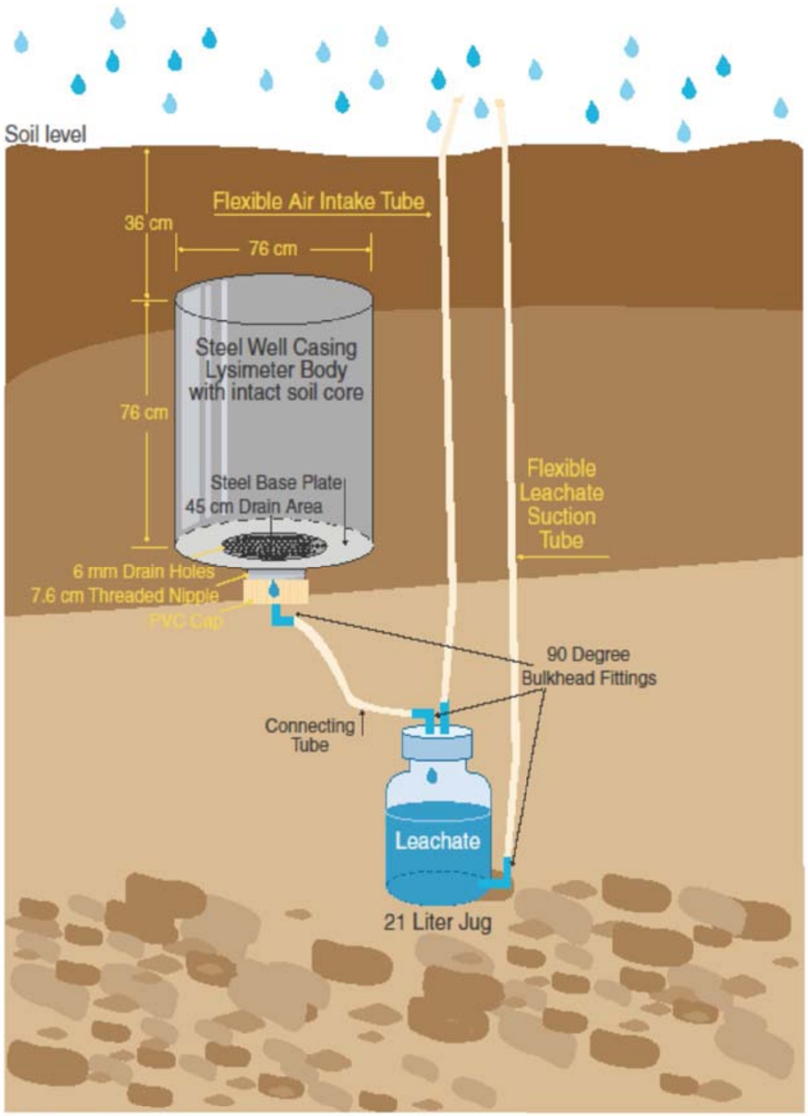
FST long-term grain yields (1981-2010)



Organic (left) and conventional (right) corn during the 1995 drought – six weeks after planting

FST Water Results

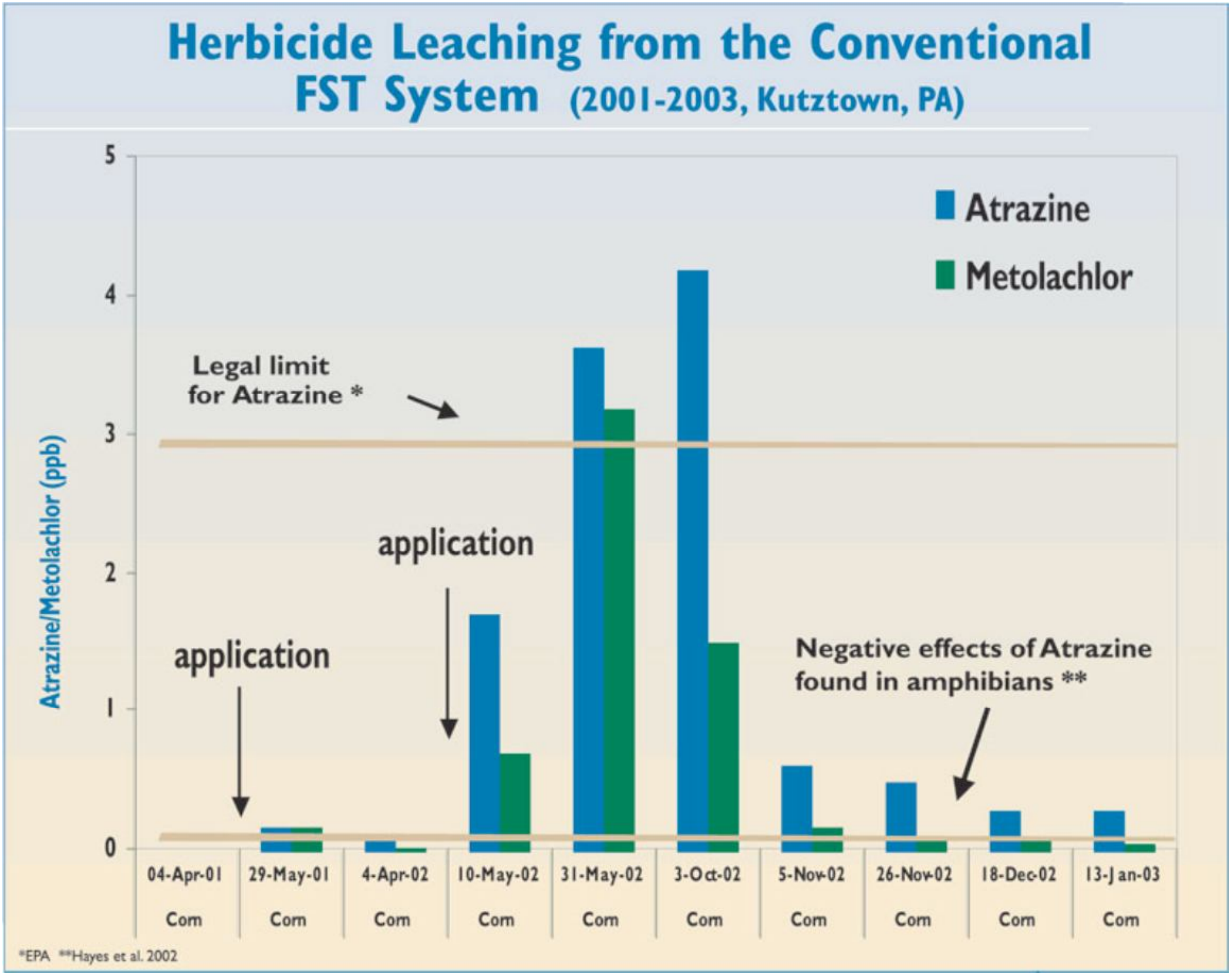
Lysimeter schematic



Lysimeter pumping year round

te

FST Water Results



FST Energy Analysis

Energy input in the conventional systems was 45% higher

- Conventional systems: Nitrogen fertilizer (41%)
- Organic systems: Fuel for field operations (45%)

Production efficiency:

28% higher in the organic systems (energy inputs per crop produced)

Greenhouse gas emissions:

40% less in organic systems (GHG emitted per crop produced)

Energy budgets for corn

Energy inputs	Organic Tilled vetch+ corn	Organic No-till vetch+ corn	Conv Tilled corn	Conv No-till vetch+ corn
Nitrogen fertilizer	0	0	9,875	4,942
Phosphorus fertilizer	0	0	391	391
Potassium fertilizer	102	102	118	118
Lime	203	203	243	243
Seed	2,559	2,559	1,182	2,468
Herbicide	0	0	1,055	1,509
Transportation of inputs	247	247	453	486
Equipment	639	615	619	509
Diesel fuel	5,359	3,046	2,725	2,201
Labor	1,041	511	712	563
Total energy (MJ/ha*yr)	**10,150**	**7,283**	**17,372**	**13,429**

This analysis was performed using the Farm Energy Analysis Tool (FEAT)3

Energy budgets for soybeans

Energy inputs	Organic Tilled rye+ soybeans	Organic No-till rye+ soybeans	Conv Tilled soybeans	Conv No-till rye+ soybeans
Nitrogen fertilizer	0	0	0	0
Phosphorus fertilizer	0	0	0	0
Potassium fertilizer	102	102	118	118
Lime	203	203	243	243
Seed	3,441	3,441	1,532	3,287
Herbicide	0	0	408	893
Transportation of inputs	465	465	315	497
Equipment	639	615	586	461
Diesel fuel	5,047	2,733	2,110	1,593
Labor	701	188	200	196
Total energy (MJ/ha*yr)	**10,597**	**7,747**	**5,512**	**7,288**

This analysis was performed using the Farm Energy Analysis Tool (FEAT)3,

FST Economic Analysis

Conventional systems had the lowest profits of all 6 systems:

- No-till: $170 /acre/year
- Tilled: $210 /acre/year

Organic systems had profits that were ~3-4 times higher:

$491 to $653 /acre/year

Most and least profitable grain crops:

- Organic systems: Wheat (~$800/acre/year)
- Conventional systems: Soybeans (~$300/acre/year)

- No-till conventional corn: $27/acre/year

Production budgets for corn

	Organic Tilled	Organic No-till	Conv Tilled	Conv No-till
	vetch+ corn	vetch+ corn	corn	vetch+ corn
Expenses				
fertilizer	0.00	0.00	118.04	90.44
herbicide	0.00	0.00	108.19	144.56
seeds	139.40	139.40	88.15	148.35
custom haul	30.00	30.00	30.00	30.00
labor	39.35	18.61	15.78	16.14
fuel	47.60	23.96	23.76	20.67
repair & maintenance	17.56	10.35	8.42	8.97
interest on op.capital	6.35	4.54	11.50	13.50
fixed expenses	52.02	30.98	27.31	27.46
Total Expenses ($/acre)	**332**	**258**	**431**	**500**
Profit ($/acre) *				
@ 100 bu/a yield	**504**	**578**	**-16**	**-85**
@ 150 bu/a yield	**922**	**996**	**191**	**122**
@ 200 bu/a yield	**1,340**	**1,414**	**399**	**330**
Break-even price ($/bu)				
@ 100 bu/acre	**3.32**	**2.58**	**4.31**	**5.00**
@ 150 bu/acre	**2.22**	**1.72**	**2.87**	**3.33**
@ 200 bu/acre	**1.66**	**1.29**	**2.16**	**2.50**

These production budgets were calculated using the free on-line Mississippi State Budget Generator (MSBG), developed by the Department of Agricultural Economics at Mississippi State University, (http://www.agecon.msstate.edu/what/farm/generator/). When available, input and price data were taken directly from data collected at the Rodale Institute (2008-2010), otherwise default values from the Budget Generator were used.

* The 3-year average price for organic corn was $8.36/bu, for conventional corn $4.15/bu.

Economic budgets for soybeans

	Organic Tilled	Organic No-till	Conv Tilled	Conv No-till
	rye+ soybeans	rye+ soybeans	soybeans	rye+ soybeans
Expenses				
fertilizer	0.00	0.00	0.00	0.00
herbicide	0.00	0.00	16.32	35.79
seeds	93.02	93.02	57.34	111.34
custom haul	8.00	8.00	8.00	8.00
labor	36.87	16.13	11.36	10.93
fuel	44.03	20.38	16.00	14.10
repair & maintenance	15.62	8.41	6.25	7.04
interest on op.capital	5.06	3.43	3.45	8.08
fixed expenses	46.70	25.66	20.10	21.20
Total Expenses ($/acre)	**249**	**175**	**139**	**216**
Profit ($/acre) *				
@ 30 bu/a yield	**314**	**388**	**168**	**90**
@ 40 bu/a yield	**502**	**576**	**270**	**193**
@ 50 bu/a yield	**689**	**763**	**373**	**295**
Break-even price ($/bu)				
@ 30 bu/acre	**8.31**	**5.83**	**4.63**	**7.22**
@ 40 bu/acre	**6.23**	**4.38**	**3.47**	**5.41**
@ 50 bu/acre	**4.99**	**3.50**	**2.78**	**4.33**

These production budgets were calculated using the free on-line Mississippi State Budget Generator (MSBG), developed by the Department of Agricultural Economics at Mississippi State University, (http://www.agecon.msstate.edu/what/farm/generator/). When available, input and price data were taken directly from data collected at the Rodale Institute (2008-2010), otherwise default values from the Budget Generator were used.

*The 3-year average price for organic soybeans was $18.77/bu, for conventional soybeans $10.23/bu.

FST Summary

- Over the 30 years of the trial, yields were the same between organic and conventional systems.
- Soil organic matter and soil structure improved in the organic systems while they stayed the same in the conventional system.
- Conventional systems used 45% more energy and production efficiency was 28% higher in the organic systems.
- The organic systems emitted 40% less GHG than the conventional systems.
- The organic systems were 3-4 times more profitable than the conventional systems.

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Thank You!

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