

ECONOMIC CONSIDERATIONS IN SOIL FERTILITY FOR ORGANIC CROP PRODUCTION

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What Is Organic Food?

- Organic Food Production Act of 1990 (OFPA)
- Set national standards for production and processing (handling) for food labeled as “organic”

National Organic Program (NOP) Final Rule

- Published December 2000
- Effective October 2002
- All natural (non-synthetic) substances are allowed and all synthetic substances are prohibited.
- National List of Allowed Synthetic and Prohibited Non-Synthetic Substances contains specific exceptions.

NOP Final Rule

- All domestic organic production and imports must be in compliance

- Provisions include:
 - Organic Production & Processing Standards
 - Organic Labeling Requirements
 - USDA Organic Seal
 - Producer/Handler Certification
 - Certifier Accreditation

NOP Final Rule

Subpart C - Organic Production Requirements

- No prohibited substances for at least 3 years
- Must develop a system plan to foster cycling of resources, promote ecological balance, and conserve biodiversity.
- Genetic engineering and sewage sludge prohibited
- Synthetic substances on the National List may be used

NOP Final Rule

Organic Production System Plan

- A description of practices
- A list of substances used including composition and source

NOP Final Rule 205.203 Soil fertility and crop nutrient management practice standard

- ❑ Must maintain or improve the condition of the soil and minimize soil erosion
- ❑ Must manage soil fertility through rotations, cover crops, and the application of plant and animal materials
- ❑ Must not contribute to contamination of crops, soil or water by plant nutrients or heavy metals.

NOP Final Rule 205.203 Soil fertility and crop nutrient management practice standard

- Raw animal manure must be composted unless:
 - Crop not intended for human consumption
 - 120 days before harvest if edible part contacts soil
 - 90 days before harvest if edible part doesn't contact soil
- Allowed materials:
 - Materials on the National List of allowed synthetics
 - A mined substance of low solubility
 - A mined substance of high solubility in compliance with conditions on the National List
 - Ash obtained from the burning of a plant or animal material
 - A plant or animal material chemically altered by a material included on the National List of allowed synthetics

NOP Final Rule 205.203 Soil fertility and crop nutrient management practice standard

- **May not use:**
 - Any material that contains a synthetic substance not on the National List of Allowed Synthetics
 - Sewage sludge (biosolids)
 - Burning as a means of disposal of crop residue except to suppress disease or stimulate germination

Nitrogen Source for Organic Crops

- ❖ Cover Crops
- ❖ Animal Manure
- ❖ Compost
- ❖ Commercial Fertilizers

Cover Crops - Advantages

- ❑ Contribute organic matter to the soil
- ❑ Contribute nutrients
- ❑ Reduce erosion
- ❑ Reduce nitrogen leaching during rainy season
- ❑ Reduce nutrient runoff
- ❑ Compete with weeds
- ❑ Provide habitat for beneficial insects

Cover Crops -Types

Cover crops tend to be left on the surface in orchards or vineyards and incorporated into the soil for annual crops

- Cereals and Grasses (annual or perennial)
 - Contribute organic matter
 - Compete with weeds
 - Absorb residual N
- Legumes
 - Fix atmospheric nitrogen in the soil
 - Contribute nitrogen when incorporated
 - Contribute organic matter

Animal Manure – NOP Restrictions

Used less
in
vegetable
production
than in
grain
production

- Animal manure must be composted *unless*:
 - ▣ Applied for a crop not for human consumption (e.g. cotton)
 - ▣ Incorporated more than 120 days before harvest if edible portion **has** contact with the soil
 - ▣ Incorporated more than 90 days before harvest if edible portion **does not have** contact with the soil

Compost

- Green wastes, crop residues, animal manures, and other organic waste materials transformed by microbial decomposition
- Can be used as a primary source of N at high rates
- Improves soil tilth
- Rate, timing, and technique of application varies
- Quality varies, nutrient content uncertain

Commercial Organic Fertilizers

- Mostly byproducts of fish, livestock, and food
- Used to supplement nutrients from cover crops, or compost, particularly late season
- Mineralization rate depends on environmental factors
- Similar to rates of cover crops or compost incorporated with tillage
- Nutrient benefits available 1 – 4 months depending on product
- May be in solution for fertigation, pelleted, granulated, powdered, or meal

Commercial Organic Fertilizers

Material	Nitrogen (%N)	Phosphorus (%P)	Potassium (%K)
Fish meal or powder	10 – 11	1.3	<1
Feather meal	12	0	0
Bone meal	2	<1	<1
Kelp	<1	0	1.7
Chilean nitrate	16	0	0
Blood meal	12	0	0

Source: Gaskell et al. 2006. Soil fertility management for organic crops.
University of California Publication 7249

Cover Crop Example – Leaf Lettuce

Operation	Month	Tractor	Implement	Material
Plant	October	130 HP 2WD	Grain drill 15'	Cereal legume mix
Chop	March	130 HP 2WD	Flail mower 13'	
Disk	March	280 HP Crawler	Finish disc 21'	

Operation	Labor	Material	Fuel, lube, and repairs	Total
Plant	\$16	\$44	\$16	\$76
Chop	4		16	20
Disk	4		24	28
TOTAL	\$24	\$44	\$56	\$124

Source: Tourte, et al. 2004. Sample costs to produce organic leaf lettuce – Central Coast region. UCCE. <http://coststudies.ucdavis.edu>

Compost and Commercial Fertilizer Example

Leaf Lettuce

Material	Method	Month	Application Rate Per Acre	Cost per Unit	Cost per Acre *
Green waste compost	Custom	October	2.50 tons	\$40	\$100
Gypsum	Custom	October	.5 tons	\$38	\$19
Pelleted chicken manure	Custom	August	1,000 pounds	\$.15	\$150
Blood meal (13-0-0)	Sidedress	September	450 pounds	\$.42	\$187
Phytamin (6-1-1)	Drip	September	17.5 gallons	\$4.89	\$86
TOTAL					\$512

* Includes application costs. For custom operations, application charge is included in the material cost.

Sources: Tourte, et al. 2004. Sample costs to produce organic leaf lettuce – Central Coast region. UCCE. <http://coststudies.ucdavis.edu>. Local input suppliers for current prices.

Cover Crop Example – Almonds

Operation	Month	Tractor	Implement	Material
Disk	September	66 HP 2WD	Offset disk 10'	
Disk and roll	September	66 HP 2WD	Ring roller 10'	
Plant	October	Custom		Subterranean clover 20 lbs. @ \$3.76
Roll	October	66 HP 2WD	Ring roller 10'	
Irrigate 2X	Oct./Nov.			

Operation	Labor	Material	Fuel, lube, and repairs/custom	Total
Disk	\$5		\$3	\$8
Disk and roll	5		4	8
Plant - custom		75	7	82
Roll	4		2	6
Irrigate 2X	2	19		21
TOTAL	\$16	\$94	\$13	\$125

Source: Holtz, et al. Sample costs to produce organic almonds. 2007. <http://coststudies.ucdavis.edu>

Compost & Organic Fertilizer Example

Almonds

Operation	Month	Tractor	Implement	Material
Leaf analysis	July	ATV		
Hull sample	September	ATV		
Soil sample	September	ATV		
Foliar spray	October	66 HP 2WD	Air blast sprayer	Boron and zinc
Apply compost	October	Custom		10 tons compost

Operation	Labor	Material	Fuel, lube, and repairs/custom	Total
Leaf analysis	\$1		\$2	\$3
Hull sample	1		1	2
Soil sample	1		2	3
Foliar spray	6	10	5	21
Apply compost		270	12	282
TOTAL	\$9	\$280	\$22	\$311

Compost and Commercial Fertilizer Example

Almonds

Material	Method	Month	Application Rate Per Acre	Cost per Unit	Cost per Acre *
Boron (Solubor)	Foliar	October	2 pounds	\$1.08	\$2.16
Zinc (MKM zinc sulfate powder 36%)	Foliar	October	10 pounds	\$.74	\$7.40
Green waste compost	Spreader	October	10 tons	\$27.00	\$270.00
TOTAL					\$279.56

* Does not include application costs

Source: Holtz, et al. Sample costs to produce organic almonds. 2007.

<http://coststudies.ucdavis.edu>

Cover Crop - Factors Which Vary

- Type of cover crop and seeding rate, e.g. cereal legume mix, cereals, cereal legume mix, and mustards
- Ground preparation
- Plant every year or every other year
- Number of cash crops per year

Compost & Commercial Fertilizer

- Factors Which Vary

- Material used
- Timing of application
- Application method
 - Ground – custom
 - Ground – owner/operator
 - Drip