Performance of Organic Farming Systems and Implications on Climate Change

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http://www.extension.org/organic_production

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Performance of Organic Farming Systems and Implications on Climate Change

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Wisconsin's organics tops the national ranks

- #1 for total organic livestock
- # 1 for field crop acreage
- #1 for total organic milk cows (22% of USA total)
- #2 in organic milk sales (64% of organic sales)
- #2 in organic farms (n=1159 farms)
- # 10 in vegetables
- **Organic dairy and livestock farms drive market for organic feed**

Source: UW-Madison CIAS/DATCP 2012 status report

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WICST was born in 1989

- Two locations:
  - Arlington (well drained silt loam soils)
  - Lakeland (more-poorly drained silt loam soils)
- Over 20 years of data summarized:
  - from 1992 to 2012
  - Trends emerging
    - Economics
    - Soil carbon
    - Yield trends
    - Weed seed

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Cash-grain systems

Continuous corn

Strip-till corn-soybean

Organic grain

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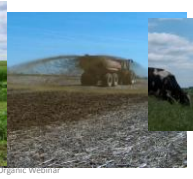
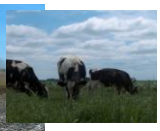
Dairy (forage-based) systems

Conventional Alfalfa

Organic forage

Managed grazing





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Effect of weed pressure on corn yield

	Wet Springs (May + June >10" rain)		Normal Springs	
	ARS	LAC	ARS	LAC
	|----------bu/a----------|			
Conventional (min-till corn-soybean)	160	137	173	132
Organic (3-yr grain)	115	103	167	124
Org:conv	72%	76%	96%	94%

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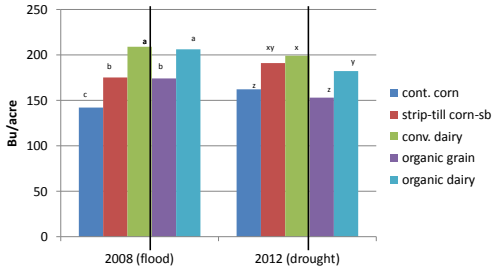
Effect of weed pressure on soybean yields

	Wet Springs (May + June > 10" rain)		Normal Springs	
	ARS	LAC	ARS	LAC
	|----------bu/a----------|			
Conventional (min-till corn-soybean)	48	57	57	53
Organic (3-yr grain)	38	44	54	49
Org:conv	79%	76%	95%	92%

30' rotary hoe or tine weeder can do ~ 30 acres/hr

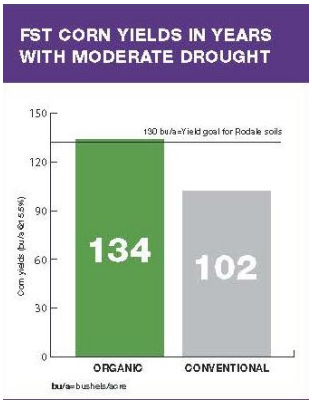
Corn yields in extreme weather yrs



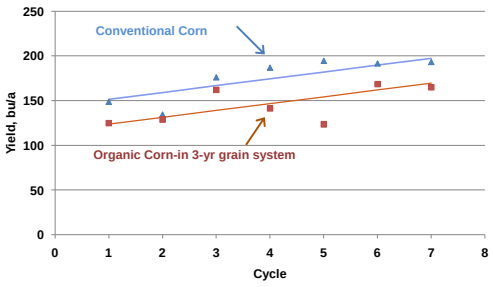
Rodale

- Corn in the legume-based (left) and conventional (right) plots six weeks after planting during the
- 1995 drought. The conventional corn
- is showing signs of water stress.

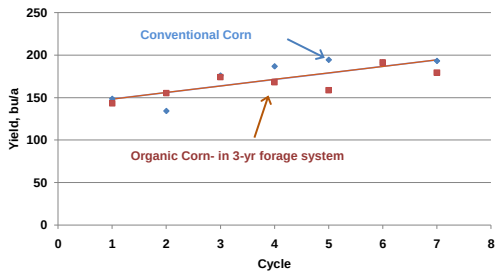
- Rodale -Organic corn yields were 31% higher than conventional in years of drought



Conventional vs. Organic Corn Yield Trends



Conventional vs. Organic Corn Yield Trends



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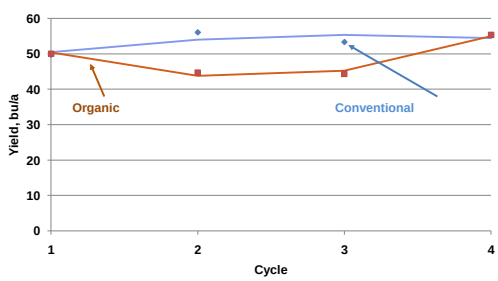
Conventional vs. Organic Soybeans



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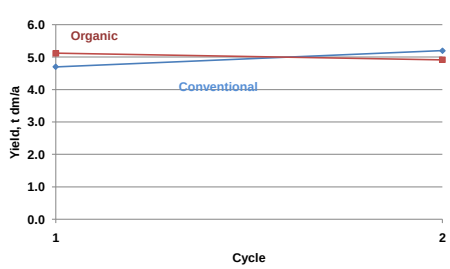
Conventional vs. Organic Alfalfa



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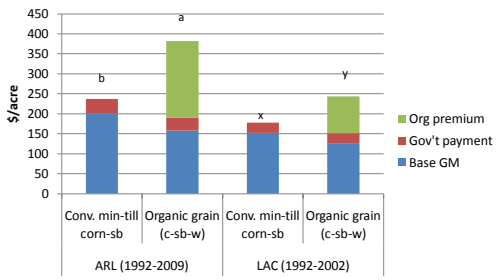
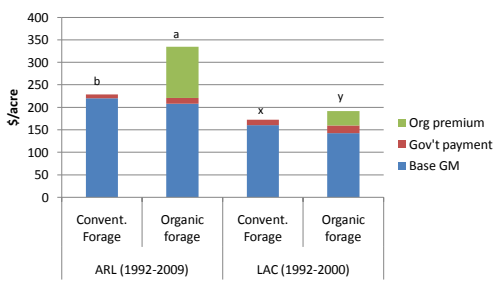
Base Gross Margins (GM)

- GM = Crop revenue – variable costs
- Grain priced at harvest; hay priced in winter
- Gov't payments included
- Feed-grade organic premiums included
- Systems scaled up to farm size
  - 1200 acres for conventional grain farms
  - 600 acres for organic grain farm
  - 150 acres of conventional and organic forage farms

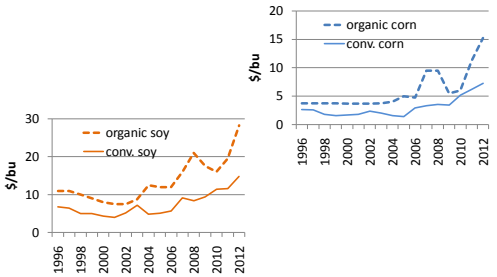
Historic GM of grain systems



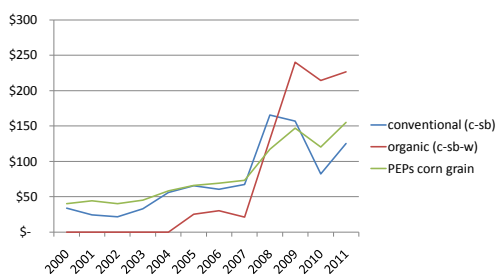
Historic GM of forage systems



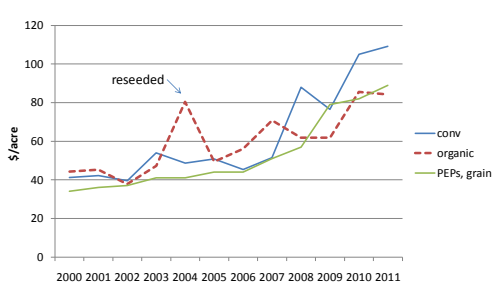
Corn and soybean feed-price trends (at harvest)



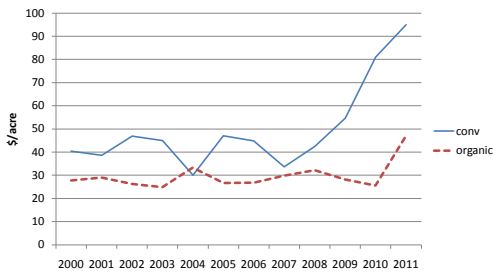
Fertilizer cost in corn phase at ARL ($/acre)



Corn seeding cost at ARL ($/acre)

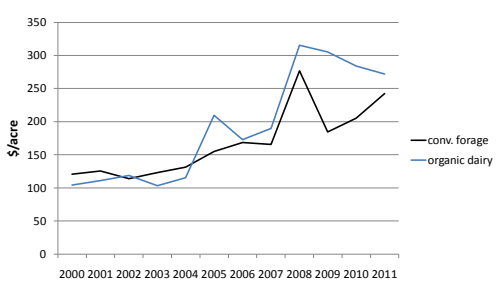


Soybean seeding cost at ARL ($/acre)

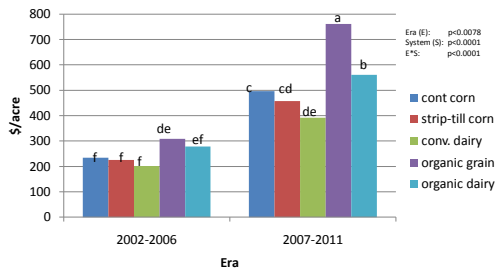


Total expense in grain systems (ARL)

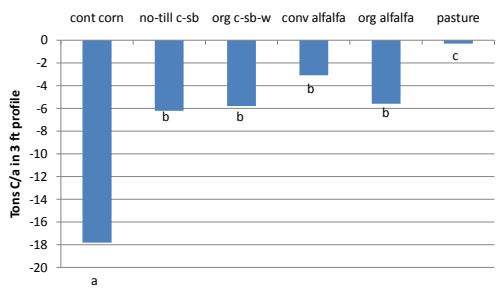
Total expense in forage systems (ARL)



Gross margins in 2000 decade-ARL



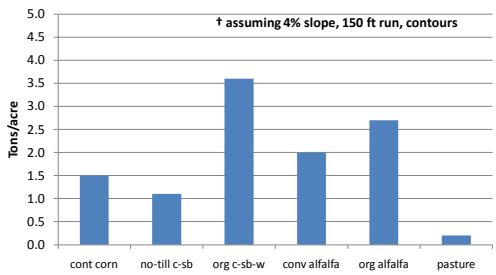
Soil Organic C changes over 20 yrs-ARL



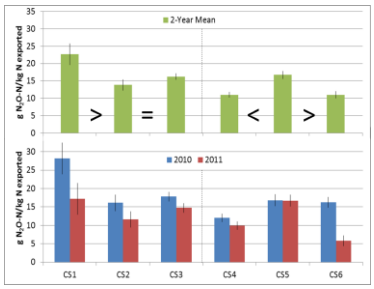
Soil C inputs on WICST

	ARL ('92-'09)	LAC ('92-'02)
System	lbs C/acre^{-1}	
Cont. corn	5390	3301
Min-till corn-sb	4081	3324
Org grain (c-sb-w)	3038	2297
Conv. Forage	6075	6353
Organic Forage	6377	7145
Pasture with managed grazing	5380	5548

RUSLE2 Soil loss estimates† (18-yr avg, ARL)

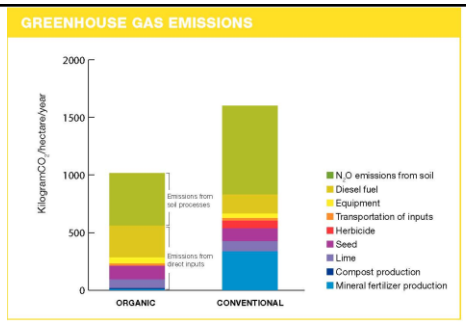


N_2O emissions/unit of N harvested-ARL



C and N changes in other Long-Term Studies

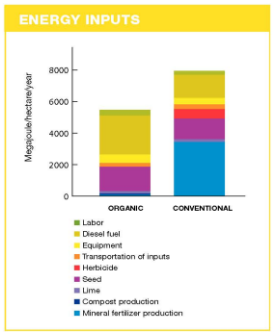
- LTAR (Iowa) - Total nitrogen increased by 33 percent in the organic plots
  - higher concentrations of carbon, potassium, phosphorous, magnesium and calcium
  - results suggest that organic farming can foster greater efficiency in nutrient use and higher potential for sequestrating carbon

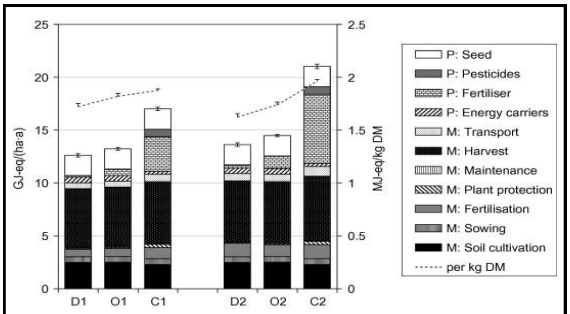


- Rodale FST - in both organic and conventional systems, the highest overall GHG emissions were caused by soil processes fueled by nitrogen fertilizer, compost, and crop residues

Rodale FST

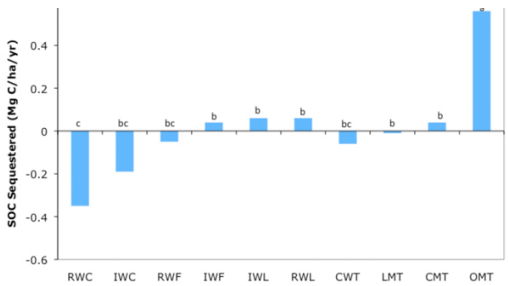
- Organic system uses 45% less energy – mainly from not allowing conventional fertilizers





- Demand for non-renewable energy resources of the farming systems in the DOC experiment (1985–1998) per hectare and year (columns) and per kg dry matter (DM, line)(Nemecek et al., 2011)

LTRAS (California)



http://asi.ucdavis.edu/rr/res/soc

Conclusions

- Yields: Org:Conv >90% when weeds controlled
- Organic yields better than continuous GM corn in extreme weather years
- Organic yields similar to rotated GM corn in extreme weather years
- Yield trends
  - Corn increased at 2.5 bu/a/yr (same for organic and conventional)
  - Soybeans had slight gain at 0.2 bu/a/yr (same for organic and conventional)
  - Alfalfa –no real trend yet

Conclusion (cont'd)

- Profitability: organic >conventional
  - Gross margin higher in last 5 yrs. vs. previous 5 yr
  - Large part of the profitability is coming from strong and steady premiums (in this study feed premiums)
  - Inputs (seed, fuel, and nutrients) are driving up expenses, often near to the cost of conventional inputs
- Ecosystem Services
  - All systems losing carbon other than pasture
  - Expand rotation with alfalfa can reduce soil loss
  - GHG lower under rotations but not necessary due to organic management

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