ECONOMICS OF SOIL HEALTH

David Archer
USDA Agricultural Research Service
Northern Great Plains Research Laboratory
Mandan, ND

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USDA Agricultural Research Service

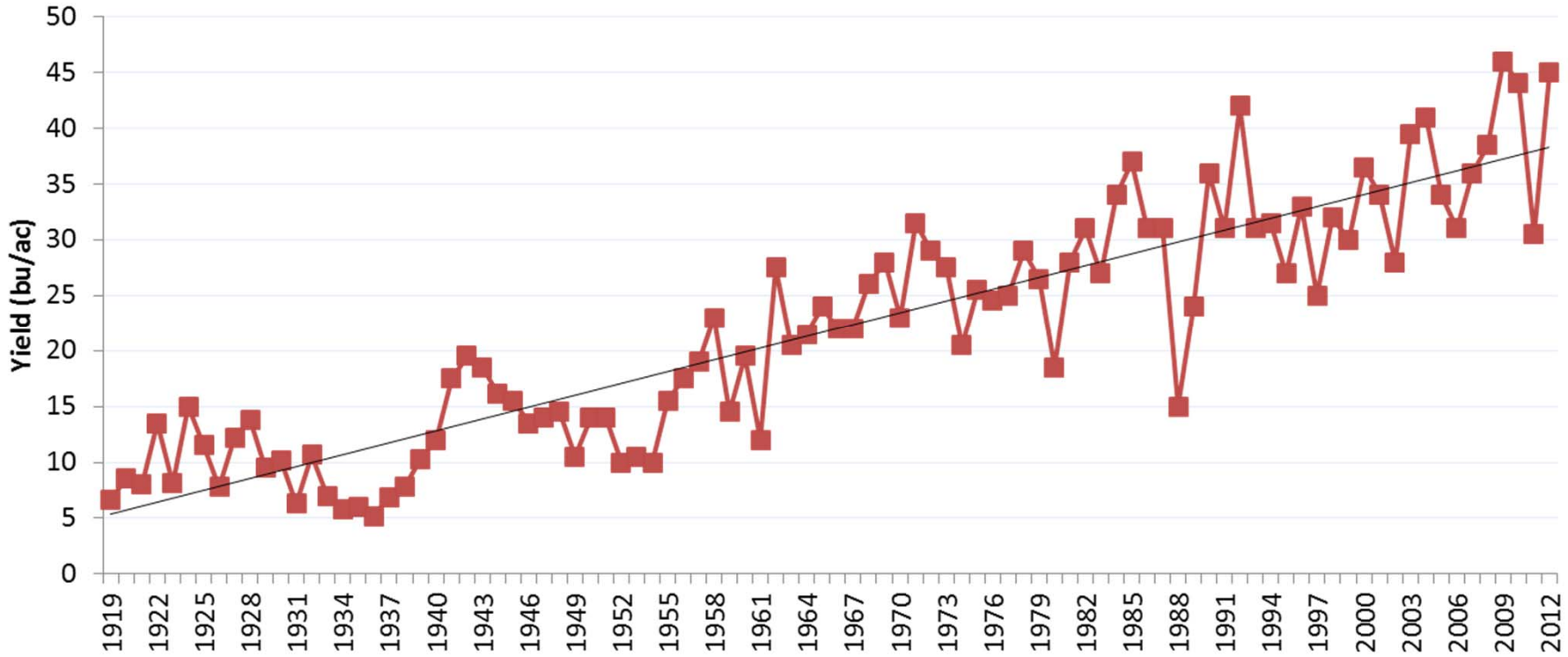
Farm Level Perspective

- Farm level is where the decisions that affect soil health are made

Economics of soil health - challenges

- Effects difficult to perceive
- Effects often long-term
- Tied to system

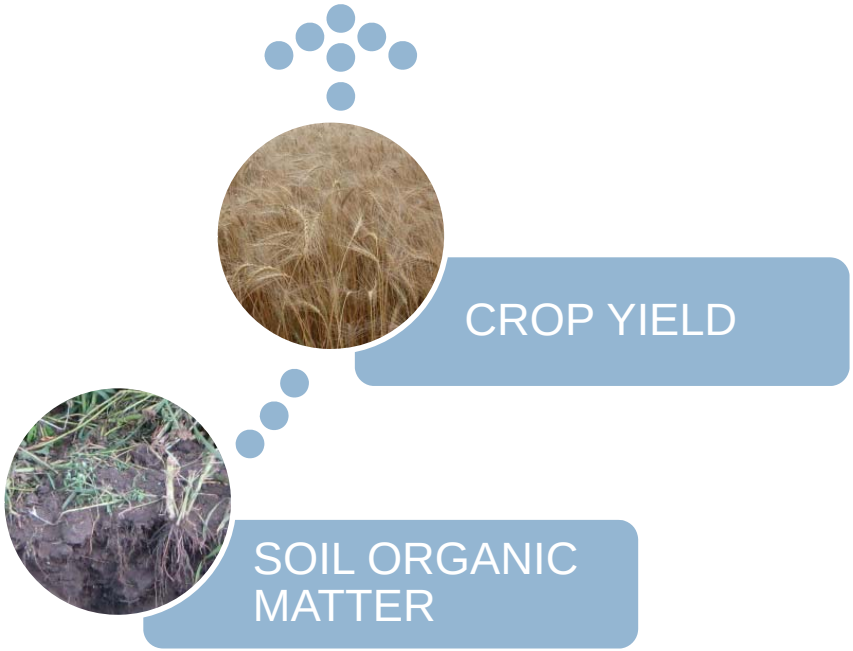
North Dakota Spring Wheat Yield



Source: USDA-NASS

Value of Soil Organic Matter

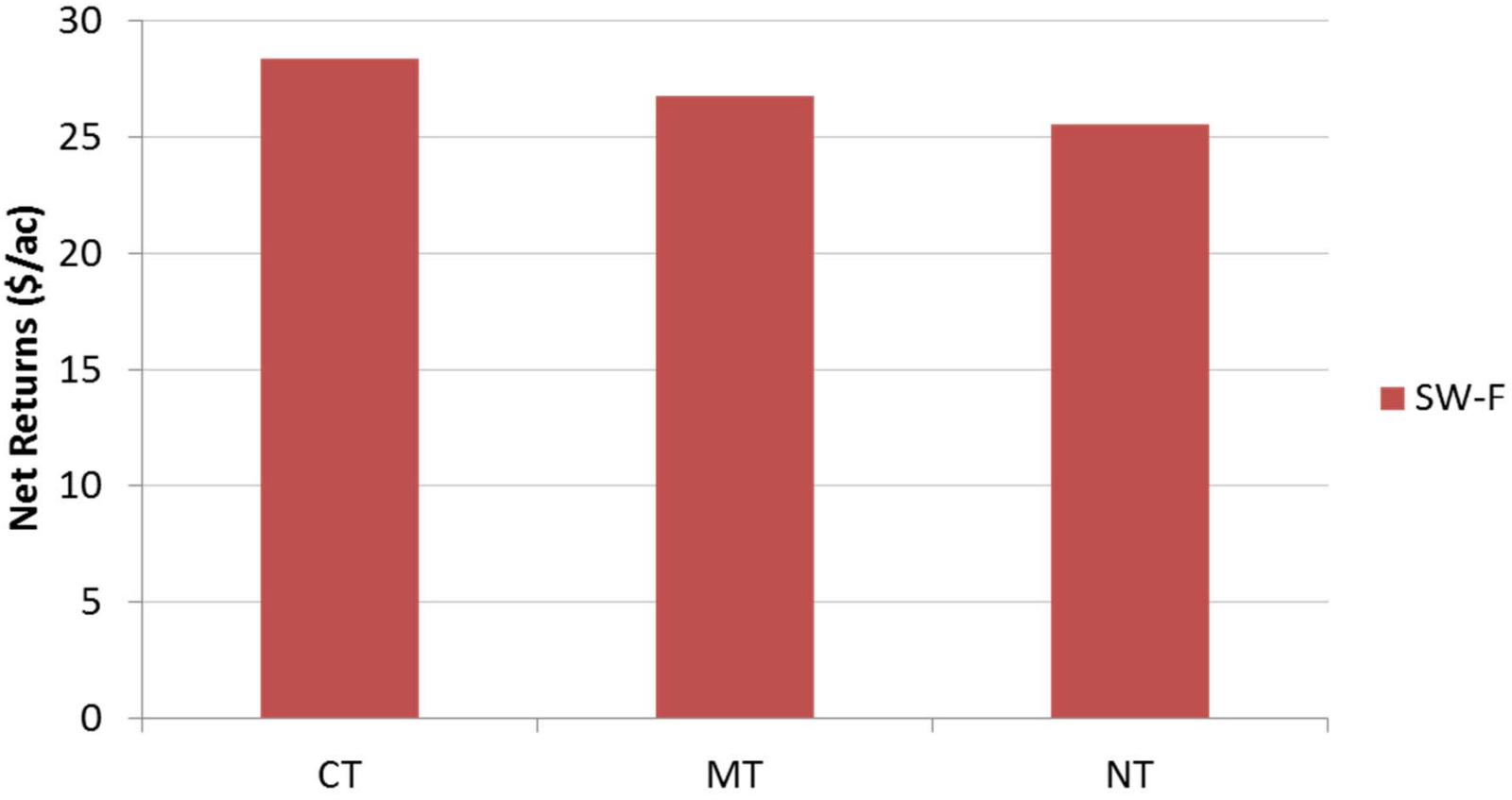
- Bauer and Black (1994)
  - An decrease in soil organic matter of 893 lb/ac decreased spring wheat grain yield 14 lb/ac
    - “primarily a consequence of a concomitant loss of fertility”



System Effects

- No-till in Northern Great Plains
  - No change in system, substituting herbicides for tillage
    - ➢ Small net effect on production costs
    - Yield effect?
      - Water savings => NT higher yield than CT in dry years
    - ➢ Small net effect on net returns

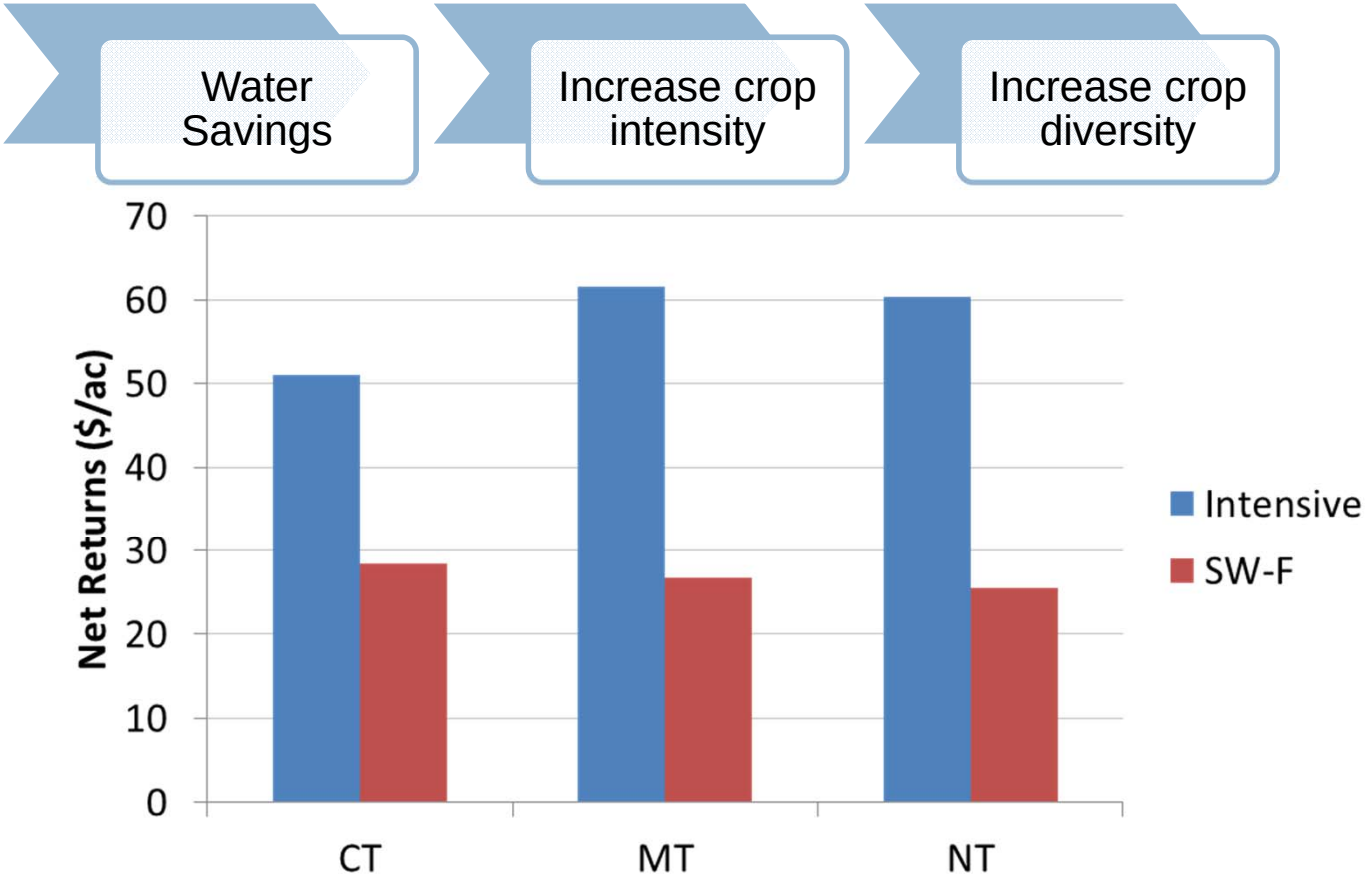
Spring-Wheat Fallow Net Returns



DeVuyst and Halvorson Agron. J. 96:148–153 (2004)

System Effects

- No-till in Northern Great Plains



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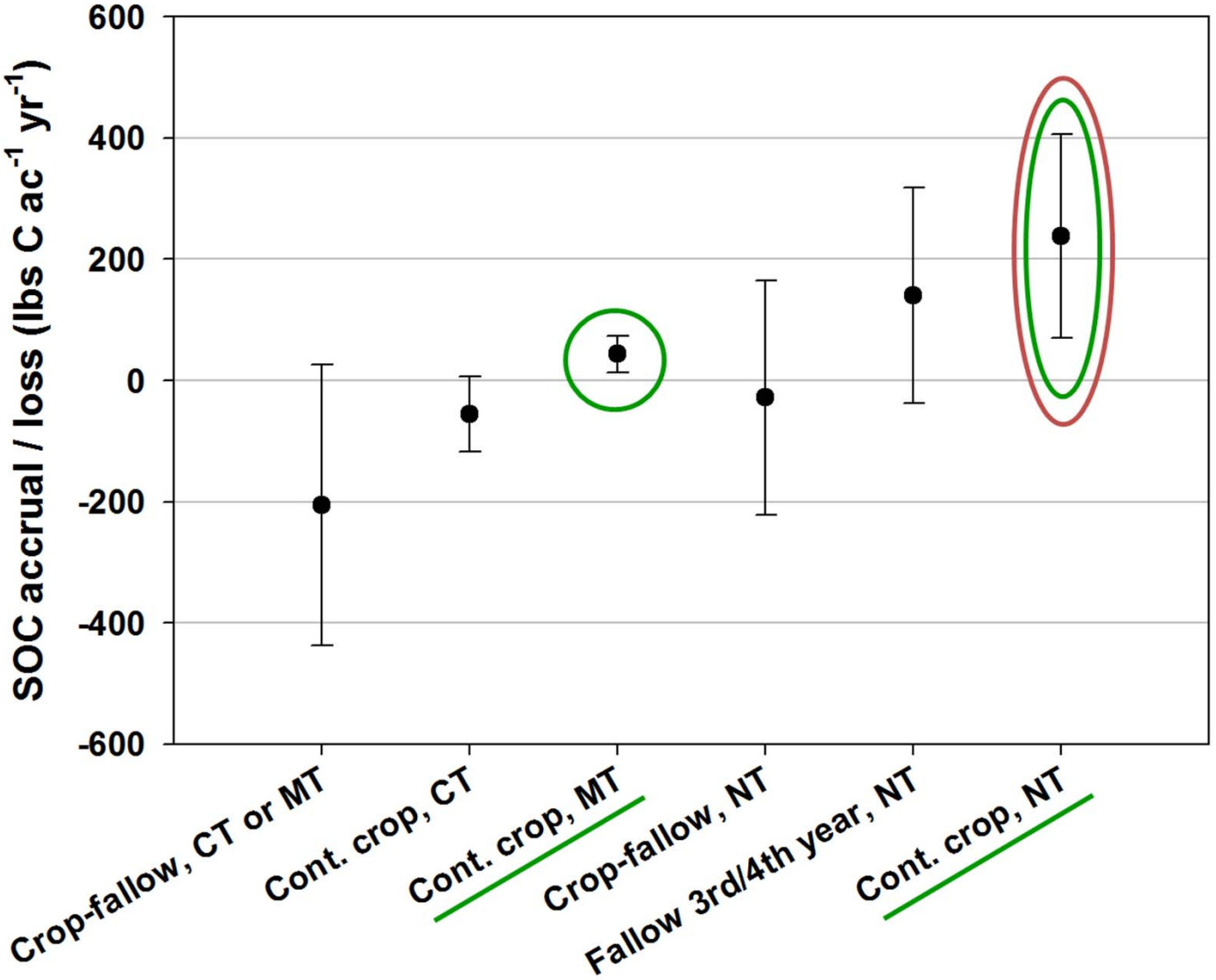
System Effects – Soil Organic Carbon



Liebig et al. (2005)

Cover Crops Study

Design:

- Cover crops planted after dry pea harvest
- Seven types of cover crops
- Four response crops planted the following spring after each cover mix

Cover Crop Treatments
1, No cover crop (check/control)
2, Purple top turnip
3, Proso millet
4, Spring triticale
5, Soybean
6, Vine pea
7, Winter canola
8, Sunflower
9, All cover crops (2-8)
10, Drop - Purple top turnip
11, Drop - Proso millet
12, Drop - Spring triticale
13, Drop - Soybean
14, Drop - Vine pea
15, Drop - Winter canola
16, Drop - Sunflower
17, Drop - Proso millet and Spring triticale
18, Drop - Soybean and Vine pea
19, Drop - Winter canola and Sunflower

Cover Crops and Cover Crop Mixtures in Semi-arid Cropping Systems

Rep 1

Response crops (Seeded, 2009)	Proso millet	Drop Soybean	Drop Proso millet	No cover crop	Drop Soybean & Vine pea	Soybean	Drop Sunflower	Drop Purple top turnip	Vine pea	Purple top turnip	Drop Vine pea	Drop Canola & Sunflower	Winter canola	Spring triticale	Drop Spring triticale	Sunflower	All cover crops	Drop Winter canola	Drop Proso & Triticale
	Cover crop treatments (Seeded, 21-22 August 2008)																		
SOYBEAN	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119
SPRING WHEAT	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138
DRY PEA	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157
CORN	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176
SPRING WHEAT (N RESPONSE)	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195

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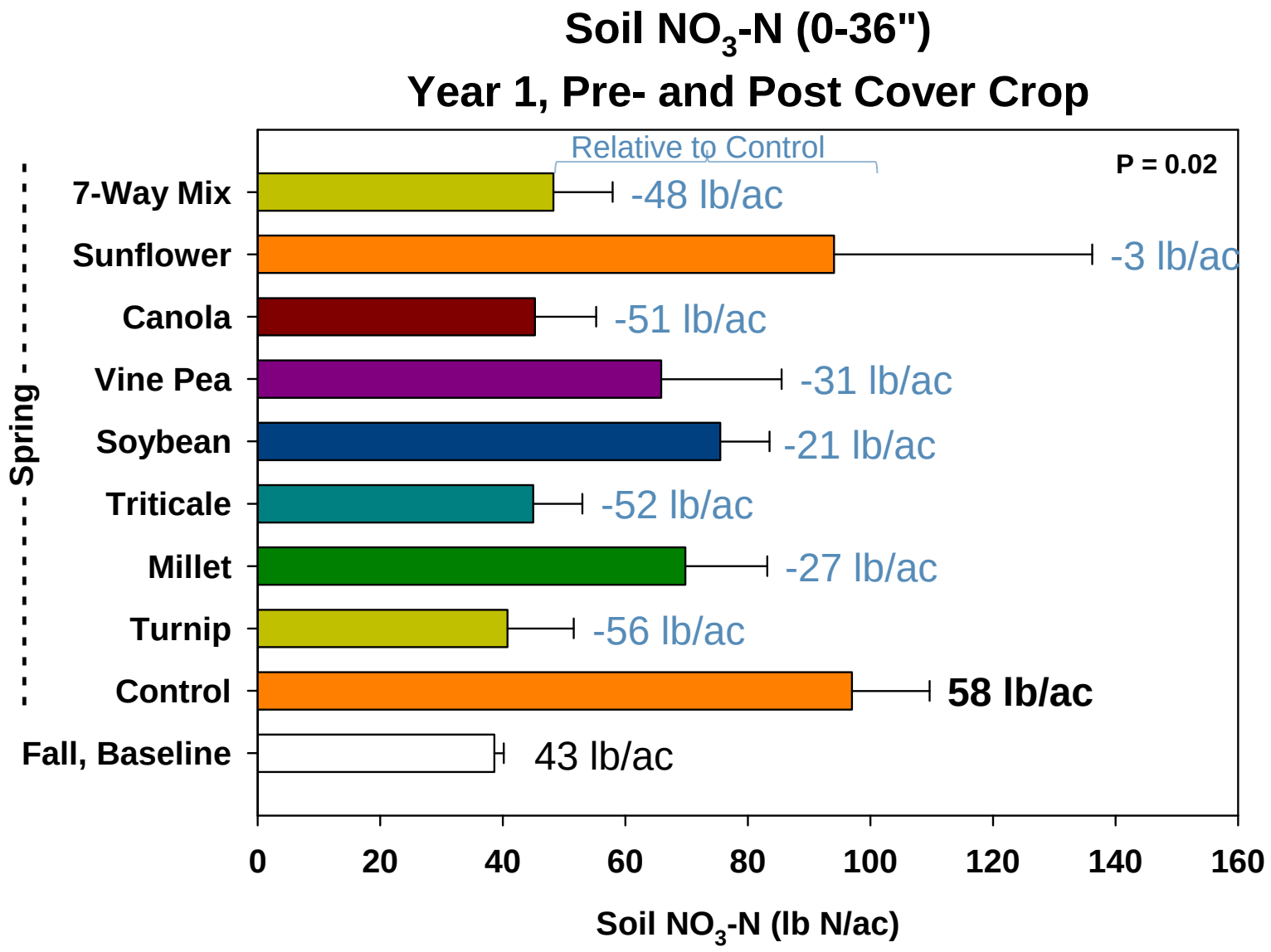
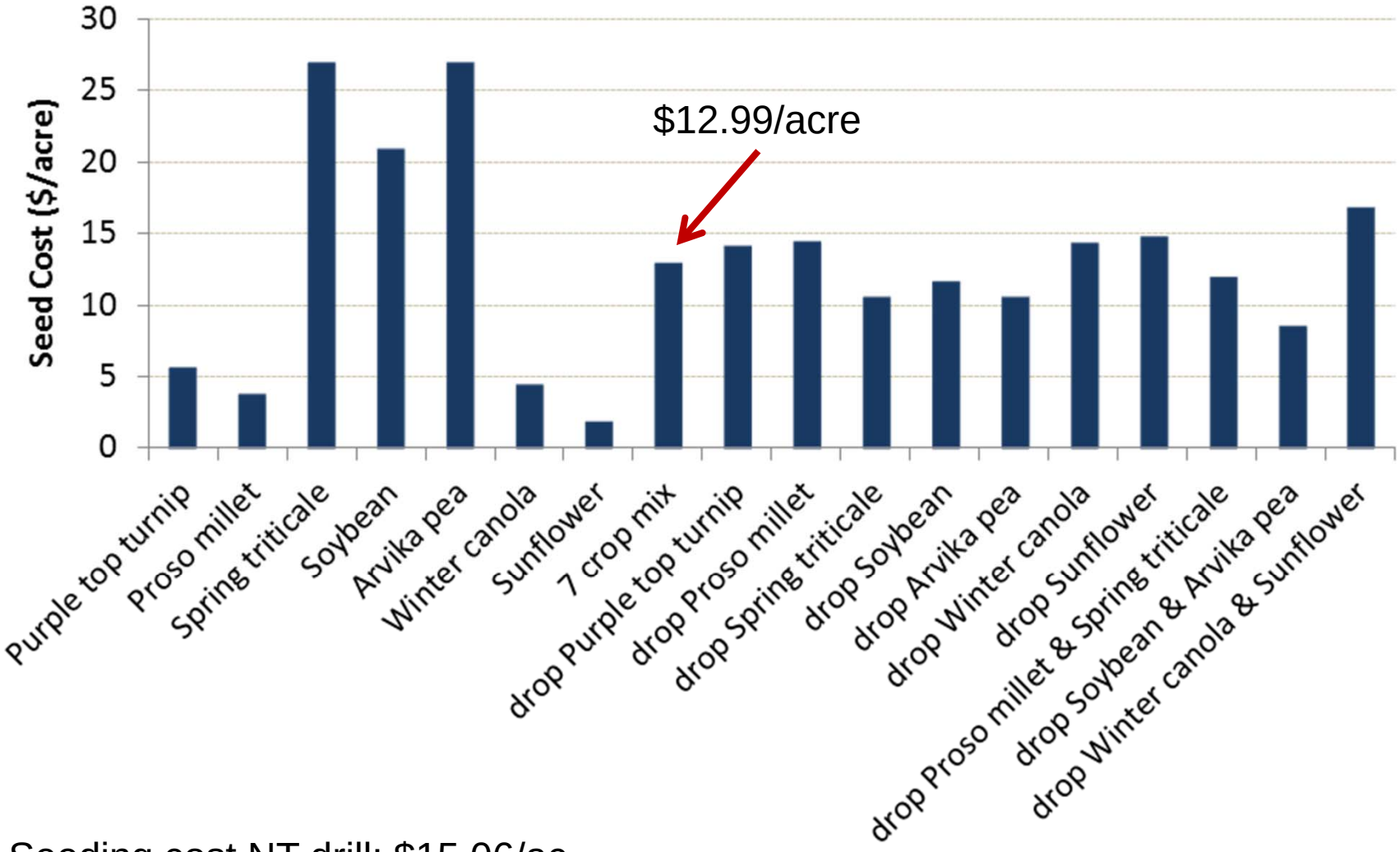
AREA 4 SCD Cooperative Research Farm



Mark Liebig, preliminary data

Cover Crop Seed Cost

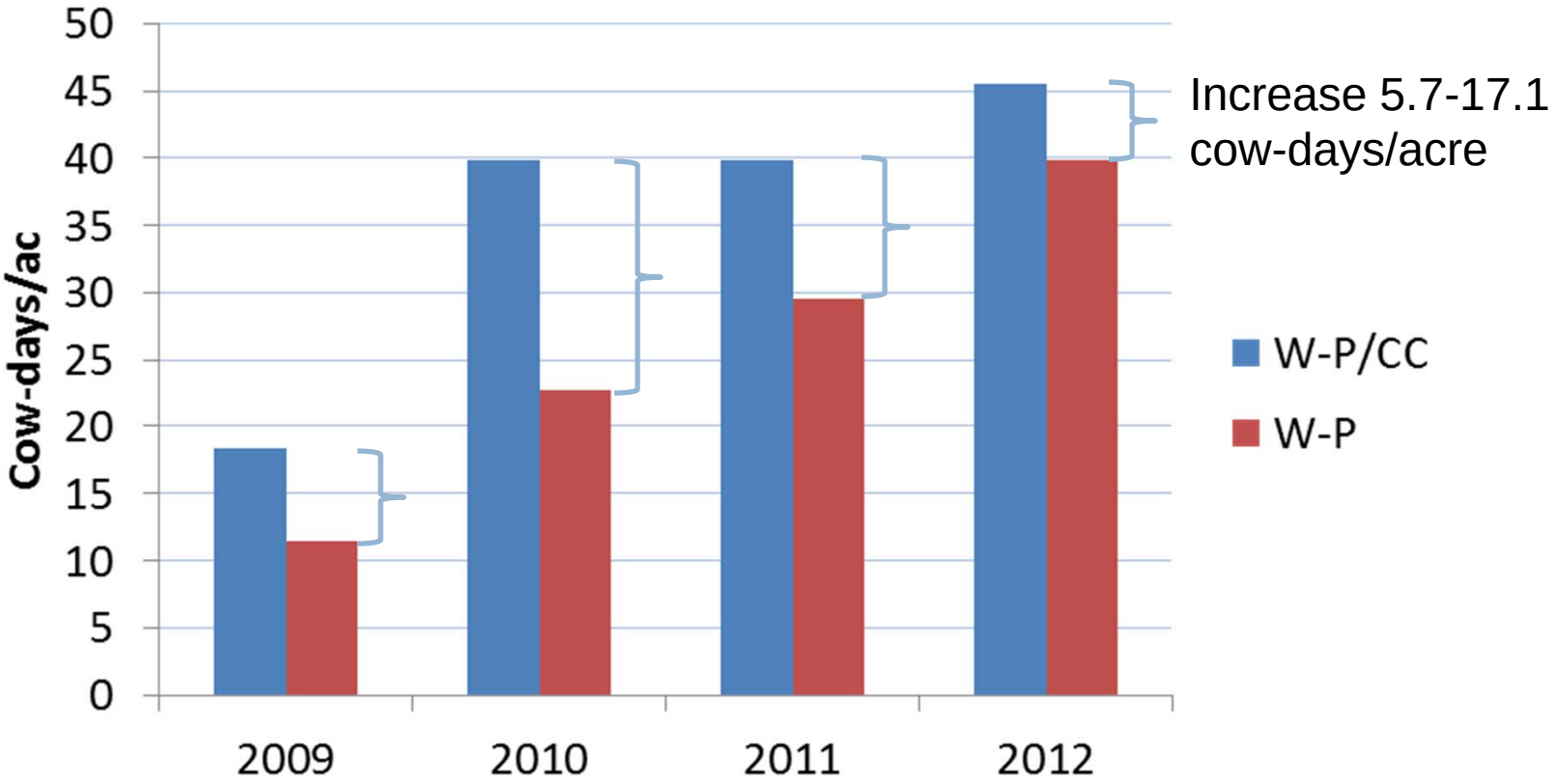


Seeding cost NT drill: $15.06/ac

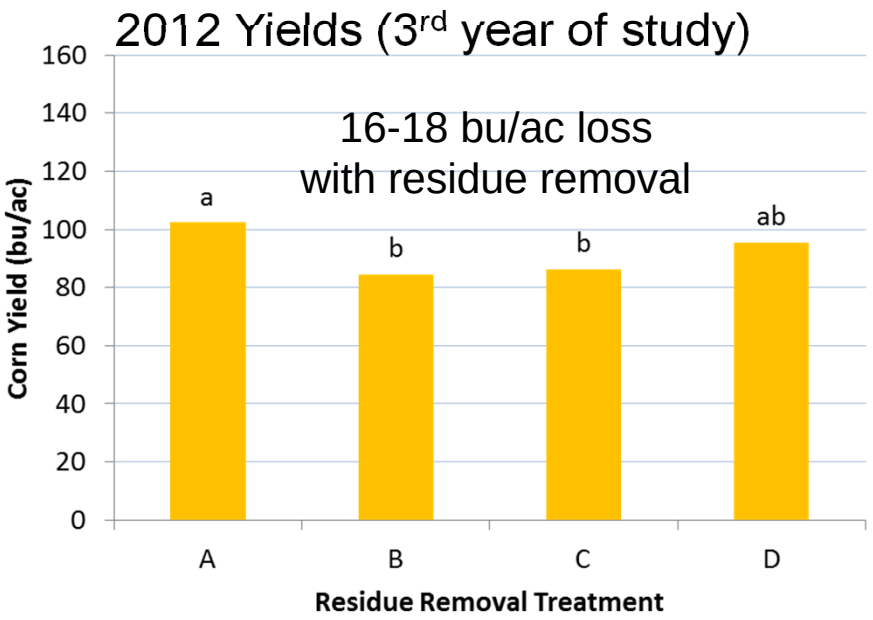
Cover Crop Mix, 10/11/10 (seeded 8/17/10)

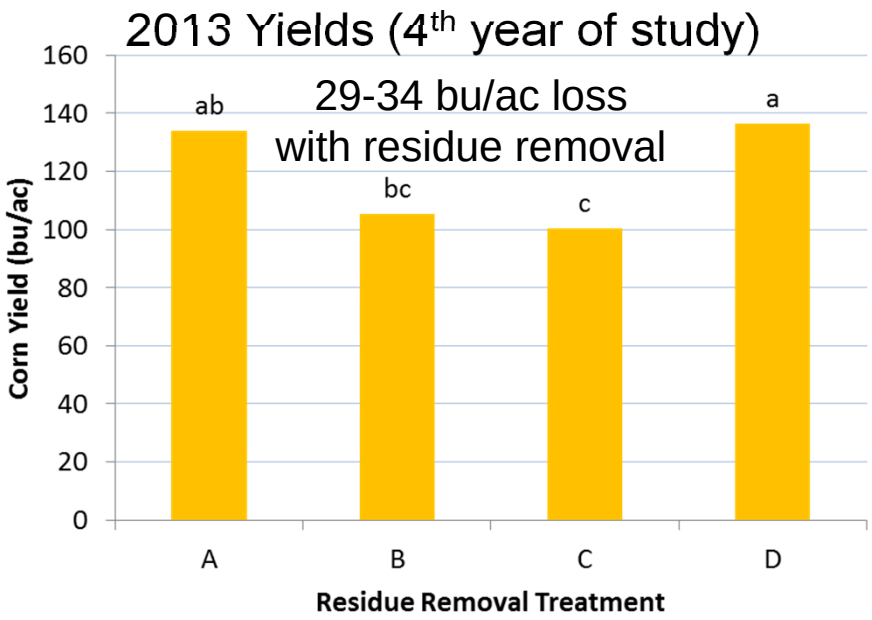

BCS Study

Grazing Benefit



Effect of Crop Residue Harvest





Treatments (spring wheat – dry pea – corn rotation)
A = No residue harvest
B = Bale and remove wheat straw
C = Bale and remove residue from each crop in rotation
D = Graze residue from each crop in rotation

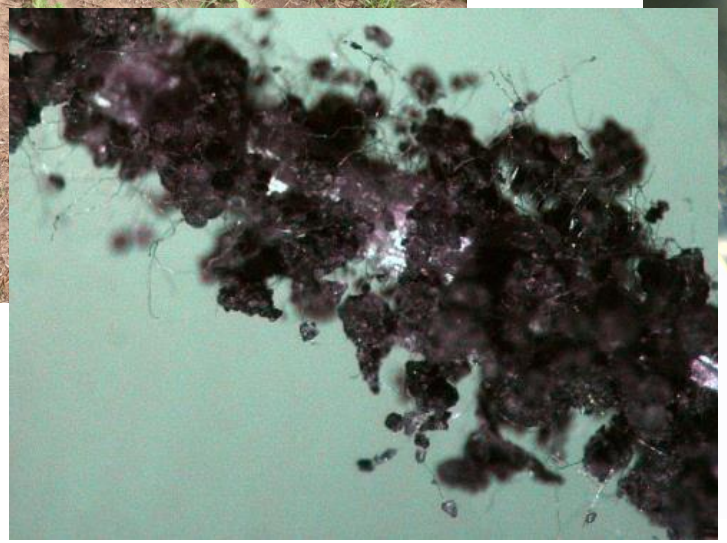
Field Research Trials

- Allow detailed analysis of treatment effects
  - include long term treatments
- Limited number of management treatments

Farmer Experience

- We know there are producers who are economically viable and who are building soil quality
- Often no ‘control’ treatments



Farmer Experience – Soil Health

- Improving on no-till with crop diversity, cover crops, integrating livestock
- On-farm observations suggested cover crops were improving soil health:
  - Increased aggregate stability
  - Reduced compaction
  - Greater soil organic matter
  - Enhanced nutrient cycling
  - Increased fungal biomass

Farmer Experience - Economics

- Yield increase (or no decrease) following cover crops
- Reduced fertilizer expense following cover crops
- Reduced herbicide expense following cover crops
- Reduced planting delays following cover crops
- Cover crop cost
  - Establishment costs
  - Full year cover crop – forgo grain income
- Grazing income and/or reduced winter feed cost

Planned On Farm Research

- Paired comparisons of ‘business as usual’ and conservation agriculture systems
  - Production (quantity and quality)
  - Economic performance
  - Ecosystem services including Soil Quality (physical, chemical, and biological indicators)
- Assess tradeoffs among production, economic, and ecosystem services

Summary

- Challenges of perception and long-term nature of benefits
- Opportunities to generate short-term benefits
- System interaction
  - Melding field research trials and farmer experience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