No-till (NT) is a technology to consider

Potential benefits . . .

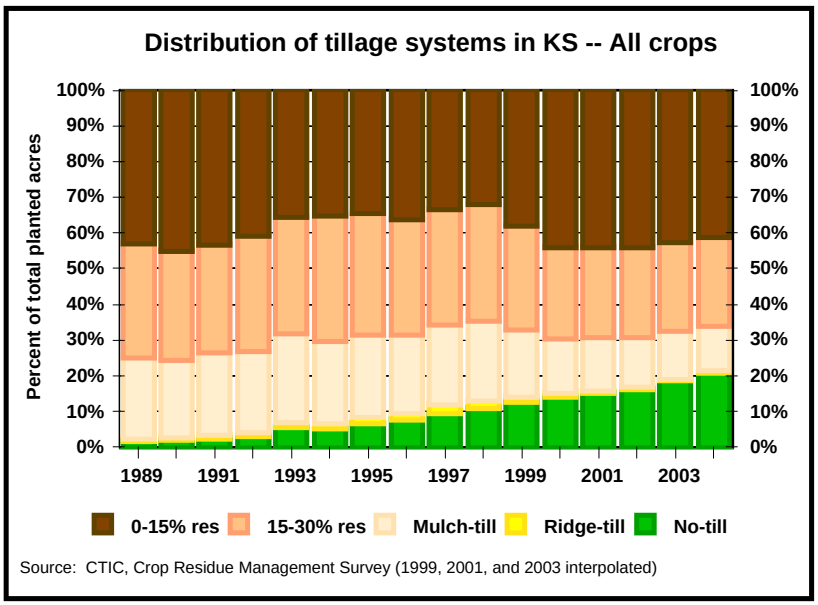
- Machinery cost savings
  - Reduces fuel and labor requirements
- Allows farm expansion
  - Dilutes fixed costs (spread over more land)
- May improve timing
  - Reduces land preparation time
  - Can increase cropping intensity
- Related to water savings
  - Can increase cropping intensity
  - Increases crop yields

Speed of technology adoption depends on

- Size of the expected profit
- Confidence in the outcome
- Investment amount required
- Keep in mind . . .
  - Late adopters adopt for survival
  - Early adopters adopt for profit
  - Speed of adoption is important only relative to your neighbors

Is NT black and white?

- NT is not black and white
  - Moisture savings come from reducing tillage
  - May use NT on one crop and not another in a rotation
- But, years of soil change can be harmed with one year of tillage
- Adopting NT happens in stages for many
  - Later adopters can skip certain stages
  - But can't "skip" time it takes for soil improvement



Source: CTIC, Crop Residue Management Survey (1999, 2001, and 2003 interpolated)

Most growth in no-till has come at expense of mulch-till

Possible reasons for switching to reduced or no-till ...

- ✓ **Increase profitability**
- ✓ **Reduce labor requirements**
- ✓ **Reduce machinery cost/acre**
- ✓ **Increase acres farmed**
- ✓ **Reduce moisture stress/increase yield**
- ✓ **Conservation compliance/soil erosion**
- ✓ **Other (e.g., wildlife, carbon sequestration)**

Profitability ...

Revenue (yield x price)

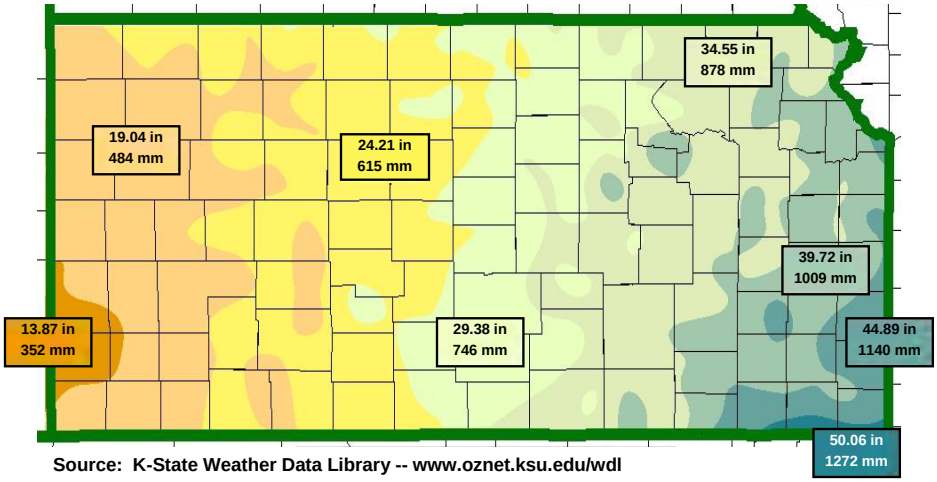
\- Cost (variable and fixed)

Profit or net returns

Tillage won't impact price, thus profitability will depend on how yields and costs are affected by reducing tillage.

Effect of no-till on *YIELDS*

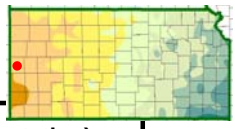
Kansas Annual Precipitation, 1971-2000

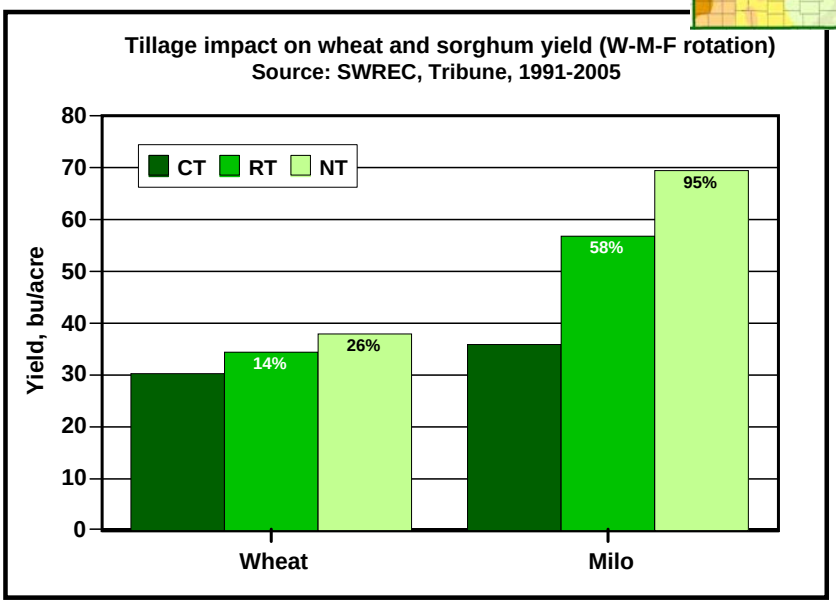


Source: K-State Weather Data Library -- www.oznet.ksu.edu/wdl

K-State research data

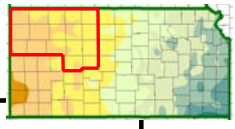
(19.0 in annual precipitation region)

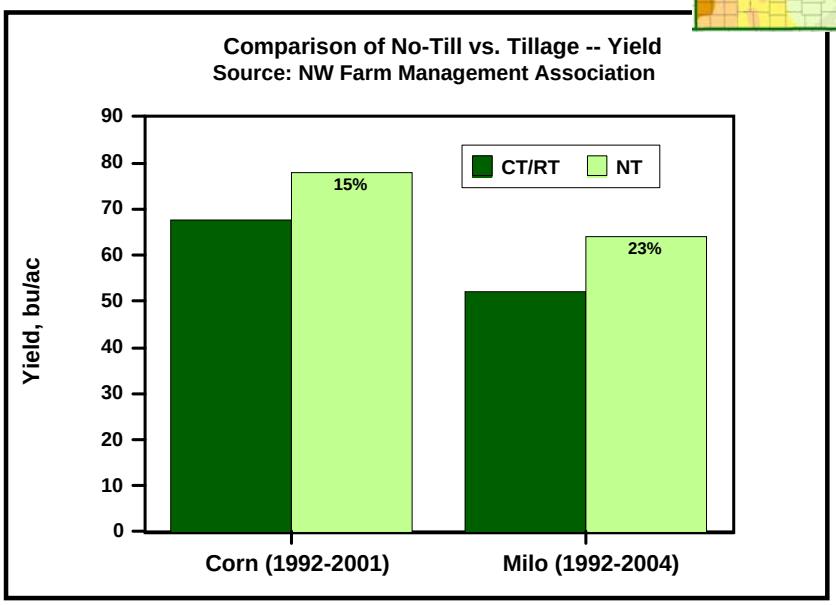




Farm-level data

(19.0-24.2 in annual precipitation region)





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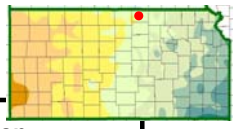
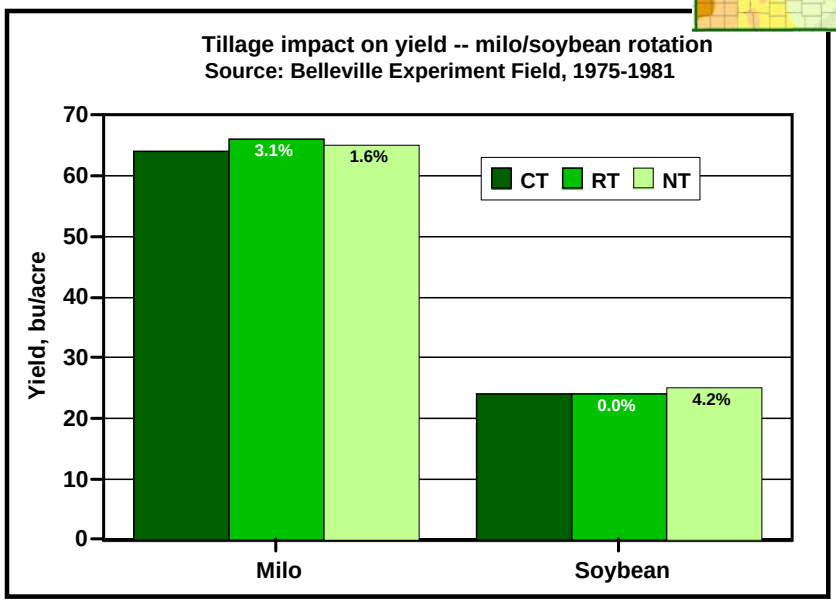
K-State research data

(29.4 in annual precipitation region)





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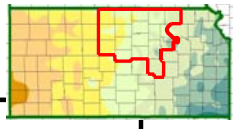
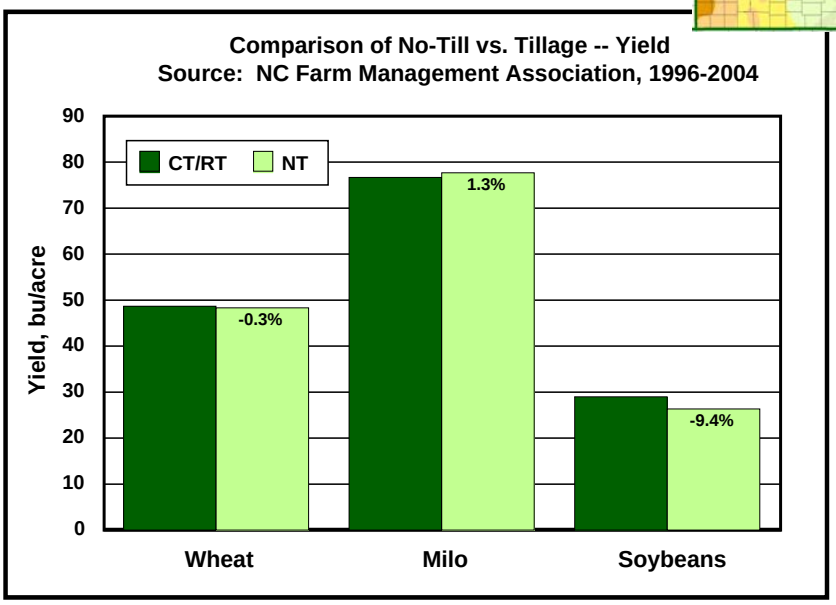
Farm-level data

(24.2-34.6 in annual precipitation region)





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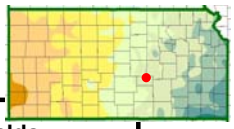
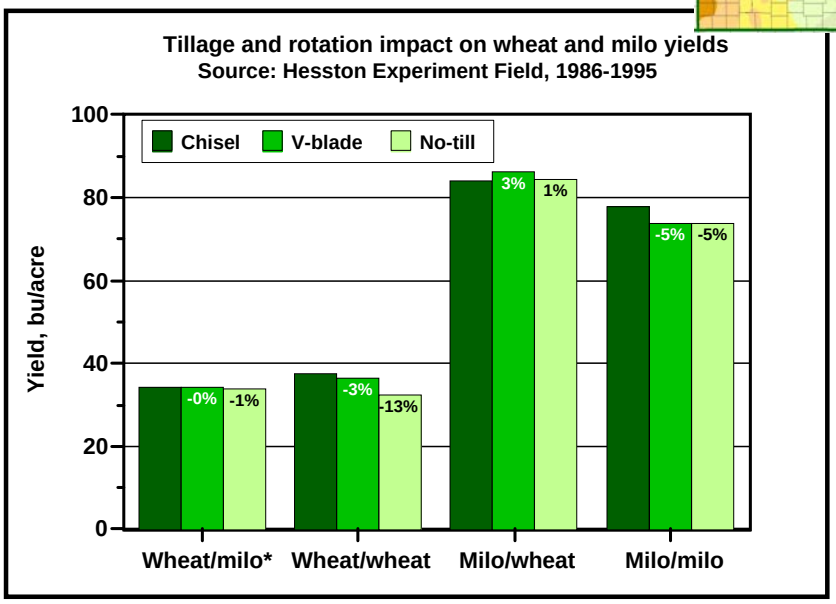
K-State research data

(29.4-34.6 in annual precipitation region)





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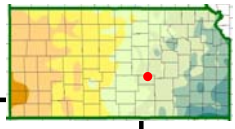
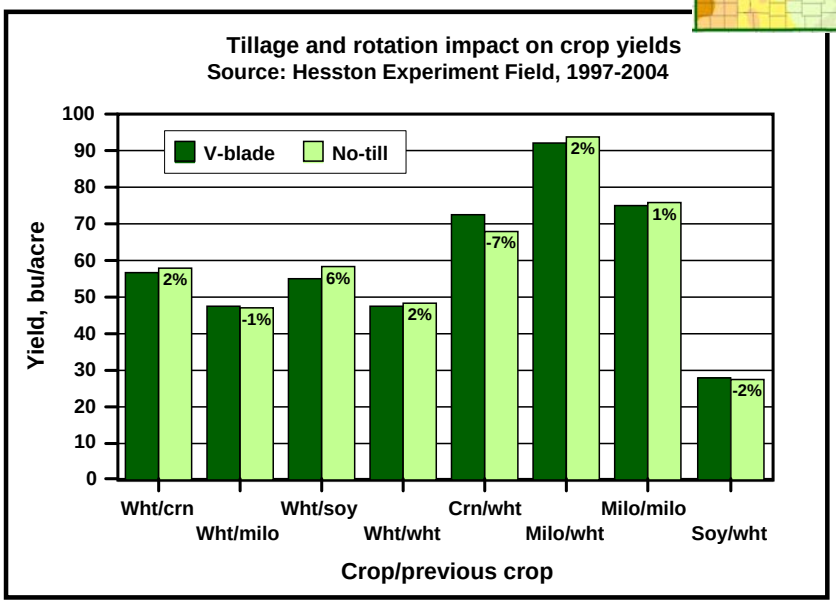
K-State research data

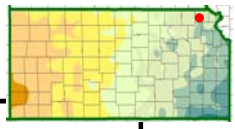
(29.4-34.6 in annual precipitation region)

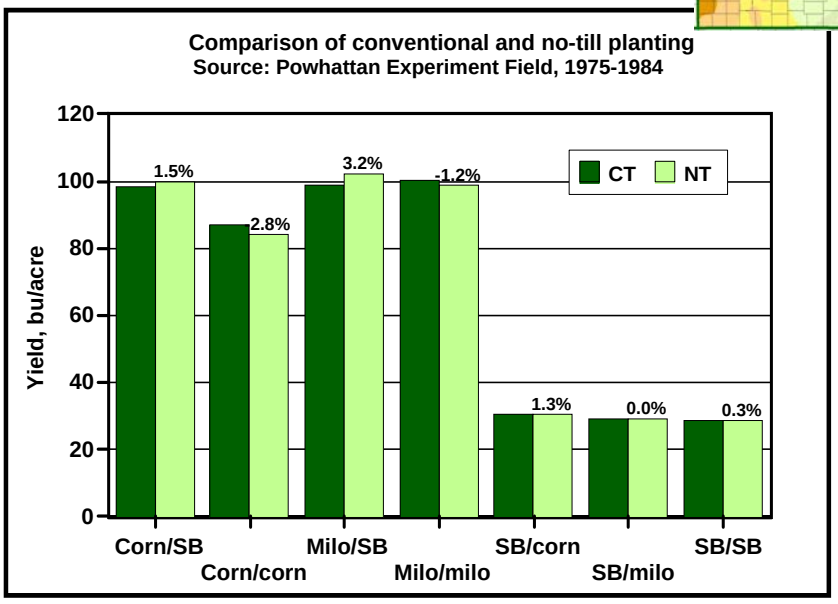




K-State research data

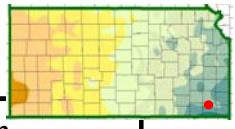
(34.6 in annual precipitation region)

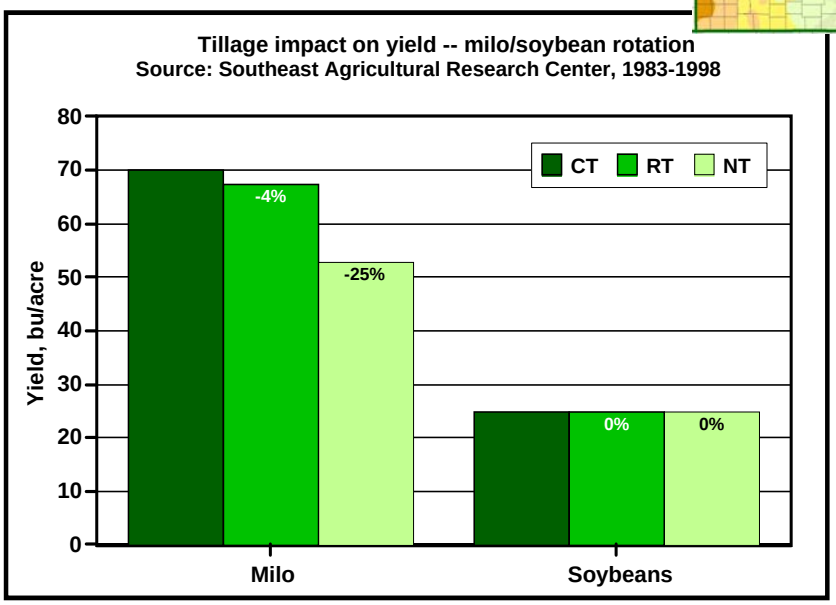




K-State research data

(44.9-50.1 in annual precipitation region)





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Effect of tillage on yields?

Research in central and eastern Kansas generally has shown little yield difference between tillage systems for wheat, milo, soybeans, and corn => NT cost driven.

Research in western Kansas has shown that yields increase as tillage is reduced, especially for summer crops such as corn and milo => NT revenue driven.

Effect of no-till on *COSTS*

- **Projected/simulated budgets**
- **Actual farm-level data**

Actual farm-level data

No-Till cost study - NC Farm Management Association, 1996-2004

	$/land acre		$/harvested acre	
EXPENSE ITEM, $/acre	CT/RT	NT	CT/RT	NT
Direct input (seed, fert, chem, etc)	$41.26	$55.41	$42.04	$53.37
Machinery cost	$39.44	$35.60	$40.24	$34.27
Labor	$28.35	$24.42	$28.95	$23.50
Total asset charge	$38.59	$38.03	$39.38	$36.63
Building and conservation	$2.99	$2.09	$3.06	$2.01
Other	$11.94	$9.09	$12.18	$8.75
Total expense	$162.58	$164.63	$165.84	$158.53
Total acres	938	1,212	908	1,256
Harvested acres/land acres	xxxxx	xxxxx	96.8%	103.6%

NT farms are cropping more intensively

Effect of no-till on costs

- Central and eastern KS data indicate slight decrease to little change in total costs if acreage is held constant. Western KS data suggest costs increase with NT compared to CT.
- Changes cost "structure" --- i.e., herbicide is substituted for tillage-related expenses.
- Fixed costs (land, machinery, management, etc.) will depend on acreage and thus will vary between producers.

Profitability ...

Revenue (yield x price)

- Cost (variable and fixed)

Profit or net returns

Western Kansas – higher yields and higher costs

Central / eastern Kansas – similar yields & costs

Profitability complicating factors:

- Cropping intensity
- Farm size
- Tillage x rotation interaction

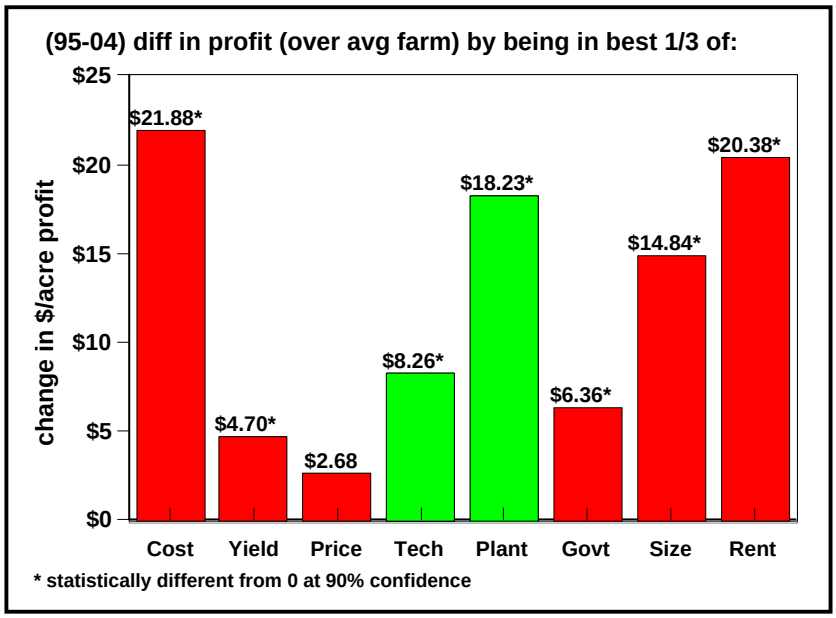
NT adoption is increasing. suggesting profitability

Economic analysis using Kansas Farm Management data

- Which management factors impact profitability?
- 10 years of data (1995-04)
- Approximately 900 farms
- Analysis focuses on crop producers

Kansas Farm Management Association
Helping You Put Knowledge To Work

Factors affecting profits …



Continuous-crop long-term NT questions

- How fast does SOM build over time?
  - How deep in the soil are changes observed?
  - Why should I care about SOM?
- Does soil structure change?
- Many crops in rotation or few?
- Will NT rotations in one area work in other areas?

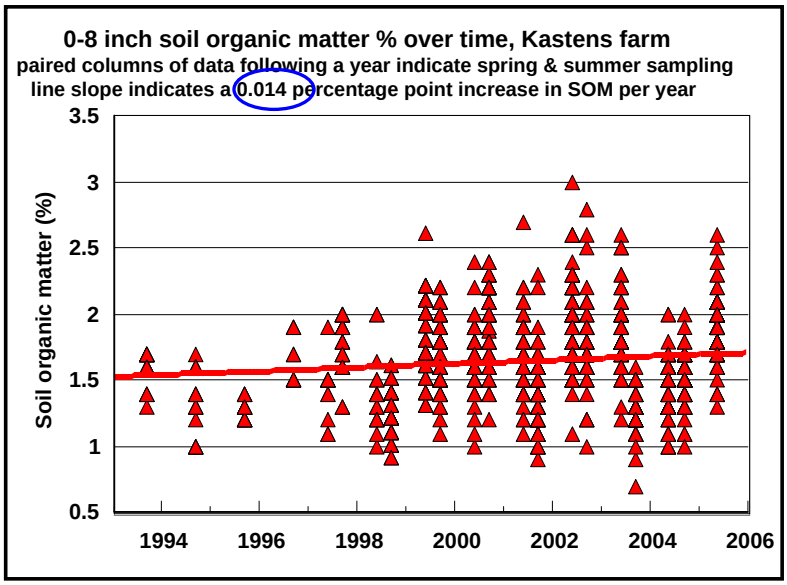
- Do soil changes impact yields, input costs, or profits?

Changes with continued NT

- Fast changes
  - Surface crop residue: improves water infiltration and reduces evaporation
  - Wheat stubble height especially important
- Medium changes
  - Soil structure (pore size) and strength:
    - Holds more water and water travels through faster
    - Surface doesn't seal off as fast during a rainstorm
    - Can support wheel traffic better
- Slow changes
  - SOM:
    - Indicator of positive change
    - Provider of mineralized crop nutrients (N & P)
    - Improves P solubility and availability

Residue: changes near the soil surface

- Get more rain in the soil and keep it there for plants
  - Crop residue improves water infiltration
  - Crop residue reduces evaporation
  - High wheat stubble better than short stubble, especially in low yielding situations
    - Akron field trial:
      - 4 inch stubble: evaporation is 80%
      - 12 inch stubble: evaporation is 50%
      - 20 inch stubble: evaporation is 38%
    - Tribune field trial (2001-2004):
      - Leaving about 13 inches rather than 6.5 inches resulted in 8.2 bu/acre increased yield for the following corn or milo crop



At this rate would take 70 years to build SOM by 1 percentage point!
And, that is at only the 0-8 inch (20 cm) depth.

NT-caused long-term changes in soils

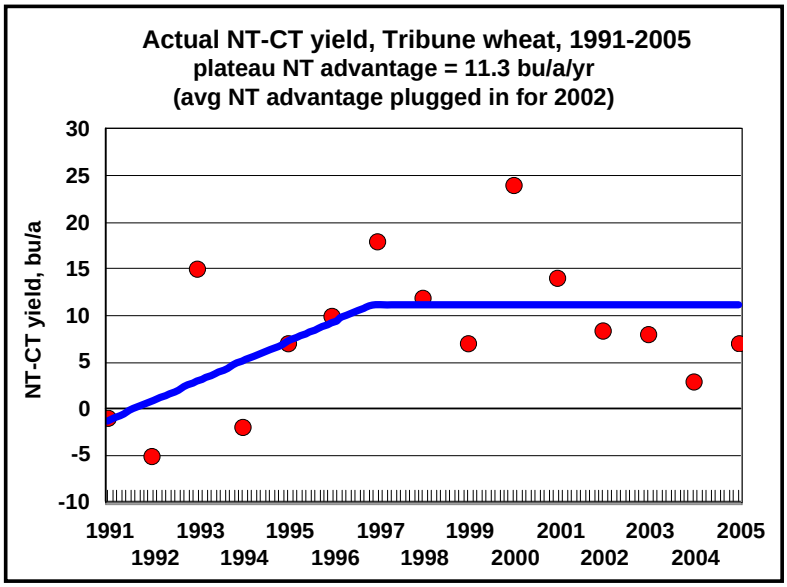
- Changes will NOT be deep in soil
  - Increased capacity of water storage not large
- Slow changes in SOM over time
  - Savings in fertilizer due to mineralization will eventually matter, but not for a long time and not as important as water savings
- But, small changes near the soil surface can be especially important in drier areas
  - It's all about getting more water in soil and retaining it
  - More water will be observed in NT soils than in CT soils, even through whole rooting zone

Tribune Kansas Research

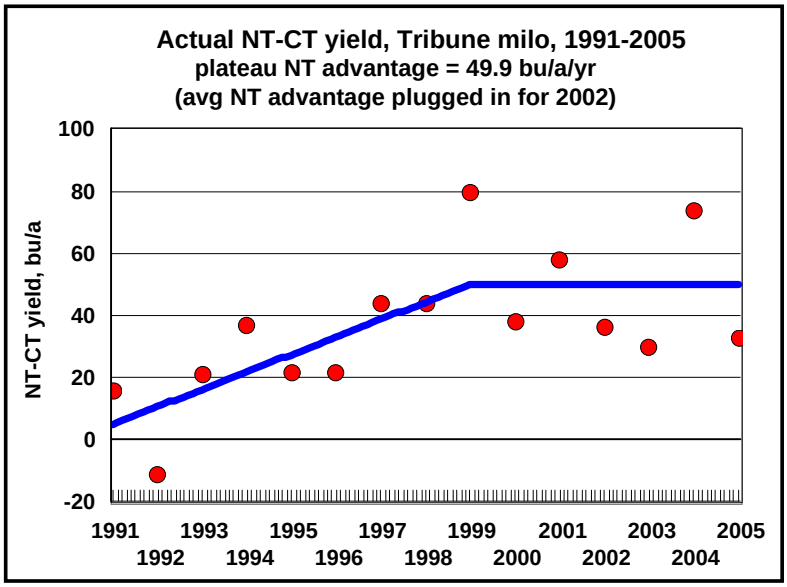
- Over 31 years (1974-2004), differences in available soil water (ASW) & rainfall explain:
  - 61% of differences in wheat yield
  - 58% of differences in milo yield
- A 15-year (1991-2005) wheat-milo-fallow (WMF) study compared CT to NT for:
  - available soil water (ASW)
  - grain yields
  - water use efficiency (WUE)

Tribune Kansas WMF rotation

- **Wheat**
  - NT has 18% more ASW at planting
  - NT has 26% higher grain yields
  - NT has 23% higher WUE
  - NT ASW grows at 0.16 in. per year
  - NT WUE grows at 1.36 lb/in. per year
  - NT yields will grow over time
- **Milo**
  - NT has 28% more ASW at planting
  - NT has 95% higher grain yields
  - NT has 101% higher WUE
  - NT ASW grows at 0.09 in. per year
  - NT WUE grows at 10.15 lb/in. per year
  - NT yields will grow over time



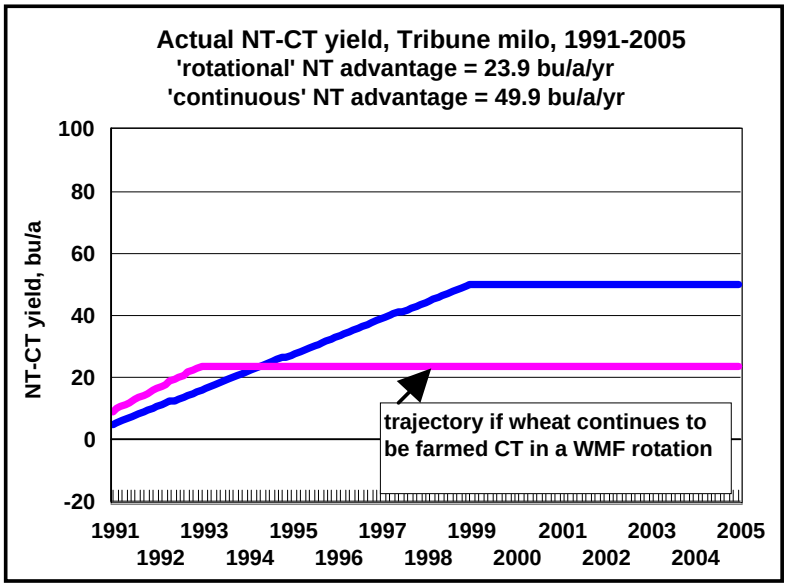
Might the blue linear plateau better represents the situation?



Might the blue linear plateau better represents the situation?

Change in NT over CT advantage over time

- NT-CT yield difference appears to have grown for about 10 years, then leveled
  - Do changes in soils and residue that improve water use stop after 10 years?
  - Are we "leaving water on the table," implying that cropping intensity should be increased?
    - A potential advantage somewhat unique to drier areas of the country
  - Can we get these advantages by tilling ahead of wheat and no-tilling ahead of milo?
    - Likely very small advantage to wheat if only milo is NT
    - Of course substantial benefit to the milo leg



The purple line drove WF to WMF or WCF in the High Plains

What to think about (in Western KS) . . .

- If you are currently in a wheat-milo-fallow CT program, move at least to ecofallow (i.e., NT ahead of milo), since well-proven:
  - Will pick up 24 bu/a on milo nearly immediately
- Then think about continuous NT, i.e., chem-fallow on the wheat:
  - Will pick up 11 bu/a on wheat in about 7 yrs
  - Will pick up another 26 bu/a on milo in about 9 yrs
- Then (or better yet, simultaneously) think about intensifying rotation:
  - To prevent “leaving water on the table”

Questions ???

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