Converting CRP Land to Crop Production

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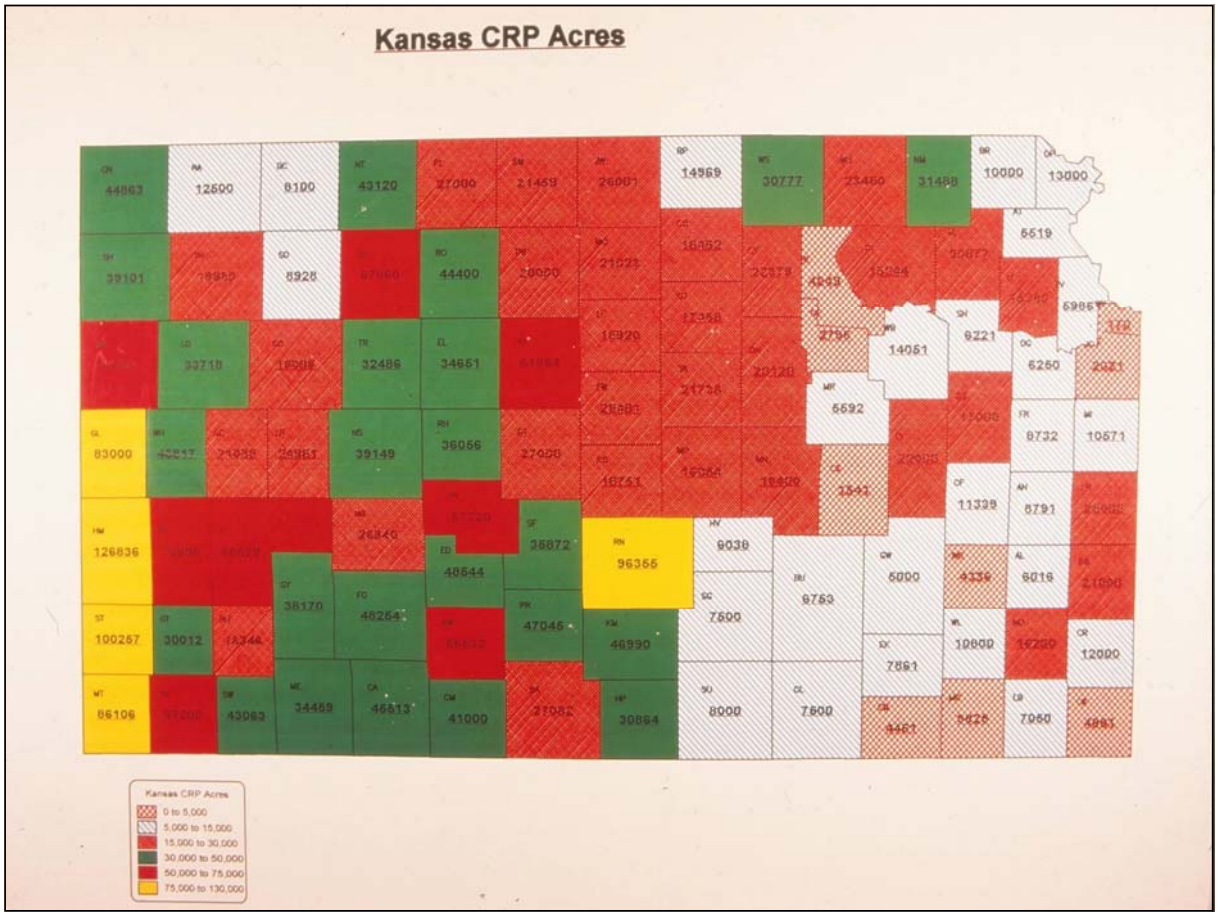

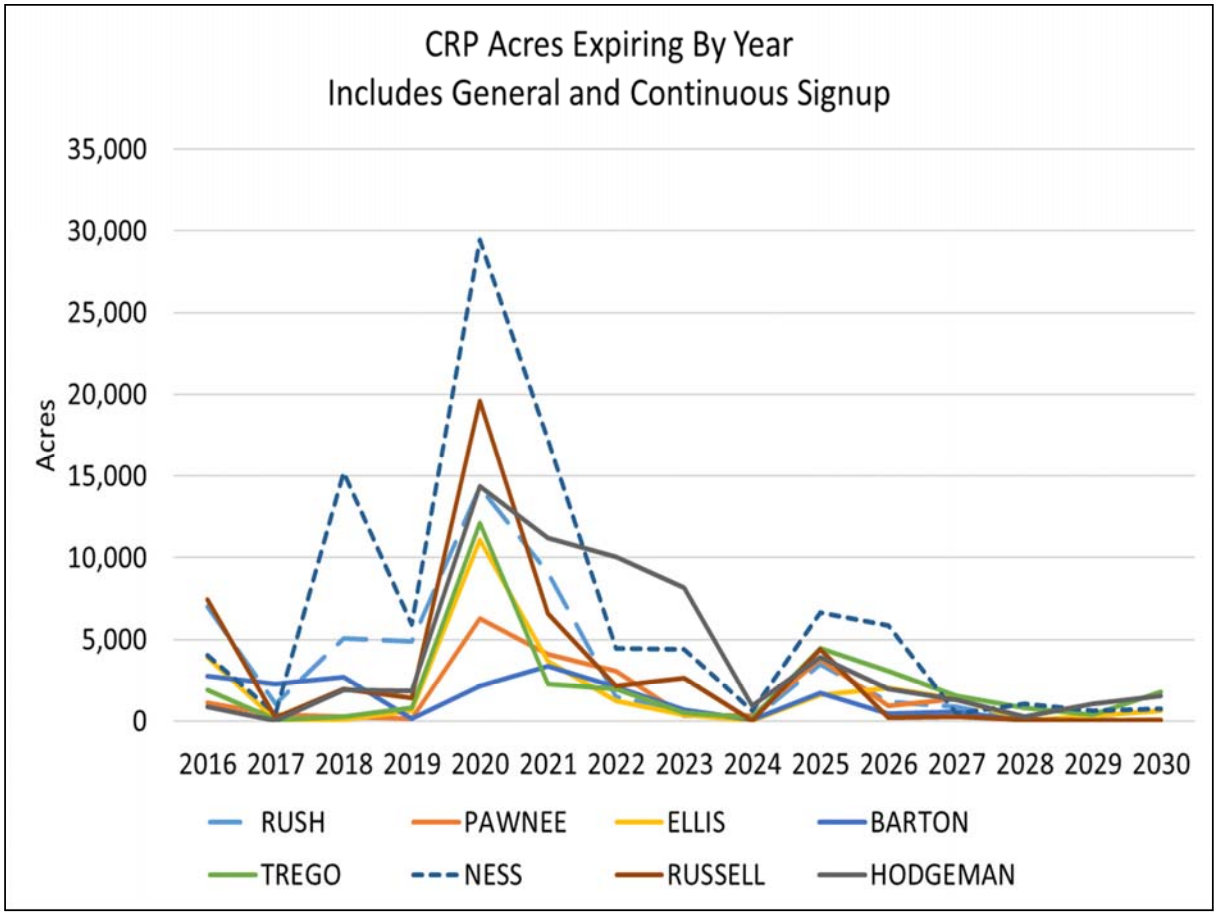

Challenge of Cropping

- Prevent Soil Erosion
- Maintain Soil Quality
- Provide Farm Profitability
- Maintain Wildlife Habitat

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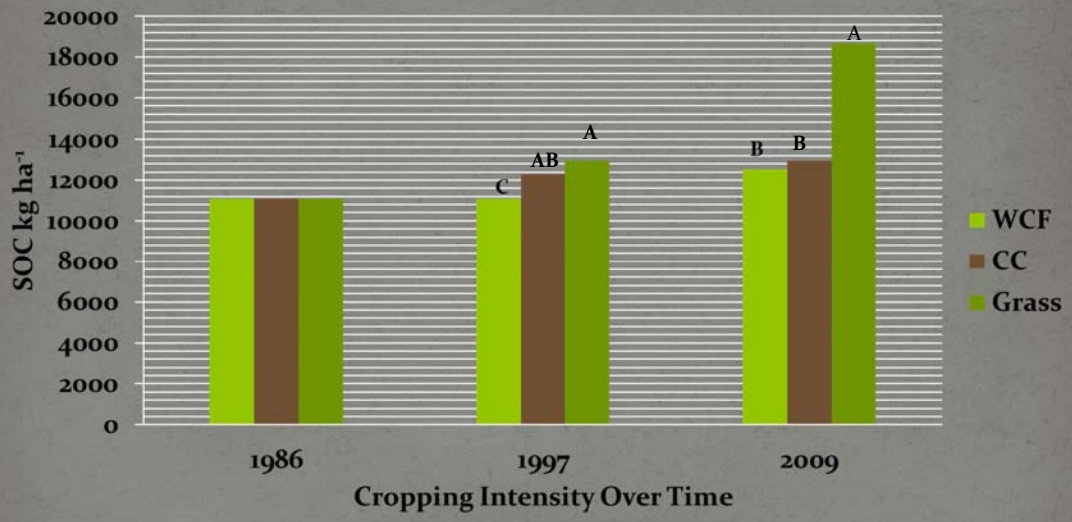
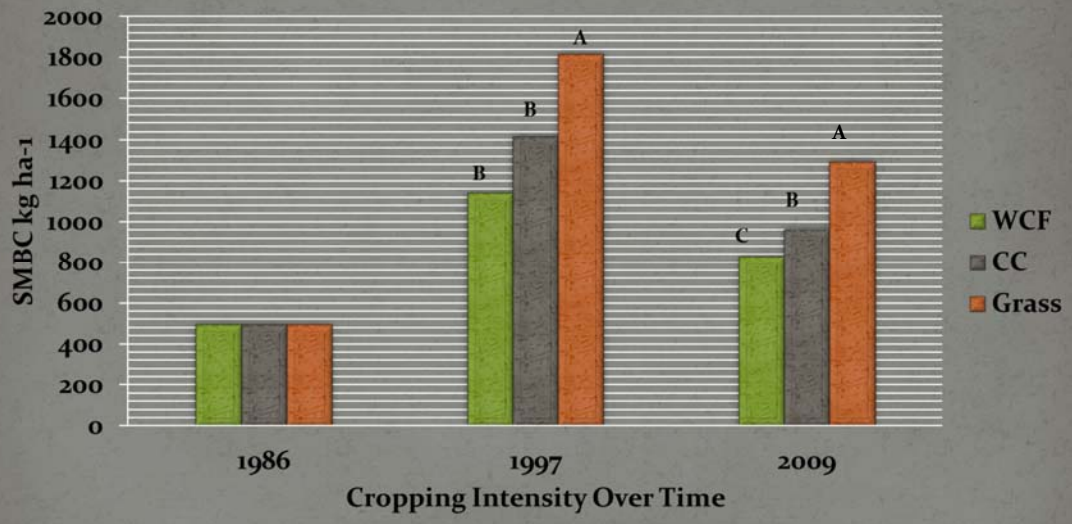
Total Soil Organic C (SOC)



Data from CSU Long-Term Dryland Rotation Study
Dan Manter, USDA-ARS, Ft. Collins

Soil Microbial Biomass (SMB-C)



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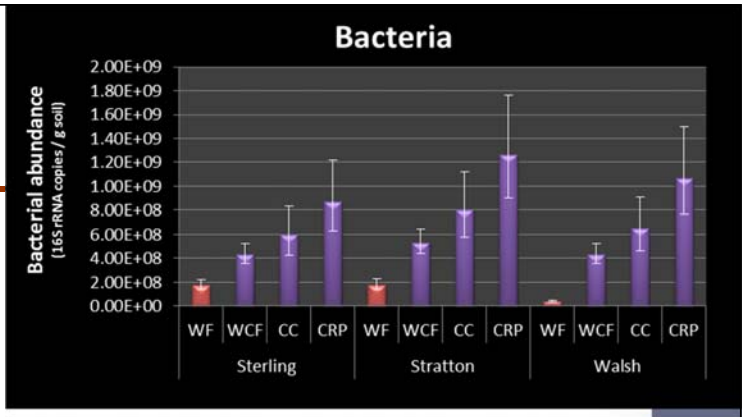
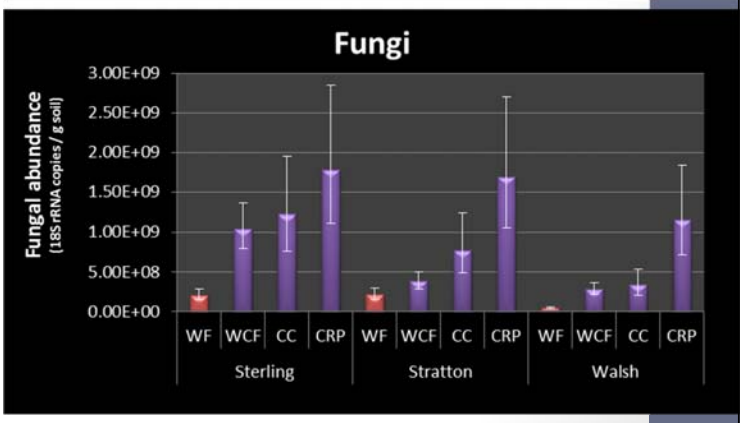
Soil Biology: abundance

Bacteria (16S rRNA) and Fungal (18S rRNA)

- **biomass increases with cropping intensity**
- **biggest change the high ET potential site**





Bacteria

	Sterling	Stratton	Walsh
WCF	149%	197%	1022%
CC	243%	347%	1580%
CRP	402%	602%	26669%

Fungi

	Sterling	Stratton	Walsh
WCF	408	79	515
CC	496	264	632
CRP	769	693	2404

Data from CSU Long-Term Dryland Rotation Study
Dan Manter, USDA-ARS, Ft. Collins

Considerations

- Residue Removal
  - Burn, mow, or leave stand
- Elimination of CRP grasses
  - Tillage vs. chemical
- Soil Water
- Soil Nutrients – Fertilizer Placement
- Perennials weeds

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CRP Observations from across the Great Plains Region

(some of which are old)

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Other Experiences in the Region - Texas

- Difficult to control warm season grass in no-till.
- Soil water depleted, necessary to fallow prior to crop.
- Perennial weeds still present, if present before CRP.

Unger, 1995

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Other Experiences in the Region - Colorado

- Tillage more effective than herbicides for controlling cool season grasses.
- 35% grass infestation in no-till following summer.

Anderson, 1995

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Other Experiences in the Region - Nebraska

- Tillage controlled grasses
  - –But difficult to prepare seedbed

Lyon, 1996

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Other Experiences in the Region - Oklahoma

- Residue removal required for herbicide effectiveness.
- Adequate grass suppression with two herbicide applications
- Only grass suppression not elimination required before cropping.

Dao, 1995

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Objective

- Determine best management practices for returning CRP land to crop production in western Kansas.

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CRP Grasses

Primary species:
- sideoats grama
- blue grama
- buffalograss
- little bluestem
- switchgrass

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Treatments

- Residue Pretreatment
  - –Burn, Mow, or Leave stand
- Grass Controls Methods
  - –Tillage, chemical, or both

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Burning CRP grass??

- Residue removal
  - Required for herbicide effectiveness?
  - Little difference between removing residue by mowing or burning
- Effect on soil nutrients?

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Range grasses - nutrient content

- lose feed value, nutrients during weathering

- Cr Protein ..... 2.1 – 5.9%
- Phosphorus ... 0.01 – 0.05%
- Potassium ..... 0.26 – 0.78%
- Sulfur ..... 0.08 – 0.15%

- N ..... 5.7 – 16.0 *lb/ton*
- P_2O_5 .... 0.4 – 1.9
- K_2O ..... 5.1 – 15.4
- S ..... 1.6 – 2.9

Horn. Mineral Content of Range Grass. Univ. of Wyoming Coop. Ext. Svc.

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What goes up in smoke?

- N ..... 100% loss
- P_2O_5 ..... 20%
- K_2O 35%
- S 75%

Nutrients remaining

- N ..... 0.0 *lb/ton*
- P_2O_5 .... 0.3 – 1.6
- K_2O ..... 3.3 – 10.0
- S ..... 0.4 – 0.7

Gelderman. 2009. Estimating Nutrient Loss from Crop Residue Fires. SDSU.

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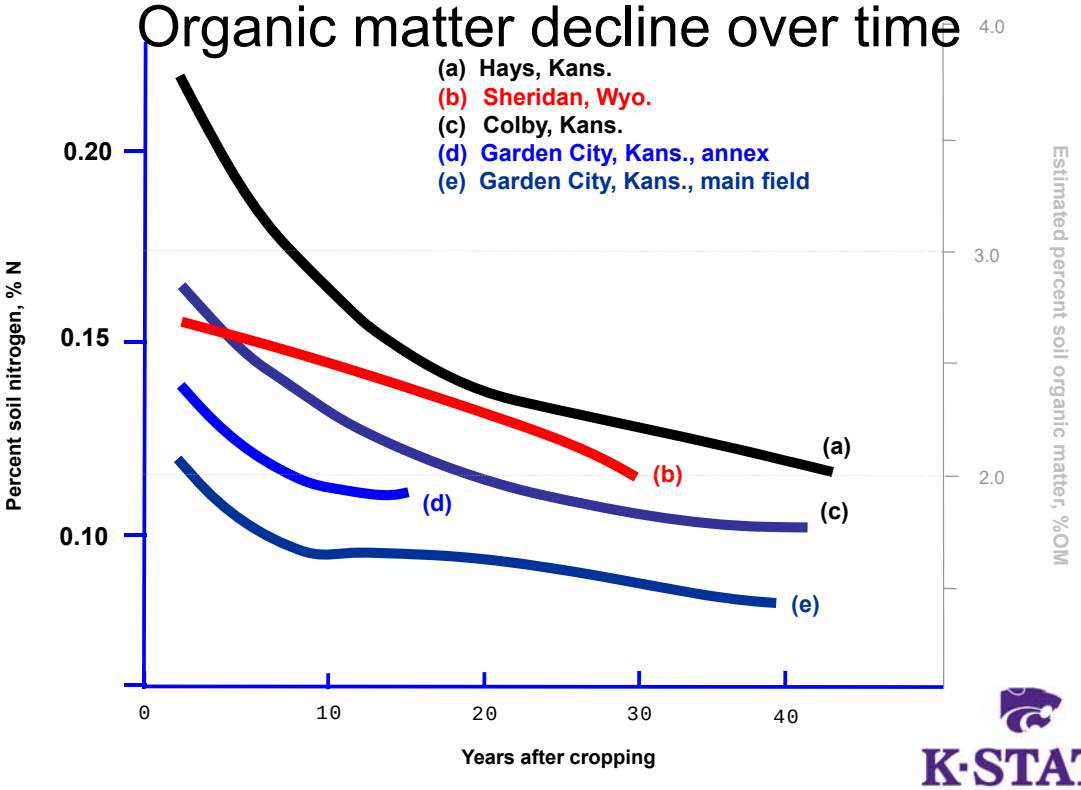
Organic matter decline over time



after Haas, H.J. et. al. 1957. Nitrogen and carbon changes in Great Plains soils as influenced by cropping and soil treatments. Tech. Bull. 1167. USDA

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Organic matter changes after CRP

- Study from 28 fields in southwest Texas Panhandle
  - loamy sand to clay loam soil types
  - CRP for 9 to 15 years
    - seeded 1985-1991, avg = 1989
  - soil sampled - fall 2000, spring 2001
- Compared 5 “agroecosystems”
  - Native range
  - CRP
  - cotton – irrigated & dryland *(conventional till)*
  - cotton w/ small grain cover crop *(reduced till)*

Bronson, et. al. 2004. Carbon and nitrogen pools of Southern High Plains cropland and grassland soils. SSSAJ 68:1695-1704.

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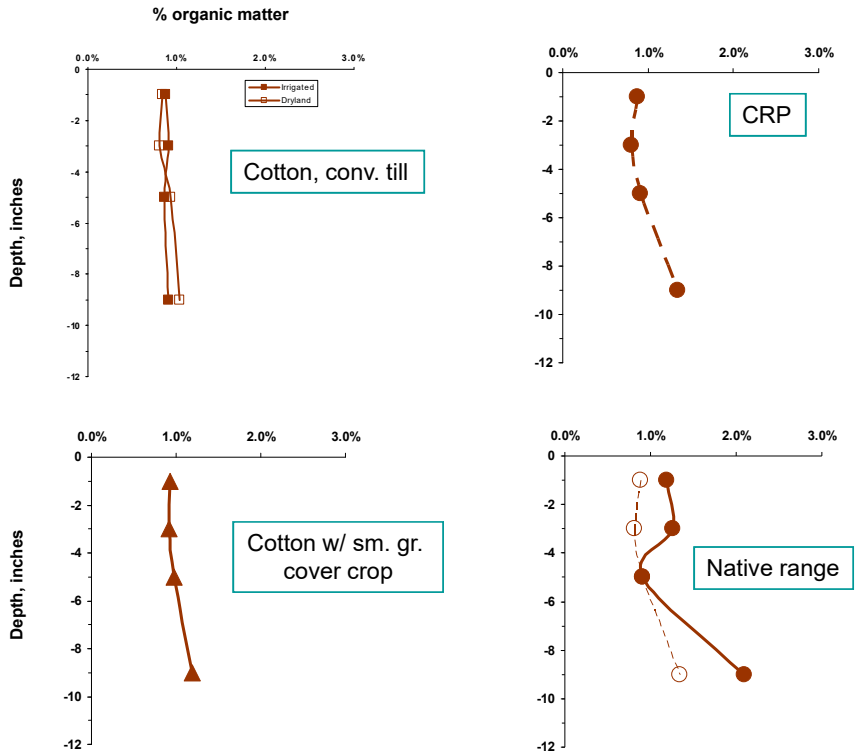

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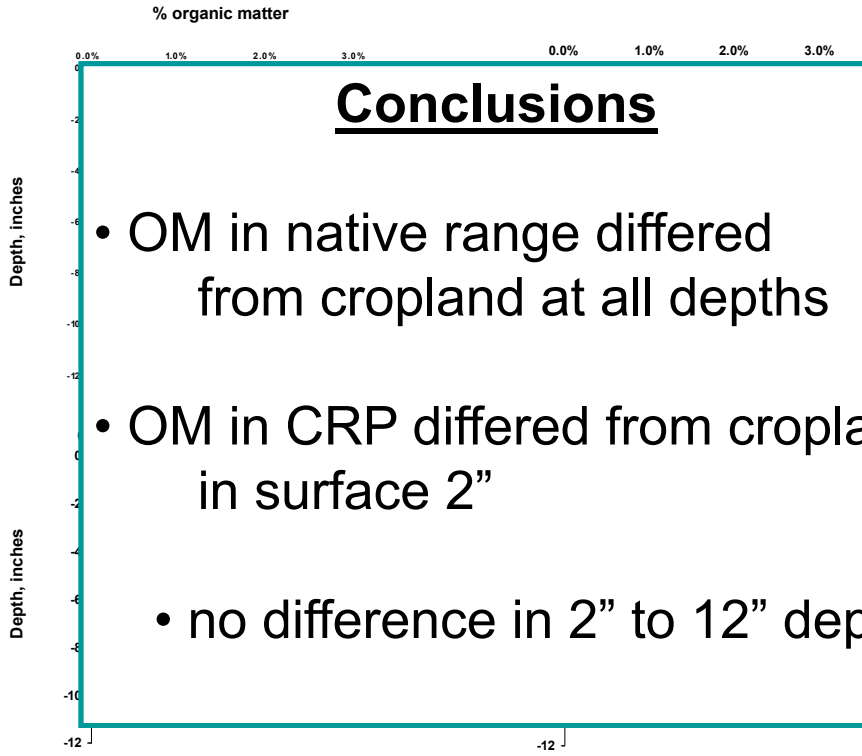

Conclusions

- OM in native range differed from cropland at all depths
- OM in CRP differed from cropland in surface 2”
- no difference in 2” to 12” depth

Bronson, et. al. 2004. Carbon and nitrogen pools of Southern High Plains cropland and grassland soils. SSSAJ 68:1695-1704.

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Colorado

- Organic matter in CRP vs. WF
  - –4 sites OM higher in CRP
  - –3 sites OM the same
  - –2 sites OM higher in WF

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Grain Sorghum

- Conventional Tillage
  - Disc: July & August
  - Sweep Plow: September & June

- No-Till
  - Glyphosate: July (2qt/a)
  - Glyphosate: September (2qt/a)
  - Glyphosate: June (1 qt/a)

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Sorghum Planting

Tillage	Burn	Mow	LS
	available water/6′ profile		
Conv. Till	6.7	7.9	9.6
Reduced Till	7.1	9.4	--
No-till	5.7	8.3	10.3

Kuttler S96

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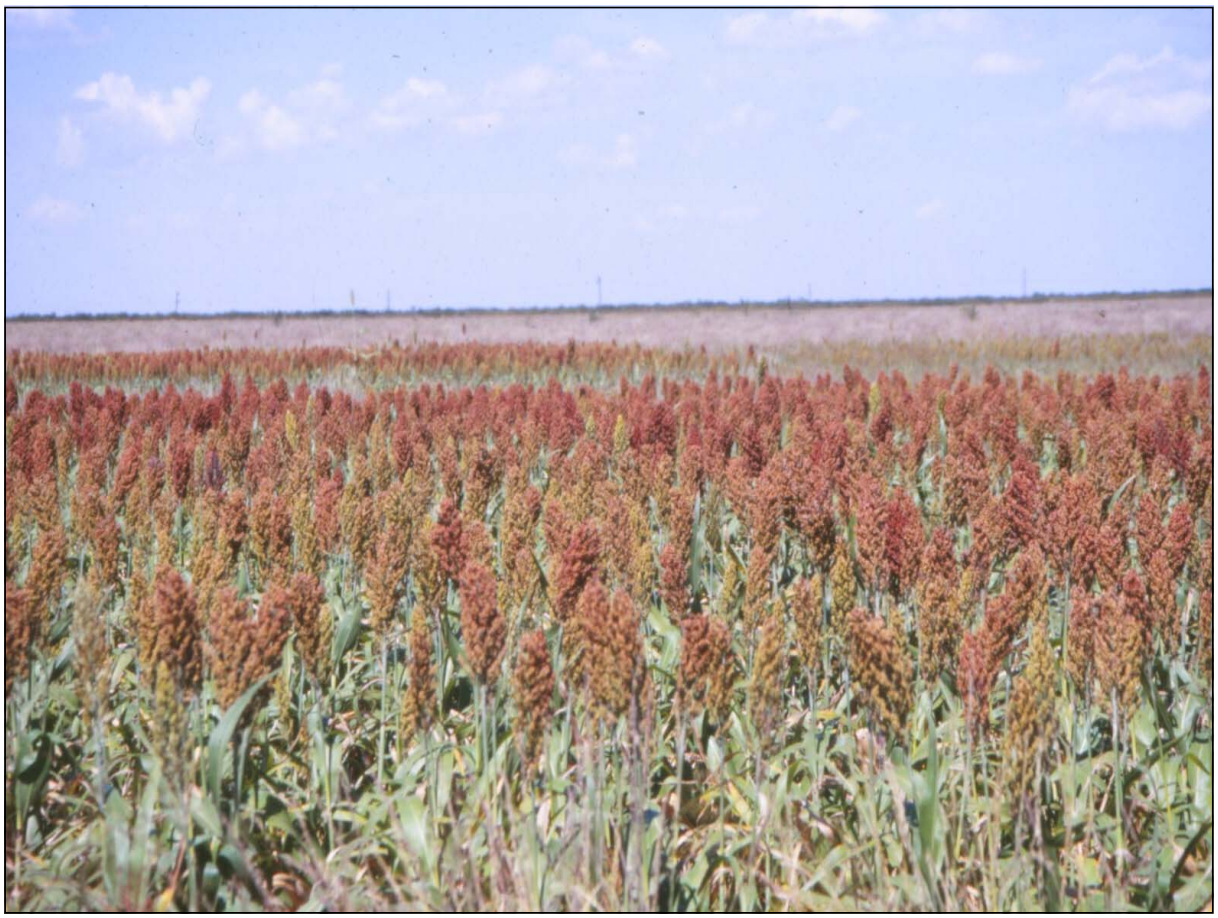

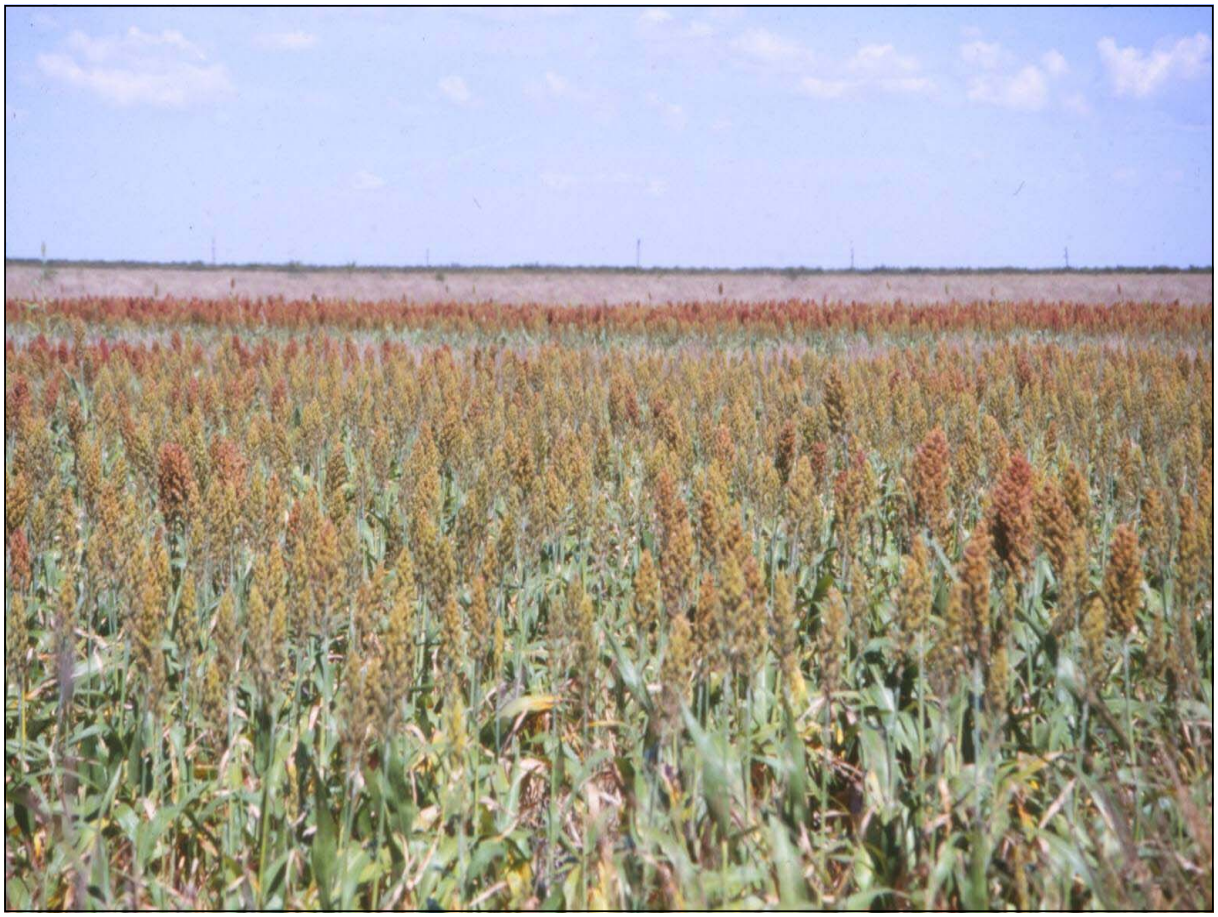

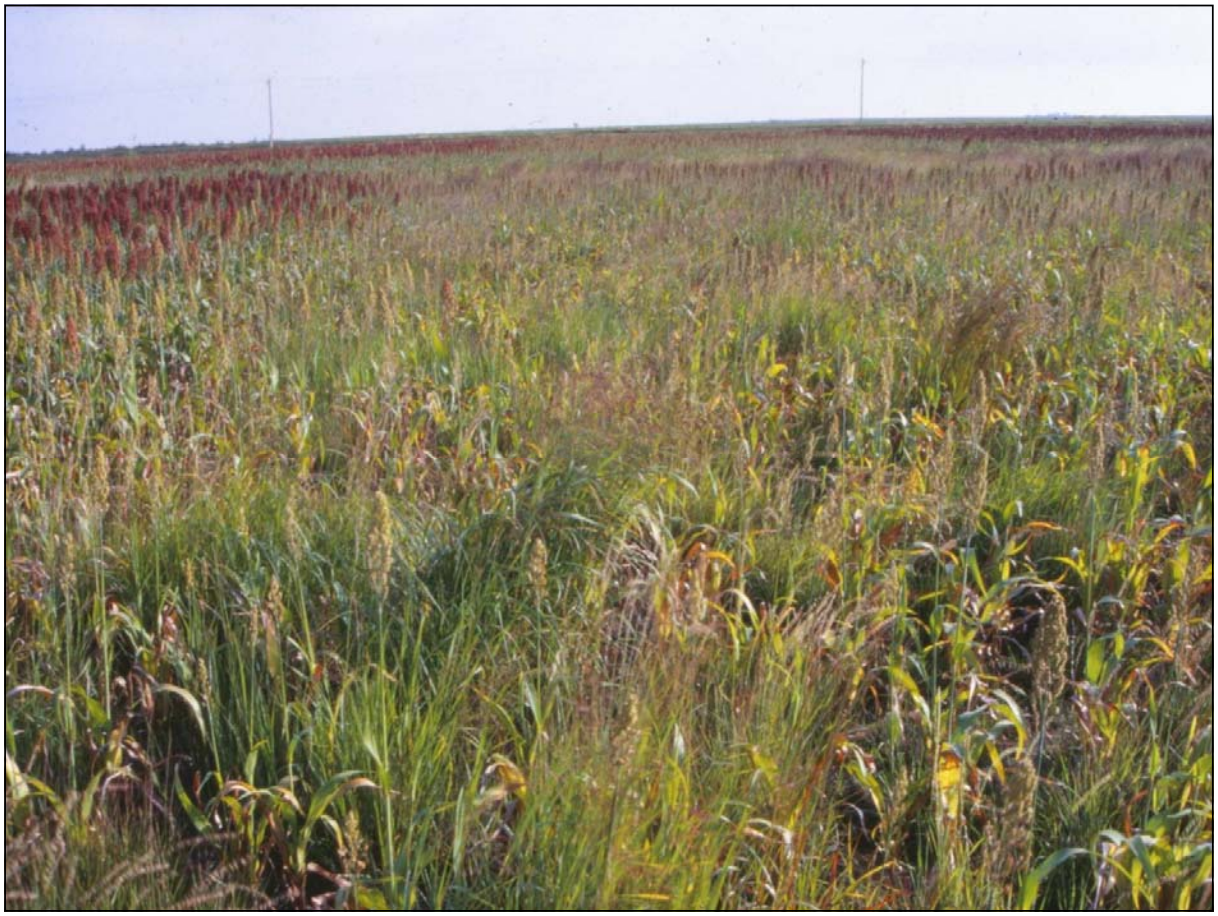

Grain Sorghum after Fallow

Tillage	Residue Treatment		
	Burn	Mow	LS
	grain yield, bu/acre		
Conv. Till	31	26	24
Till-Chem	22	18	--
Chem-Till	12	14	--
No-till	6	8	5

$LSD_{0.05}$ 7 bu/a

S96

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Sideoats Grama Control
90 DAT July 1

RoundUp Ultra	Burn	Mow	LS
1 qt/a	54%	60%	53%
2	81%	82%	69%
3	86%	87%	81%

Cramer, 1996

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Little Bluestem Control
90 DAT July 1

RoundUp Ultra	Burn	Mow	LS
1 qt/a	21%	38%	37%
2	47%	61%	55%
3	70%	69%	72%

Cramer, 1996

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Switch Grass Control
90 DAT July 1

RoundUp Ultra	Burn	Mow	LS
1 qt/a	33%	35%	66%
2	73%	47%	74%
3	82%	60%	82%

Cramer, 1996

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Wheat

- Conventional Tillage:
  - July –Disc
  - August—Disc
  - September—Sweep Plow
  - June—Sweep Plow
  - July—Sweep Plow
  - September—Sweep Plow

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Wheat

- No-Till:
  - July —Glyphosate (2qt/a)
  - June —Glyphosate (2qt/a)
  - August—Glyphosate (2qt/a)

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Soil Nitrate

- 2 ppm in surface foot of soil.
- < 1 ppm in 2-6 feet.

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Wheat Following CRP Residue Left Standing

Wheat Grain Yield (bu ac^{-1})				
N Rate (lb ac^{-1})	**0**	**50**	**100**	**150**
Conv. Till	24	30	36	44
No-Till	7	16	28	34

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Wheat Following CRP
Residue Mowed

Wheat Grain Yield (bu ac^{-1})				
N Rate (lb ac^{-1})	**0**	**50**	**100**	**150**
Conv. Till	17	29	37	40
Reduced Till	10	18	31	30
No-Till	8	17	27	32

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Wheat Following CRP
Residue Burned

Wheat Grain Yield (bu ac^{-1})				
N Rate (lb ac^{-1})	**0**	**50**	**100**	**150**
Conv. Till	16	27	34	37
Reduced Till	12	23	28	33
No-Till	4	15	21	28

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CRP going to Wheat: Leave stand, mow, or burn

- No clear differences between methods in Tribune study, with a slight numerical advantage to leaving residue standing
- Recall in the sorghum study, there was more soil water at sorghum planting where CRP residue was left standing

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Wheat

- Reduced Tillage:
  - July —Glyphosate (2qt/a)
  - August—Disc
  - September—Disc
  - June—Sweep Plow
  - July—Sweep Plow
  - September—Sweep Plow

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Wheat Following CRP: Averaged Across Residue Treatments

Wheat Grain Yield (bu ac^{-1})				
N Rate (lb ac^{-1})	**0**	**50**	**100**	**150**
Conv. Till	19	29	36	40
Reduced Till	11	21	30	32
No-Till	6	16	25	31

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If you are going to do tillage, does it matter when?

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Residue Treatment and Timing of Initial Tillage

- Time of Initial Tillage:
  - Fall vs. Spring
- Tillage:
  - Disc vs. Sweep Plow
- Residue Treatment:
  - Leave stand or burn
- Second tillage was the opposite of first.
- All then received sweep plow twice.
- N Rates: 0, 50, 100, and 150 lb N ac^{-1}

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Winter Wheat Following CRP

Fall Tillage Leave Residue Stand					
Wheat Grain Yield (bu ac^{-1})					
	Nitrogen Rate (lb ac^{-1})				
Tillage Method	0	50	100	150	Mean
Disc	10	21	25	31	22
Sweep	8	17	26	31	21
Control:	1	6	8	11	6

$LSD_{0.05}$ treatment=10 N rate=2

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Winter Wheat Following CRP

Spring Tillage Leave Residue Stand					
	Nitrogen Rate (lb ac^{-1})				
Tillage Method	**0**	**50**	**100**	**150**	**Mean**
Disc	**8**	**18**	**27**	**33**	**22**
Sweep	**11**	**18**	**26**	**32**	**22**
Control:	**1**	**6**	**8**	**11**	**6**

$LSD_{0.05}$ treatment=10 N rate=2

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Winter Wheat Following CRP

Spring Tillage Burn Residue					
	Nitrogen Rate (lb ac^{-1})				
Tillage Method	**0**	**50**	**100**	**150**	**Mean**
Disc	**9**	**17**	**26**	**34**	**21**
Sweep	**10**	**17**	**30**	**34**	**23**
Control:	**1**	**6**	**8**	**11**	**6**

$LSD_{0.05}$ treatment=10 N rate=2

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Challenge of Cropping

- Prevent Soil Erosion
- Maintain Soil Quality
- Provide Farm Profitability
- Maintain Wildlife Habitat

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From 1997 Tribune Study to On-Farm Observations in 2009

- In 2008-2011 I was involved with several producers in bringing CRP back into production in west-central Kansas.
- We took lessons learned from the Tribune studies and tried to apply them
  - High rates of N
  - Left the grass standing
  - No-till practices, despite earlier results

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Producer Comments

- SC – “The one thing I’ll adamantly stand behind is that tillage is never necessary, Sometimes the first year fails such as in 2011-2013 but after that the best yields on our farm consistently come from no-tilled CRP and no-tilled native sod.”

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Producer Comments

- WA – “I would still recommend starting with wheat when breaking CRP or sod... Having a fallow period to get the grass under control and recover water is important”
- SC – Budget for a glyphosate spraying every 4 weeks, the first should be happening as soon as the first sprigs of CRP grass shoot through

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Nutrient management

- Soil test
  - Eroded soils?
    - Low test to start?
    - Time won't help!
      - Haying = nutrient removal
  - Profile nitrate will likely be very low
  - Phosphorus, zinc may be low or very low

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Things to Consider - Fertility

- Nitrogen, Nitrogen, Nitrogen, Nitrogen….
  - Subsurface placement would be best
  - Dry urea would be next best
  - Broadcast spray UAN would be the worst option
  - Yields were still going up at 150 lb/ac in the Tribune studies, both wheat and sorghum
- Banded application of Phosphorus

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Things to Consider - Fertility

- Immobilization is a major concern
  - CRP grass is around 100:1 C:N ratio
  - Wheat Stubble is around 80:1
  - Immobilization occurs at ratios above 40:1
- It will take a large amount of N to bring that ratio down so that the Nitrogen cycle can function

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Things to Consider Field Management

- Consider the grass has likely utilized all available profile water, a fallow period prior to planting is likely to be beneficial
- Crop Selection
  - Wheat (maybe use a Clearfield variety?)
  - RR/GT Corn
  - Forage Sorghum
  - Soybeans?
    - Will you get enough canopy closure?
  - Grain Sorghum
    - Please don't do this, what would you do for in-season grass control if there are escapes

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Things to Consider – Time

- The longer the window of opportunity to get grasses under control and have the ground in a fallow period, the higher the chances of success
- Economics of early buyout? I think it would pay in many cases.
- The first crop could very well be a challenge, by many accounts, productivity increases with subsequent crops

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Questions

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