Organic No–Till Vegetables

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ISU Organic Projects

- Neely-Kinyon Farm, Greenfield, IA (50 acres certified)
  - LTAR (corn, soybeans, oats, wheat, alfalfa)
  - Bean leaf beetle/aphid management
  - Soybean variety trials
  - Organic sweet corn
  - Organic grapes
  - Organic tmnts. for soybean rust

- Grape and apple on-farm trials
- No-Till organic vegetables and grains (Cover crops trials)

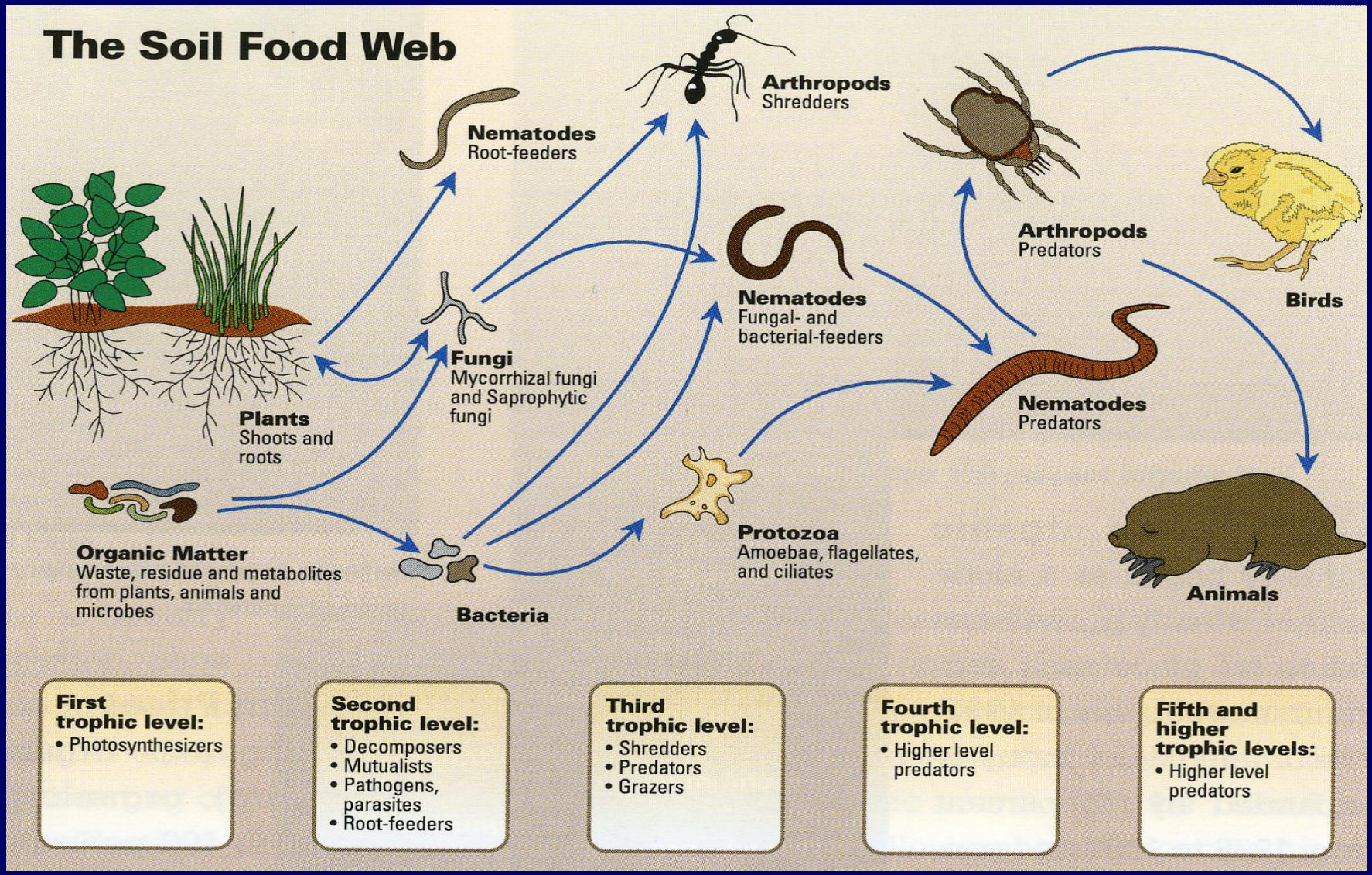
- National Institute of Health Echinacea and St. John’s wort
- Crawfordsville Organic Rotations (organic seed)

Italian Sabbatical (2014): Monsampolo CRA Research Station

Maintaining or Improving Soil Quality: A requirement in organic production

- Crop rotations
- Compost
- Cover crops
  (tilled and no-till)
- Amendments

Maintaining the soil food web



Using Cover Crops

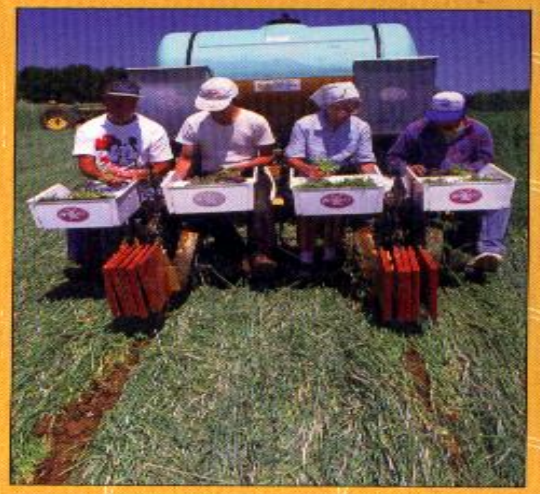
- Provide nitrogen
- Add carbon (biomass)
- Protect soil from erosion
- Weed management
- Provide habitat for wildlife and beneficial insects
- Reduce inputs/create new source of income

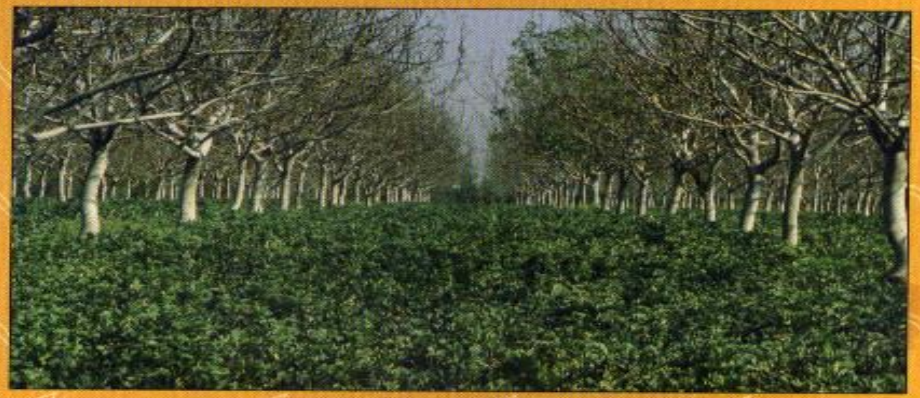
Managing Cover Crops Profitably

SECOND EDITION

SUSTAINABLE AGRICULTURE NETWORK

HANDBOOK SERIES BOOK 3





Total Nitrogen Source

- Hairy vetch: 90-200 lb. N/A
- White clover: 80-200
- Sweetclover: 75-200
- Berseem clover: 75-220
- Austrian winter peas: 90-150
- Red clover: 70-150
- Kura clover: 75-200
- Medics: 50-120

Grass Cover Crops

Rye before soybean

- Primarily for biomass/carbon inputs
- Lower N amounts/best if mixed with legume if need to add N
- Useful for prevention of soil erosion and as a “catch crop” for excess N (rare on organic farms)
- Weed control and some nematode control
- Rye, oats, wheat, barley, sorghum-sudangrass, ryegrass

Total Nitrate-Nitrogen Lost (2002-2005)

Treatment	Nitrate-N lost, 4-yr total
	lb/acre
Corn-Soy w. Rye	70
Corn-soybean	179

T. Kaspar, USDA-National Soil Tilth Lab, Ames, IA

Establishing Cover Crops with a Grain Drill or Shallow Tillage

- Only winter hardy small grains – rye, winter wheat, triticale
- Mid Sept. to late Oct. (will survive later)
- Lower seeding rate than overseeding
- More reliable stand establishment

Research Results

All over the board

- Hairy vetch boosted corn yield equiv. to 180 lb. N/A (Maryland)
- Medium red clover/oats/H.V. equiv. to 65-103 lb. N/A in corn (Wisconsin)
- Austrian winter peas, HV and alfalfa equiv. to 80-100% of potato's N requirements
- Austrian winter peas/HV/alfalfa equiv. to 63-90 lb. N/A in muskmelons (Kansas)

Solutions to N Loss

- Shallower tillage
- No- or minimum-tillage slows loss
- Always use grass/legume mix to provide slower release of N compared with pure legume
- Cover crops add OM--release of N in subsequent years

The benefits of no-till

- No mechanical tillage
- Less soil erosion
- Moisture conservation
- Lower weeding costs

Michigan State's schedule

				Crimping/planting			
Trt	Cover crop planting date	Rye (bu/A)	Vetch (lbs/A)	May 25	June 2	June 5	June 15
1	Sept. 15	2.5	0	--	--	crimped/planted	--
2	Sept. 15	2.5	0	--	crimped	crimped/planted	replanted
3	Sept. 15	2.5	0	--	--	crimped/planted	replanted
4	Aug. 24	0	30	crimped	crimped	crimped/planted	--
5	Aug. 24	0	30	--	crimped	crimped/planted	replanted
6	Aug. 24	0	30	--	--	crimped/planted	replanted
7	Aug. 24	2	25	--	--	crimped/planted	--
8	Aug. 24	2	25	--	crimped	crimped/planted	replanted
9	Aug. 24	2	25	--	crimped	crimped/planted	replanted
10	weed free	2	--	rotary mowed	rotor tilled	--	planted
11	weed free	2	--	rotary mowed	rotor tilled	--	planted

- Had to re-plant due to poor stand of seedlings; not a problem in Iowa
- Transplants can go in once cover crop is dead

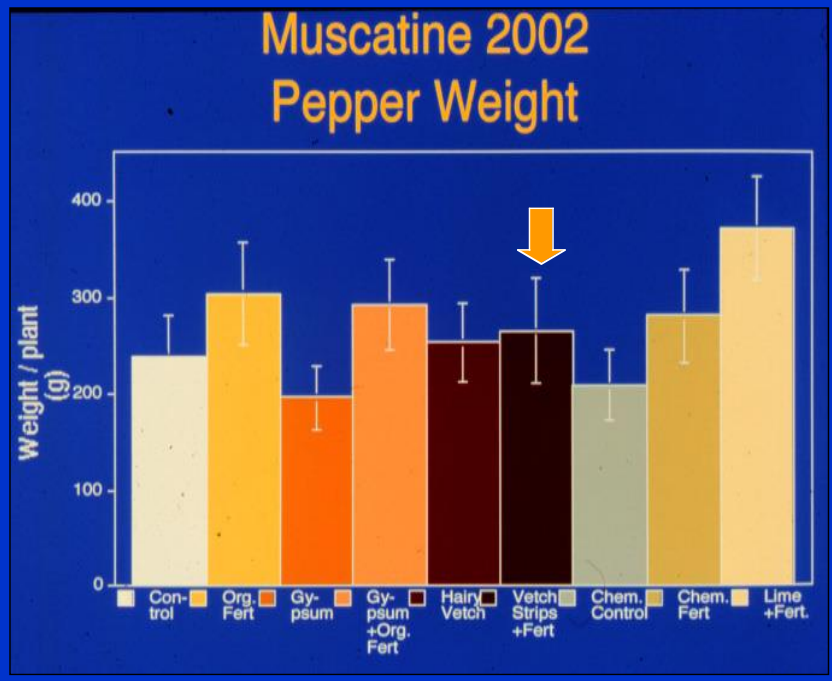
Cover Crops Research-Iowa, 2000

- Hairy vetch + winter rye @ 25 lb/acre and 70 lb/acre
- Irrigation is helpful to increase cover crop biomass
- HV/rye strips: mowed to kill; 15” strip cut in mulch for pepper transplants
- Incorporated vetch: mowed and tilled mid-May-planted June 1

- 2006 - 2014: Organic No-Till tomatoes, field corn, soybeans, sweet corn, broccoli, squash and lettuce

Tilled and strip-tilled cover crops

Compost plus Strip-Tilled Cover Crop: Best Combination



Transplanting organic vegetables into tilled under cover crops or strip-tilled cover crops.

Delate, K. H. Friedrich and V. Lawson. 2003. Organic pepper production systems using compost and cover crops. Biol. Ag. and Horticulture 21 (1): 131–150.

Ron Morse's No-Till Vegetable Transplanter

Rodale's No-Till Plus One-Pass System

Front-mounted roller
No-till drill on rear

Fluted coulters cut through crushed cover crop residue

A uniform cover crop stand will give the best results

October: 1 month after seeding

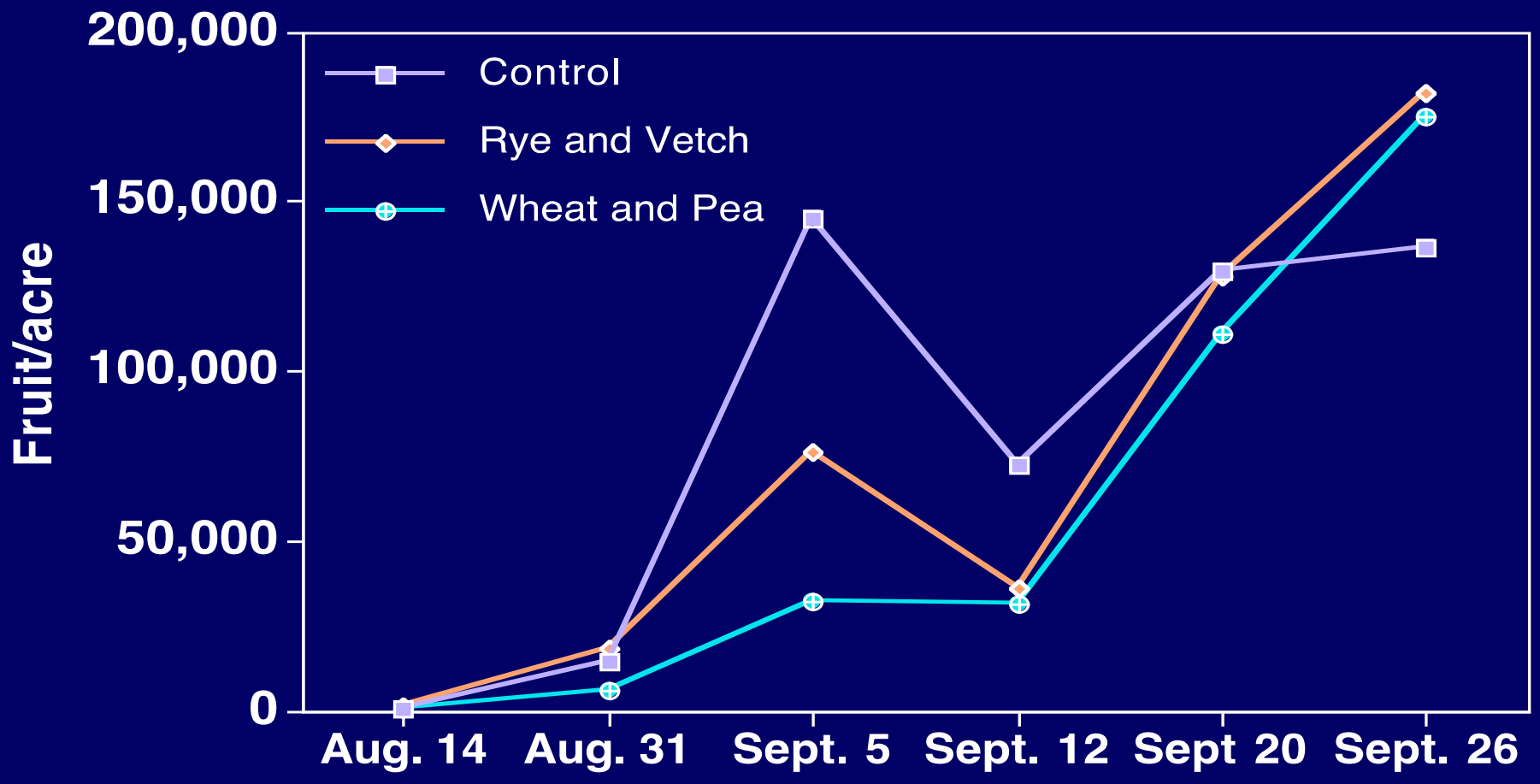

Wheat remained standing more than rye after rolling; all cover crops died within a month after rolling

Weed populations and disease occurrence in No-Till Plus trial, Neely-Kinyon

Treatment	Weed Populations (weeds/m^2)				Disease (%)
	July 20, 2006		August 14, 2006		July 11, 2006
	Broadleaves	Grasses	Broadleaves	Grasses	
No Cover	16.00b	18.44	0.11	0.85a	4.89
Rye and Hairy Vetch Cover	1.22a	10.78	0.11	0.82a	6.11
Wheat and Winter Pea Cover	0.89a	7.89	0.11	17.52b	7.37
LSD 0.05	8.79	NS	NS	14.51	NS

Weeds lower in hairy vetch/rye no-till plots

Tomato yield in No-Till Plus trial, Neely-Kinyon



Fruit numbers equivalent between treatments; longer harvests in no-till plots

Overview of USDA-IOP project: tilled and no-tilled hairy vetch and rye plots

No-till plots in late May before rolling


Rolling rye/ seeding soybeans
CASE INTERNATIONAL
885


Crushed rye

Rolling is best when grain rye is in anthesis (pollen shed)
If too early, rye will pop back up after rolling

Hairy vetch alone more difficult

Multiple rolling plus mowing and still growing

Microbial biomass C and N higher in organic NT under grain crops

Site	MBC NT	MBC CT	MBN NT	MBN CT
Iowa	194	185	48	35
Minnesota	218	191	69	65
Pennsylvania	190	170	66	51
Wisconsin	174	162	49	47
Michigan	173	166	36	36
North Dakota	273	264	42	38

-Values in mg/g

-Sharon Weyers, USDA-ARS, Morris, MN
-Fall 2010 soil samples; after 3 years of organic reduced tillage

USDA-NIFA-ORG experiment examines straw mulch vs. no-till vs. tilled vegetables

•Mechanically transplanting in rolled organic no-till cover crops

-Coulters with weed whippers on planter used ahead of transplanting to make rows

Iowa crops: tomatoes and onions-2011
Peppers and sweet corn-2012
Tomatoes and sweet corn-2013

Excellent emergence and transplant survival in no-till crushed cover crop.

2013: Another drought year

Iowa Vegetable Yields: 2013

	NC-AM-T-M	NC-AM-T-NM	C-AM-NT-NM	C-AM-T-M	C-AM-T-NM	C-NT
Iowa						
Tomato Yield (lb/acre)	34,519a	**36,684a**	21,606.4ab	24,472a	25,750a	10,702b
Sweet Corn Yield (lb/acre)	6,977ab	**8,006a**	3,551bc	6,699ab	7,073ab	957c

In drought year, no-till yields lower than tilled plots; composted animal manure associated with numerically higher yields; mulch effects not as clear (variable results, with more impact on tomato yields than sweet corn yields).

Soil quality summary: Florida

- **More tropical regions (Florida) use *Crotolaria juncea* as a cover crop in the summer for fall vegetable crops**
- **No-till crops had equal yields to crops in plastic mulch**
- **Mulched tomato plots had lower soil nitrate than non-mulched**

Moving to Italy

On-farm cover crop

Stefano Canali, Rome


FIAT


TORINCAB
SAME
EXPLORER


SAME
SAME


QUIVOGNE
MARCHETTI


Saldo, Inc., Matera
Manufacturers of new roller innovations
CHIPPER - COVER - CROP
NEW


SOLDO
GREASE