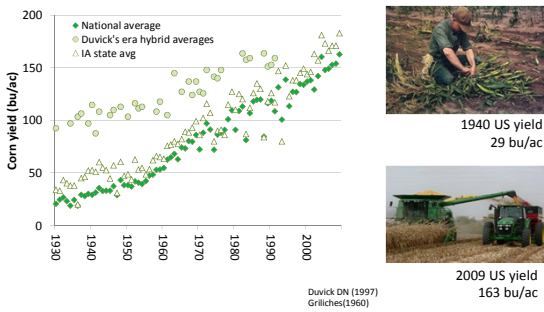


### Corn Stover Harvests: Soil, Nutrient and Costs considerations



Use Of Corn and Residues in the Future for Beef Cattle  
Mead, Nebraska  
June 20<sup>th</sup>, 2012

### Corn yields have increased as new technologies are developed and used




1940 US yield  
29 bu/ac

2009 US yield  
163 bu/ac

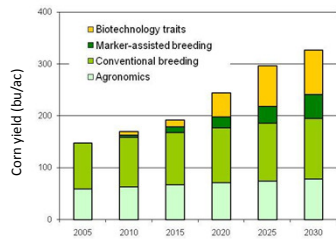
Duvick DN (1997)  
Grilliches(1960)

### Higher yields come with more residue



Livingston County, IL 28 May 2010  
Strip till corn after corn  
2009 corn yield 230 bu/ac

### Anticipated impact of improvements in agronomics, breeding and biotechnology on average corn yields in the United States

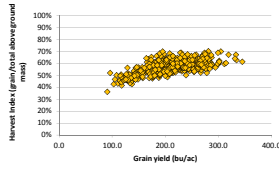


Edgerton (2008) Increasing crop productivity to meet global needs for feed, food and fuel. Plant Physiology 149:1-7


### Stover: A challenge and an opportunity

The amount of stover on a field increases as grain yields increase

Harvest index vs. grain yield



Planting 2<sup>nd</sup> yr corn in Nebraska




2008 trials- 13 locations, 14 unique hybrids (101 to 111RM)

Grain ~ 58% of the dry biomass in a field at harvest  
Stover (stalks, cobs, leaves) ~ 42% of the dry biomass

200 bu/ac field  
4.8 bone dry tons/ac  
3.4 bone dry tons/ac

### Growers are spending time and money to manage residue

Specialized equipment



Yetter Manufacturing  
Cut and Move Combo

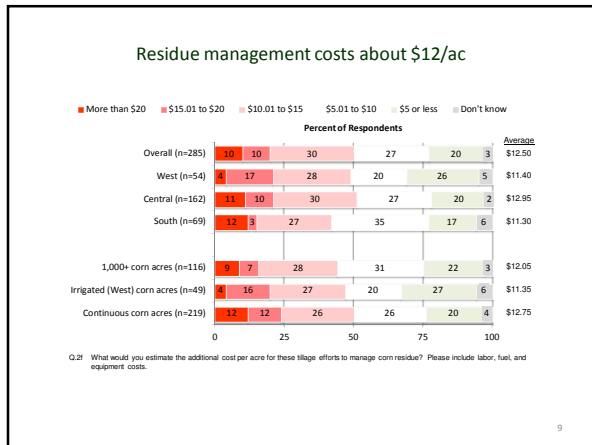
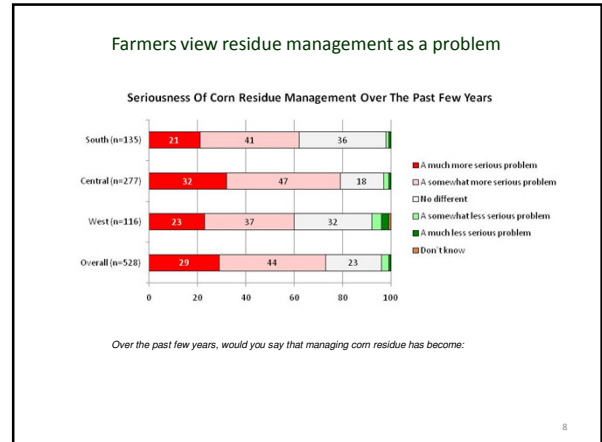
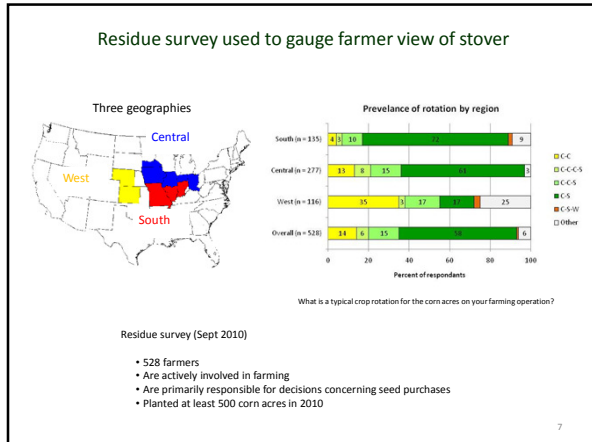
John Deere Stalk Master  
Corn Head Row Unit

Calmer Revolving Window  
BT "CRUSHING" knife Rolls

Tillage passes based on rotation (Eastern IA)

	0	1	2	3	4
Corn-corn	0	1	5	4	1
Soy-corn	1	22	2	0	0

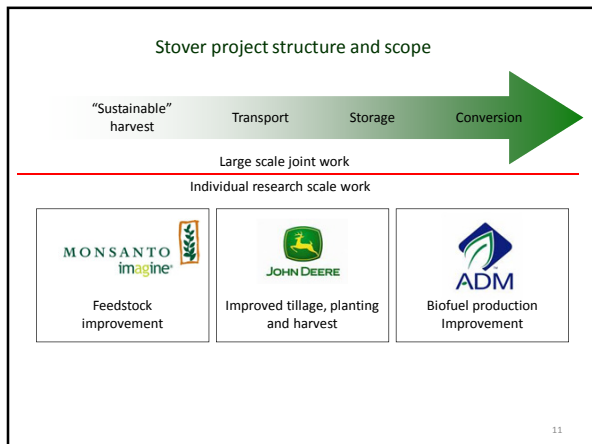
Monsanto 2009 grower interviews



### Uncertainty and risks of corn stover harvests

Baled field in Iowa      Shredded field in Nebraska with wind drift

- Properly done, corn stover harvests will increase the value of an acre of corn
- Improperly done, corn stover harvests will damage fields



### Soil health: Manage to erosion and organic matter targets

Stover is required to maintain soil quality

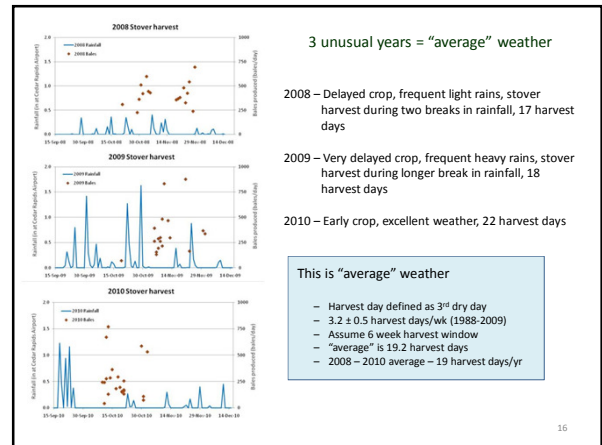
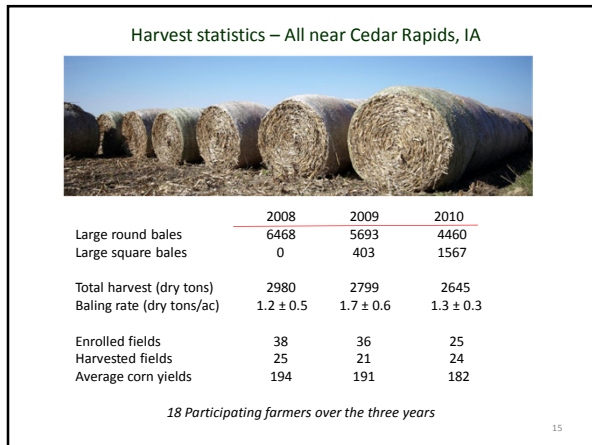
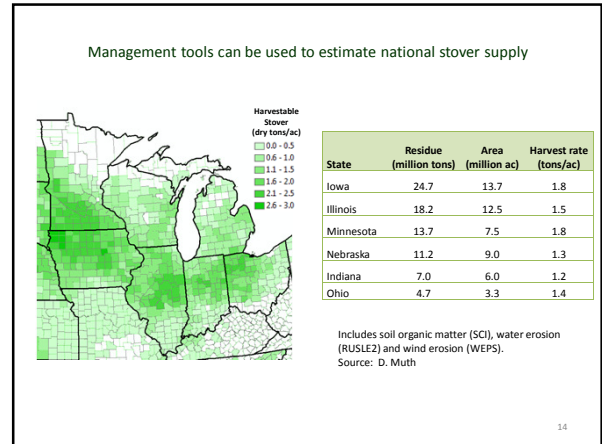
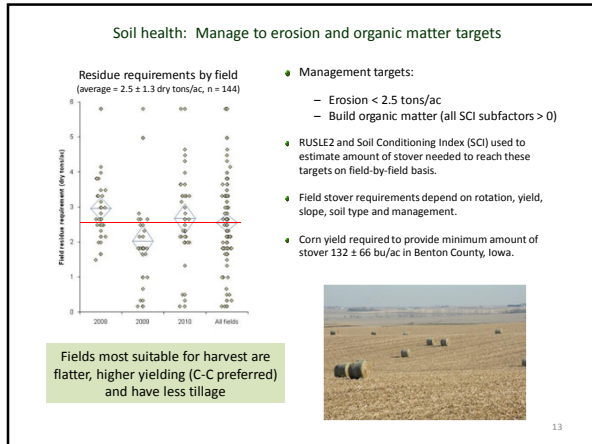
- Reduces wind erosion
- Reduces water erosion
- Provides organic matter to soil

Soil organic matter

- Enhances soil water and nutrient holding capacity
- Improves soil structure (less crusting, compaction and erosion)
- Promotes higher crop yields


Conservation planning tools (RUSLE2, WEPS, and SCI) have been used to estimate field-specific stover retention targets

- Andrews S (2006) Crop Residue Removal for Biomass Energy Production: Effects on Soils and Recommendations  
[http://soils.usda.gov/sqi/management/files/aforum\\_residue\\_white\\_paper.pdf](http://soils.usda.gov/sqi/management/files/aforum_residue_white_paper.pdf)
- University of Nebraska Extension: Harvesting Crop Residues  
<http://www.lanrpubs.unl.edu/epublic/pages/index.jsp?what=publication&publicationid=1026>
- USDA NRCS (2010) Conservation practice standard 344: Residue management, Seasonal.  
<http://ftp-fc-sc.gov.usda.gov/NHQP/practice-standards/standards/344.pdf>
- USDA NRCS Soil Quality Institute (2003) Interpreting the Soil Conditioning Index: A Tool for Measuring Soil Organic Matter Trends. Technical Note No. 16  
[http://soils.usda.gov/SQI/management/files/eq\\_atn\\_16.pdf](http://soils.usda.gov/SQI/management/files/eq_atn_16.pdf)




### Three balers used in 2010 harvest


John Deere 567/568



Case IH RB564



New Holland BB9080



	JD 567/568	CIH RB564	NH BB9080
Bales made	4460	1567	1567
Baling rate (bales/hr)	38.6 ± 9.2	42.6 ± 7.0	42.6 ± 7.0
Bale weight (lbs fw/bale)	1050 ± 148	1044 ± 120	934 ± 137
Bale moisture (%)	9.8 ± 1.5	13.2 ± 4.4	14.9 ± 5.5
Bale density (lbs dw/ft³)*	7.9 ± 1.4	7.5 ± 2.4	9.1 ± 3.6

\*Standard deviation includes variation in fresh weights, moisture content and volume

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### Bühler/Inland 2500 bale carrier

Huge improvement, staging 86 bales/hr in 2009 vs. 19 bales/hr in 2008





2008

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### Large square system tested in 2010

New Holland BB9080 large square baler



Bühler/Inland 4480 bale carrier





WesternAG storage design

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### New Holland H5980 Heavy Duty Wheel Rake





Care needs to be taken not to over harvest

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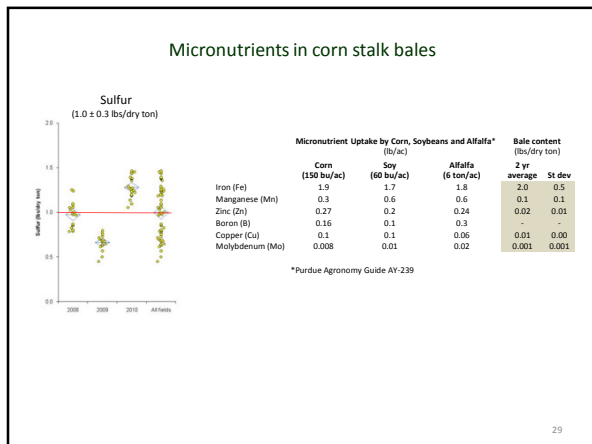
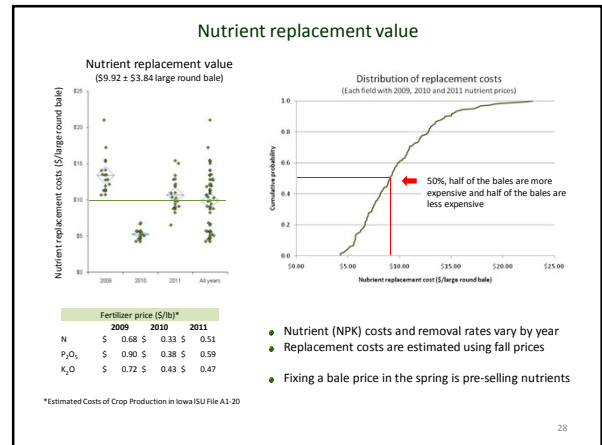
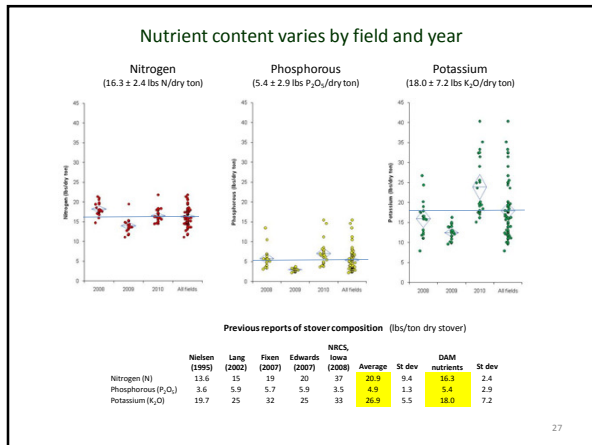
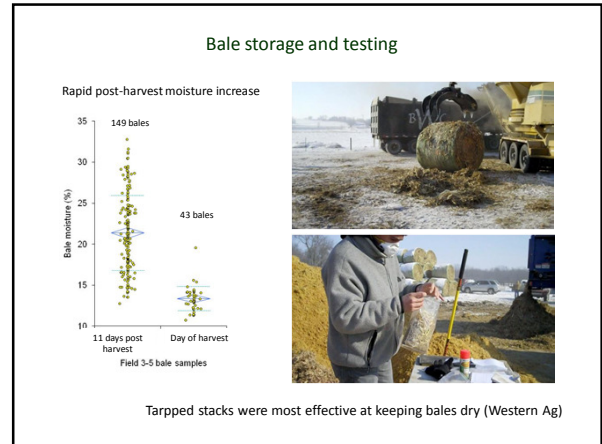
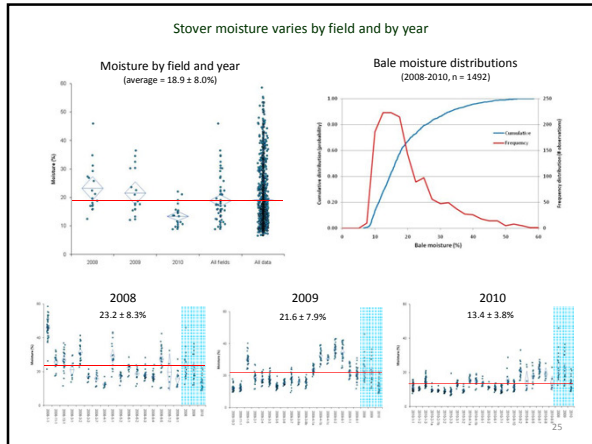


### Measuring bales






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Cornrower – Chopping corn head with windrow former



Windrowed corn stover



Chopping behind the Cornrower



Chopped, treated stover packed into a bunker



Chopped, treated stover packed into a bunker



Corn stover harvests and uses: Summary



- Properly done, stover harvests can improve the value of an acre of corn
- Requires management to erosion and organic matter targets
- Nutrient (N, P, K) removal costs average about \$10/bale
- Harvesting dry stover can be challenging
- Cattle feed application works with wet stover
- Lower cost, higher volume bulk harvest are possible