



ORGANIC NUTRIENT MANAGEMENT: Details for Implementation

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Outline

- Organic Soil Fertility: The basics
- Crop Rotations
- Cover Crops
- Manure & Compost
- Livestock Standards
- Approved & Prohibited Substances
- Organic Nutrient Application and Planning

What is Organic Agriculture?

- *The production of crops and animals without the use of synthetic pesticides or fertilizers.*
- “An organic farm, properly speaking is not one that uses certain substances and avoids others; it is a farm *whose structure is formed in imitation of the structure of a natural system*; it has the integrity, the independence, and the benign dependence of an organism.”

- Wendell Berry



NOP Definition of “Organic Production”

- ❖ **Positive definition:** ‘A production system that is managed . . . by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity’ (7 CFR 205.2)

“...maintain or improve soil and water quality...”

- ❖ **Negative definition:** Food produced and handled without synthetic substances (with specific, limited, well-defined exceptions), and excludes genetically modified organisms, sewage sludge, and irradiation (7 CFR 205.105)



-- Organic Food Production Act, 1990

Related NOP Requirements

- Organic System Plan
- Recordkeeping
- **§ 205.200** Production practices ... must maintain or improve the natural resources of the operation, including soil and water quality.



Anyone know
what this is?

§ 205.203

Soil fertility and crop nutrient management practice standard.

- (a)maintain or improve the physical, chemical, and biological condition of soil and minimize soil erosion.
- (b) ...rotations, cover crops, and the application of plant and animal materials.
- (c) ...manage plant and animal materials to maintain or improve soil organic matter content in a manner that does not contribute to contamination...
- (d) ...manage crop nutrients and soil fertility to maintain or improve soil organic matter content in a manner that does not contribute to contamination ...
- (e) The producer must not use: *Prohibited substances*

Organic Soil Fertility

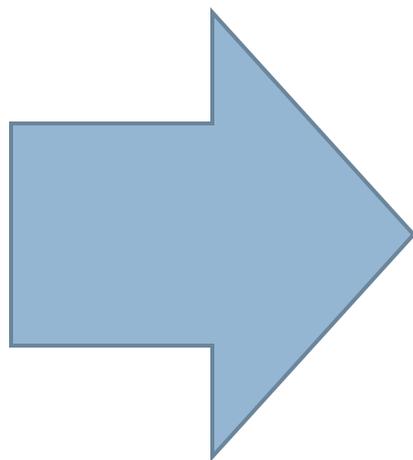
- One component of integrated farm plan
- Relies on biological processes
- What does this mean?
 - ▣ **“Feed the soil so that the soil can feed the plants”**
 - ▣ Moisture, temp., tillage, N levels all affect decomposition and mineralization
 - ▣ Crop and animal residues do not afford precise nutrient management (exact amount at exact time)

Soil 'Livestock'

- Fix atmospheric N
- Promote decomposition of OM so that nutrients are available to plants
 - ▣ PAN is released from OM through mineralization
- Mycorrhiza develop symbiotic relationships with roots to extend reach
- Produce microbial polymers that contribute to soil aggregation

Why do stable soil aggregates matter?

- ❑ Improved water and nutrient holding capacity
- ❑ Improved infiltration
- ❑ Improved aeration
- ❑ Improved tilth and soil structure



- ❑ Deeper/healthier roots
- ❑ Easier tillage
- ❑ Decreased crusting & clodding
- ❑ Decreased erosion

(a) The producer must select and implement tillage and cultivation practices that maintain or improve the physical, chemical, and biological condition of soil and minimize soil erosion.

- **Reduce soil disturbance:**
 - Minimum till & mulch till
 - Flame weeding
 - Choosing appropriate environmental and soil conditions
- **Build soil organic matter:**
 - Mulch
 - Cover crop
 - Crop rotations
 - Compost & manures

Organics biggest challenge!



Gardens of Eagan
Taken May 17, 2010, Rye

(b) The producer must manage crop nutrients and soil fertility through rotations, cover crops, and the application of plant and animal materials.



§ 205.205 Crop rotation practice standard.

- The producer **must** implement a crop rotation including but not limited to sod, cover crops, green manure crops, and catch crops that provide the following functions that are applicable to the operation:
 - ▣ Maintain or improve soil organic matter content;
 - ▣ Provide for pest management in annual and perennial crops;
 - ▣ Manage deficient or excess plant nutrients; and
 - ▣ Provide erosion control.

Real Fields on Real Farms:

This page is from *Crop Rotation on Organic Farms: A Planning Manual*, NRAES 177. To purchase the book, visit www.nraes.org or www.sare.org, or call (807) 255 7654. The first page of this PDF has information on fair use.

		One Straw Farm Drew Norman, Md.	Pleasant Valley Farm Paul & Sandy Arnold, N.Y.	Riverbank Farm Davida Blyn, Conn.		
Y1	Winter	Orchardgrass – Alfalfa Hay	Mulch	Hay		
	Spring		Lettuce			
	Summer	Plow-down – Fallow	Beans	Buckwheat		
	Fall	Crimson Clover – Vetch	Radish	Oats – Red Peas		
Y2	Winter	Tomatoes	Winter Rye		Multiple Crops In Strips: Onions/ Spinach/ Beets/Radish/Salad Mix/ Lettuce/Peas	
	Spring		Carrots			
	Summer	Beans	Turnips	Carrots	Beets	Lettuce
	Fall	Rye – Vetch	Rye	Rye		
Y3	Winter	Plow-down – Fallow	Lettuce	Tomato / Pepper / Eggplant on plastic	OR Cucumber/ Zucchini / Melon on plastic	
	Spring	Brassicas	Winter Squash (with hay mulch)			
	Summer		Mulch	Winter Rye		
	Fall					
	Winter					

KEY

- "Fallow" indicates a deliberate period of bare soil, often with frequent cultivation to kill weeds.
- Split boxes indicate strip crops or split beds.
- Intercrops with crops from more than one family are represented by a dark gray background.
- Cash crops are indicated by black text, cover crops and fallows by white text.

The boxes below show the color codes for plant families in the rotation diagrams.

^d Harvest of brassica and fall cool-season crops extends into winter. Clovers may be interseeded at the last cultivation.



Organic Cover Cropping

- Common Types
 - ▣ Higher seeding rates- up to 50% +



Common Vetch



Kansas State University Research Plot
Taken July 7, 2008, 'Pacific Gold' mustard

Species	Dry Matter (T/A)	Total N (lb/A)	PAN (lb/A)
Fava beans	3.5	140	50%
Hairy vetch	2.2	140	50%
Common vetch	2-3	120	50%
Sub clover	2.5	115	50%
Crimson clover	3	110	50%
Field pea	1.7	100	50%
Red clover	1.7	85	50%
Rape seed	3	80	0
Small grains	2-3	60	0
Annual rye grass	3	45	0
Cereal rye	2-3+	0	0
Sudhan grass	Very high!	?	?

Using Cover Crops in Oregon EM8704



Gardens of Eagan
Taken Aug. 18th, 2010, Millet



Varies based on % legumes, maturity, and other factors



Organic Cover Cropping

- Mixes/cocktails
 - ▣ Combine multiple benefits
 - ▣ Increase diversity and habitat
 - ▣ Grasses immobilize or release small amounts of N: -5%-20% PAN
 - ▣ Legumes have 30-50% PAN
- Sources
 - ▣ Organic v. Non-Organic Seed
 - Commercial Availability

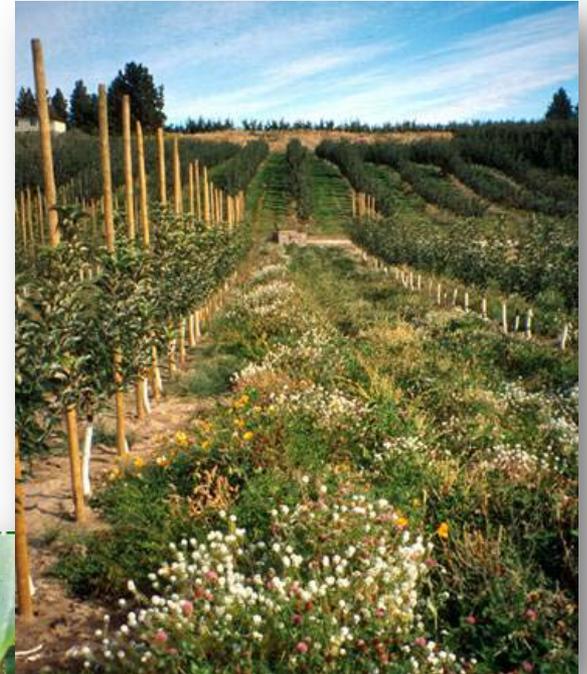


IA NRCS, Wells Dairy

Aerial applied wheat and red clover into organic soybeans for weed control and winter cover.

Additional Cover Crop Considerations

- ❑ Prevent leaching and runoff!
- ❑ Complexity of N release
- ❑ Pest & Disease Management
- ❑ Weed Management
- ❑ Allelopathy



(c) The producer must manage plant and animal materials to maintain or improve soil OM content in a manner that does not contribute to contamination. . .

Animal and plant materials include:

- ❑ Raw animal manure
- ❑ Composted plant and animal materials
- ❑ Un-composted plant materials.



Raw animal manure

- Must be composted unless it is:
 - Applied to land used for a crop not intended for human consumption
 - Incorporated into the soil not less than ___ days prior to harvest
 - 90: edible portion doesn't have direct contact with the soil
 - 120: direct contact with soil

Processed manures can also be used until the day of harvest with documentation of that it has reached 165F or 150F for one hour.



Compost

- NOP regulation defines compost as a process that:
 - ▣ Established an initial C:N ratio of between 25:1 and 40:1
 - ▣ Maintained between 131 °F and 170 °F for
 - 3 days using an in-vessel or static aerated pile system; **OR**
 - 15 days using a windrow composting system, during which period, the materials must be turned a minimum of five times.
- The pH value of finished compost is usually 6.5-7.5. At pH values below 7.5, N remains in the ammonium form and is not subject to loss as ammonia gas. - OSU EM 8954-E

More on Manure & Livestock

- Organic v. Conventional Manure
 - Contamination
- Origin of Livestock
- Livestock feed
- Health care
- **Living Conditions**
- Pasture

Organic Livestock Living Conditions

- (a) *The producer of an organic livestock operation must establish and maintain year-round livestock living conditions which accommodate the health and natural behavior of animals, including:*
 - (1) ***Year-round access for all animals to the outdoors, shade, shelter, exercise areas, fresh air, clean water for drinking, and direct sunlight, suitable to the species, its stage of life, the climate, and the environment. Yards, feeding pads, and feedlots may be used to provide ruminants with access to the outdoors during the non-grazing season and supplemental feeding during the grazing season. Yards, feeding pads, and feedlots shall be large enough to allow all ruminant livestock occupying the yard, feeding pad, or feedlot to feed simultaneously without crowding and without competition for food. Continuous total confinement of any animal indoors is prohibited. Continuous total confinement of ruminants in yards, feeding pads, and feedlots is prohibited.***
- It does not currently say access to soil or give stocking densities



Concerns?

- Effects on the current CNMPs when animals are “confined” in covered free-stall barns for 4 months a year
 - ▣ *(b) The producer of an organic livestock operation may provide temporary confinement or shelter for an animal because of:*
 - *(1) Inclement weather;*
 - *(4) Risk to soil or water quality;*
 - ▣ Oregon Tilth allows free stall barns with open sides because there has been no further clarification on the definition of "outdoor access". Animals must have fresh air and access to direct sunlight. This could vary by certifier and can change if additional guidance from the NOP is released.

Concerns?

- The need to comply with outdoor loafing areas accessible for an undefined period of time, in any kind of weather.
 - ▣ Producers can opt to build an uncovered concrete outdoor area with an enclosed barn for temporary confinement during inclement weather, assuming it meets the standards.
- Producers need to be complaint with this rule by June of 2011
- NOSB meeting in April for feedback

Organic Livestock Living Conditions

- (a) *The producer of an organic livestock operation must establish and maintain year-round livestock living conditions which accommodate the health and natural behavior of animals, including:*
 - *Pasture requirements*
 - *Appropriate clean, dry bedding. When roughages are used as bedding, they must be organic.*
 - *Shelter*
 - *The use of yards, feeding pads, feedlots and laneways that shall be well-drained, kept in good condition, and managed to prevent runoff and contamination*

(d) A producer may manage crop nutrients and soil fertility to maintain or improve soil OM content in a manner that does not contribute to contamination . . . by applying 'APPROVED substances'.

- Review § 205.203 (d) 1-5
- In other words, synthetic materials cannot be used unless they are specifically approved, and natural materials can be used unless they are specifically prohibited.
- 'Prohibited substances' also include: sewage sludge, GMOs, treated lumber, and burning as a means of disposal for crop residues produced on the operation:
 - *Except, That, burning may be used to suppress the spread of disease or to stimulate seed germination.*

Where can you look for approved substances?

- Third party sources that review materials for compliance with the NOP regulation:

- OMRI, Organic Materials Review Institute

<http://www.omri.org/home>

- WSDA Materials List

<http://agr.wa.gov/foodanimal/organic/materialslists.aspx>



Where can you look for approved substances?

Welcome to the Organic Materials Review Institute | Organic Materials Review Institute - Windows Internet Explorer

File Edit View Favorites Tools Help

http://www.omri.org/

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Welcome to the Organic Materials Review Institute

Founded in 1997, the Organic Materials Review Institute (OMRI) provides organic certifiers, growers, manufacturers, and suppliers an independent review of products intended for use in certified organic production, handling, and processing. OMRI is a 501(c)3 nonprofit organization. When companies apply, OMRI reviews their products against the National Organic Standards. Acceptable products are OMRI Listed® on the *OMRI Products List*. OMRI also provides subscribers and certifiers guidance on the acceptability material inputs in general under the National Organic Program.

How Can We Help You?

Find Products
OMRI® Listed products undergo a rigorous review to ensure that they comply with USDA organic standards. The online list of products is updated regularly to

Get Listed
The OMRI review service verifies your credibility and allows customers to confidently choose your product for organic production. Application forms are

Become a partner
OMRI was founded by organic certifiers and continues to serve certifiers and their clients with crucial information to ensure organic integrity. The OMRI

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News

OMRI Announces New Fees for 2011
(January 24, 2011) In order to continue

Where can you look for approved substances?

The screenshot shows a web browser window with the address bar displaying <http://www.omri.org/simple-gml-search/results/straw>. The page features the OMRI logo and a navigation menu on the left with links for Home, OMRI Lists, Organic Seeds, Subscribers, Certifiers, Product Suppliers, About, Contact, Help, and Donate. The main content area is titled "Generic Materials Search: straw" and shows "2 results" and "2 items found." It includes a link to view the OMRI Generic Materials List Glossary in PDF format and instructions to click on arrows or material names for more details. A search box on the right contains the text "straw" and a "Search" button. Below the search box is a "Need More Tools" section with a link to an OMRI Subscription. A blue arrow points from the search box to the "Have you forgotten your e-mail?" link.

Generic Materials Search: straw

2 results
2 items found.

View the OMRI Generic Materials List Glossary in PDF format [here](#).

Click on the arrow or the material name to view more details about each material.

- ▶ Plants
- ▼ Straw
 - Status: Allowed
 - Class: Crop Fertilizers and Soil Amendments, Crop Pest, Weed, and Disease Control
 - Origin: Nonsynthetic
 - Description: May be from nonorganic sources. Must be from nongenetically modified plants.
 - NOP Rule: 205.203(c)(3) Uncomposted plant materials.

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straw

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Can't find what you're looking for? Get an [OMRI Subscription](#) and you will have access to advanced search tools, newsletters, technical references, and more.

Common Organic Nutrient Sources

□ Organic Matter is #1

□ Nitrogen

- **Blood meal (12-0-0)** Made from slaughterhouse waste and is one of the highest non-synthetic N sources.
- **Feather meal (7-12% N)** Sourced from poultry industry, has relatively high N but is lower release.
- **Fish meal (10-6-2)** Ground and heat dried fish waste.
- **Seed meals- Soy, cotton, flax (ranges 6-8% N)** Can be sourced from GMOs and have substantial pesticide residue.
- **Alfalfa meal (2-1-2)** Primarily for OM and trace minerals.

□ Phosphorous

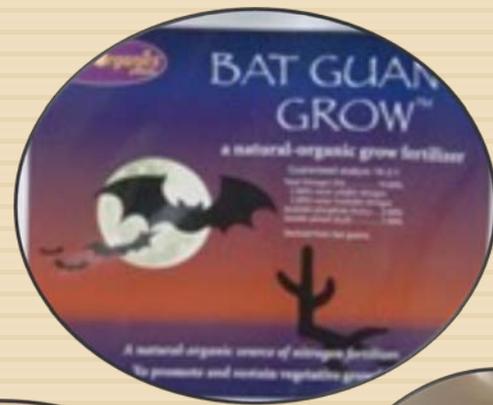
- **Bone meal (3-15-0)**

□ Potassium

- **Greensand (0-0-3)** Mined from the ocean floor with up to 30 trace minerals.

□ Other

- **Kelp-** Trace mineral source



How do you calculate organic nutrients?



Soil & Tissue Testing

- Beyond mineral composition
 - ▣ OM & PAN but cannot predict how much organic N will mineralize
 - ▣ Measuring N mineralization through crop N uptake
 - ▣ Biological assessments
 - ▣ Organic/alternative minded labs
- Using LGU labs

Publications & Resources

- What Is Sustainable Agriculture?
- Master Publication List
- Education
- Energy Alternatives
- Farm Start-Up

Home > Master Publication List > Alternative Soil Testing Laboratories

Alternative Soil Testing Laboratories

By Steve Diver
October 2002
IP234

Table of Contents

- Introduction
- Emphasis on Humus, Organic Matter, Compost, Microbial Analysis
- Emphasis on Mineral Analysis and Fertilizer Recommendations
- Soil Testing Supplies—Instruments—Equipment

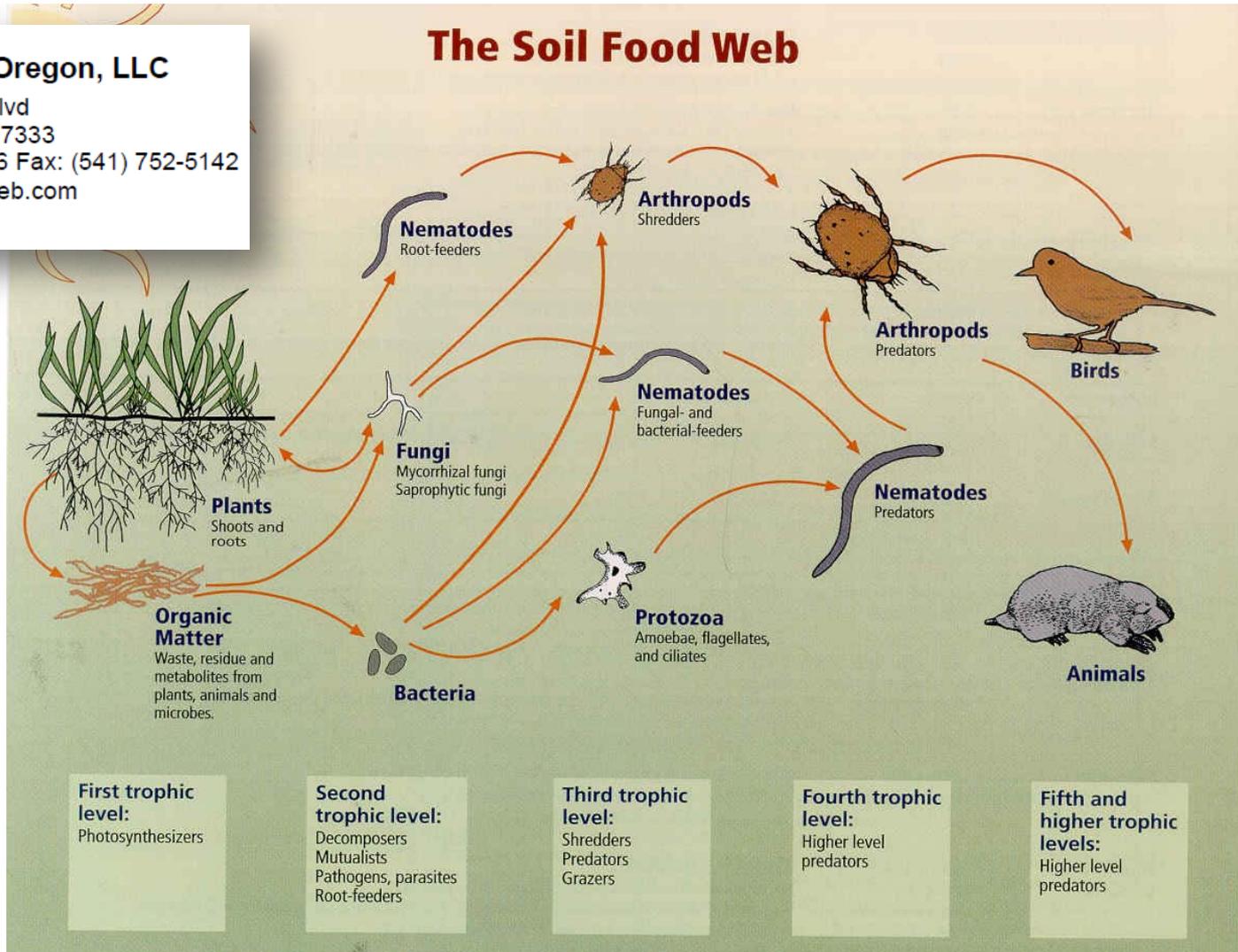
Measuring Soil Biology



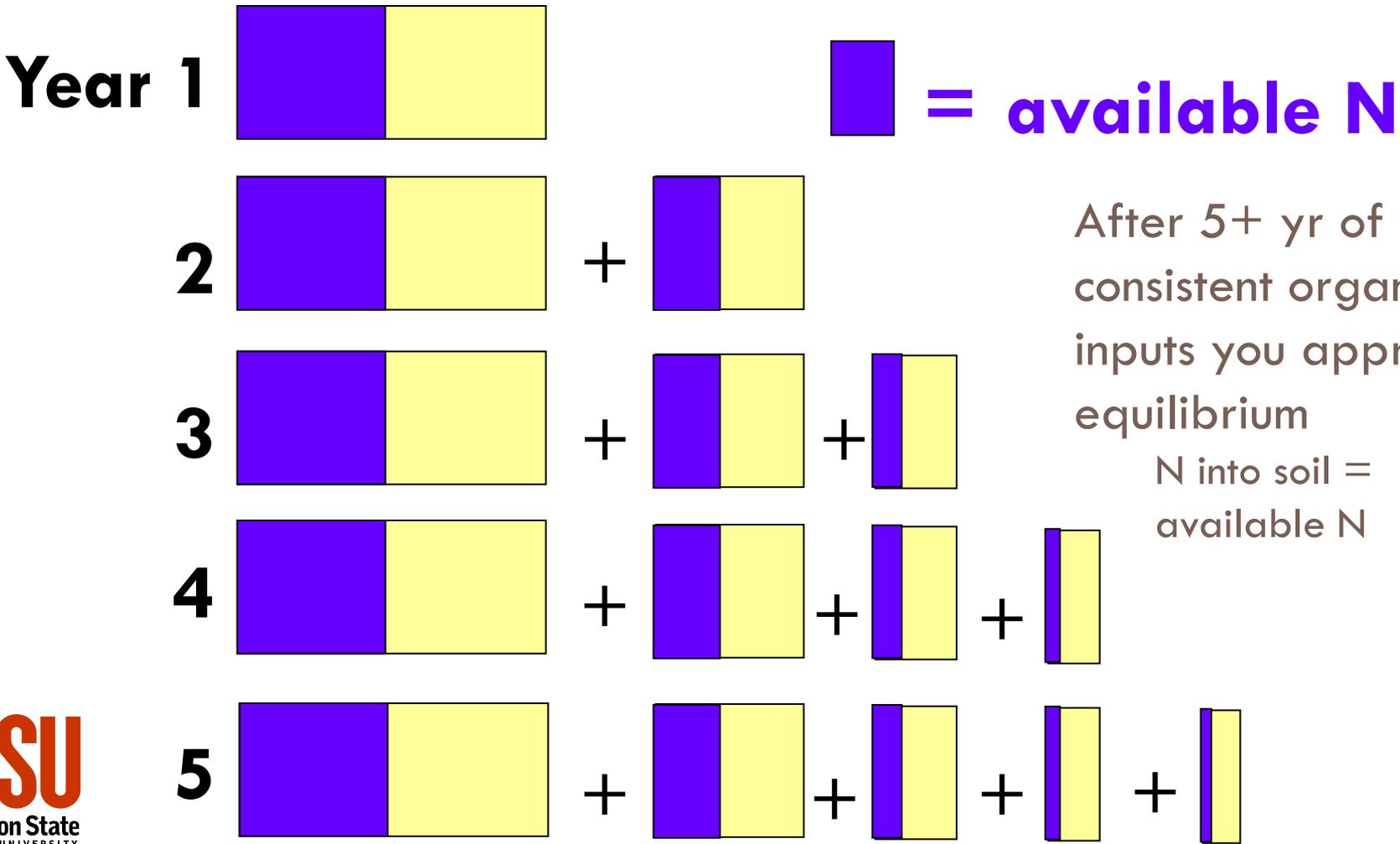
Soil Foodweb Oregon, LLC

635 SW Western Blvd
 Corvallis, Oregon 97333
 Tel: (541) 752-5066 Fax: (541) 752-5142
 info@oregonfoodweb.com

The Soil Food Web



Cumulative Available N from an Organic Source



After 5+ yr of consistent organic inputs you approach equilibrium
 N into soil = available N



Open minds. Open doors.™

Courtesy of Dan M. Sullivan, Crop & Soil Science, OSU

Calculating Organic Nutrient Applications

CC_Calculator_v4_04-27-10_0.xls [Compatibility Mode] - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Acrobat

Function Library: Insert Function, AutoSum, Recently Used, Financial, Logical, Text, Date & Time, Lookup & Reference, Math & Trig, More Functions, Name Manager, Define Name, Use in Formula, Create from Selection, Defined Names, Trace Precedents, Show Formulas, Trace Dependents, Error Checking, Remove Arrows, Evaluate Formula, Formula Auditing

A6 fx Blood meal (12.5-1.5-0.6)

1 **ENTER FERTILIZER ANALYSES & SEE FERTILIZER, COMPOST AND COVER CROP PAN ESTIMATES**

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

3	MATERIAL	FERTILIZER ANALYSIS (%) (ppm/10,000=%)															
4		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)	P ₂ O ₅ (%)	K ₂ O (%)	Ca (%)	Mg (%)	S (%)	B (%)	Cu (%)	Fe (%)	Mn (%)	Zn (%)
5	ORGANIC FERTILIZERS																
6	Blood meal (12.5-1.5-0.6)	12.5	91	60	75	7.50	9.38	1.5	0.6								
7	Bone meal (3-20-0.5)	3.0	95	17	32	0.52	0.97	20.0	0.5								
8	Chicken manure - dried (3.5-2-2)	3.5	85	32	47	1.11	1.64	2.0	2.0	7.0	1.0	0.5					
9	Feather meal (granulated) (13-0-0)	13.0	97	60	75	7.80	9.75	0.0	0.0								
10	Fish meal (10-6-2)	10.0	92	60	75	6.00	7.50	6.0	2.0								
11	Meat and bone meal (7-8-0)	7.0	93	60	75	4.20	5.25	8.0	0.0								
12	Muriate of potash (KCl) (0-0-6)	0.0	100	0	0	0.00	0.00	0.0	60.0								
13	Soy meal (6.5-1.5-2.4)	6.5	90	60	75	3.90	4.88	1.5	2.4		3.0						
14	Sulfate of potash (0-0-50)	0.0	99	0	0	0.00	0.00	0.0	50.0		0.0	17.0					
15	Sulfate of potash (0-0-50)	0.0	99	0	0	0.00	0.00	0.0	50.0		0.0	17.0					

How do we know if it works?

Pass



Fail



What to check?

- Soil quality- aggregate stability, OM, microbial activity
- Crop health & yields →
- Disease & pest levels
- Water quality
- Erosion

If one of these is off then
the system is out of
balance...

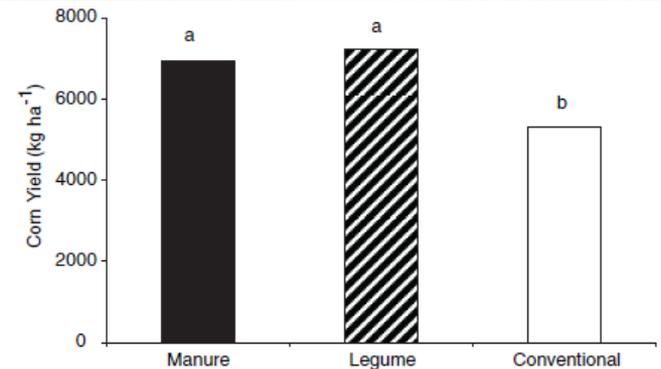


FIGURE 6.14 Mean corn yields in drought years (1988, 1994, 1995, 1997, 1998) in The Rodale Institute Farming Systems Trial. Different letters above bars denote statistical differences ($p = 0.05$).

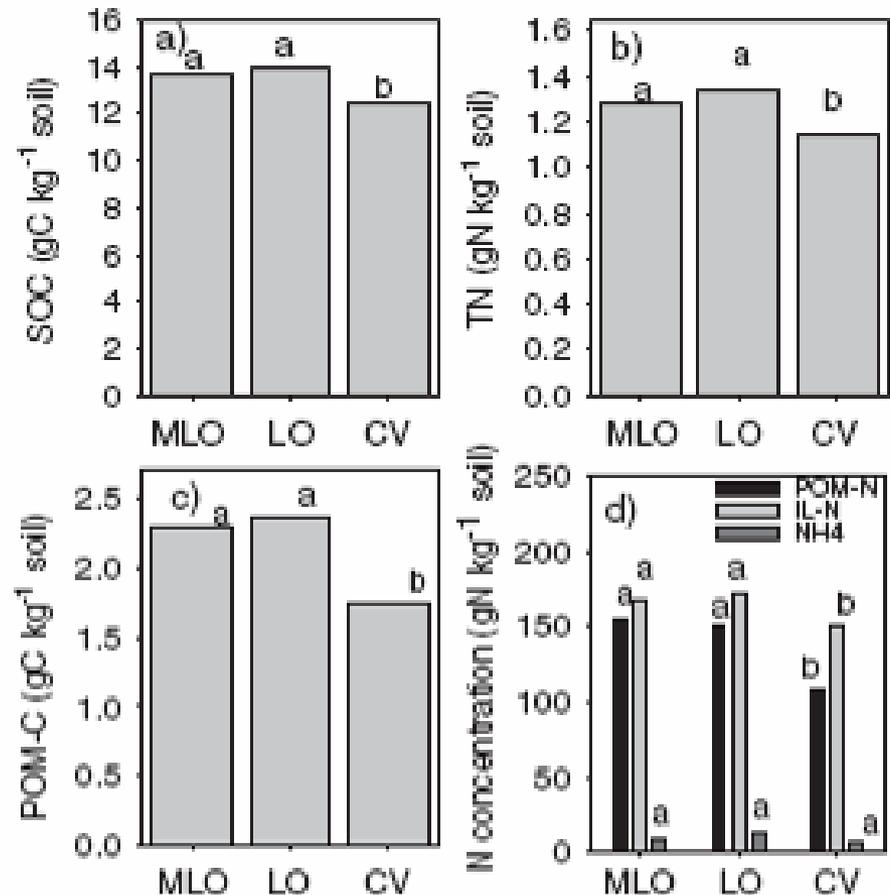
Organic Nutrient Management Results

- 9-year annual cropping trials, with tillage; no pasture systems
- (MD, PA, OH, IA, WI, MI, CA)

Organic mgt. led to:

- Soil POM C, N **+30-40%**
- SOC ave. 10 yr **+14%**
- Legume based system similar to manure based

MLO manure organic
LO legume organic
CV conventional



Questions?

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Resources

'Estimating Nitrogen Mineralization in Organic Potato Production' OSU EM 8949, Jan. 2008

'Estimating Plant-available Nitrogen from Manure' OSU EM 8954, Jan. 2008

Organic Cover Crop & Fertilizer Calculator
<http://smallfarms.oregonstate.edu/calculator>

eOrganic

www.extension.org/organic_production

ATTRA

www.attra.ncat.org

Rodale

www.rodaleinstitute.org

