RE·
FORM·
ENERGY

Cellulosic Ethanol

The Grower “Value”

Cellulosic Ethanol- The Grower "Value"

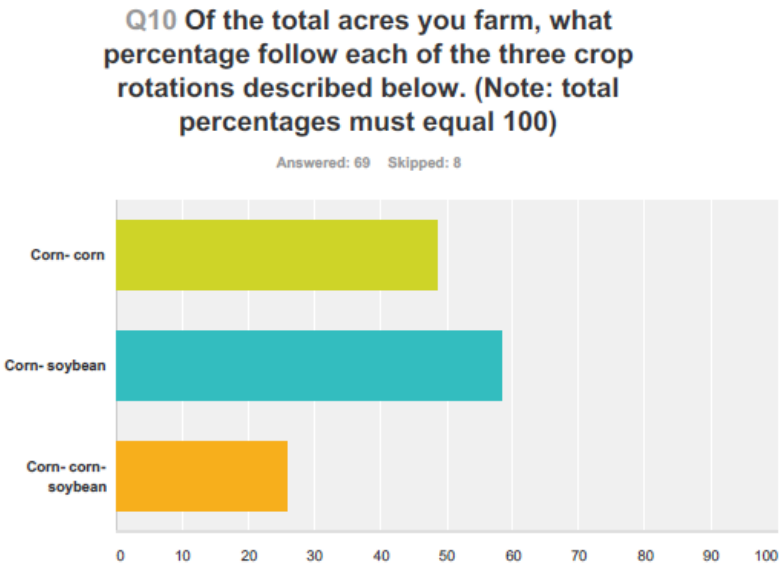
- Why would a grower allow DuPont to bale their cornstalks?
  - Increase Yield
  - Expense Reduction
  - Managing Residue Sustainably
  - Payment For Corn Stover
- What about field access, twine and nutrient costs?

- How would a grower participate?
  - Contract with DuPont to perform the harvest
  - Lease or purchase equipment to shred, bale, store, and deliver stover to the bio-refinery

Current Ways Of Managing Residue

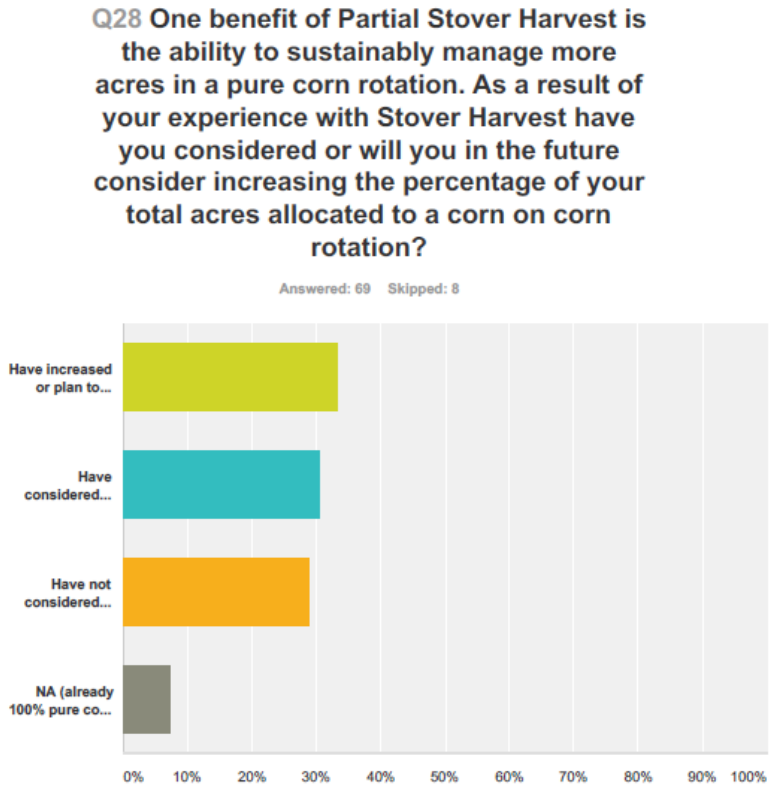
- Tillage
  - Conventional
  - Reduced
- Crop Rotation
  - Corn Soybean Rotation
- Removal For Livestock Feed or Bedding
  - Bale
  - Chop
  - Graze
- Don’t Remove Residue
  - No Till Farming

Crop Rotation



- Managing residue through removal has eliminated the continuous corn on corn yield penalty.
- Managing residue through removal can increase the flexibility of rotating to the profitable acre if an opportunity arises.
- Continuous corn rotation with stover removal will add more residue to the soil than a corn f/b soybean rotation.

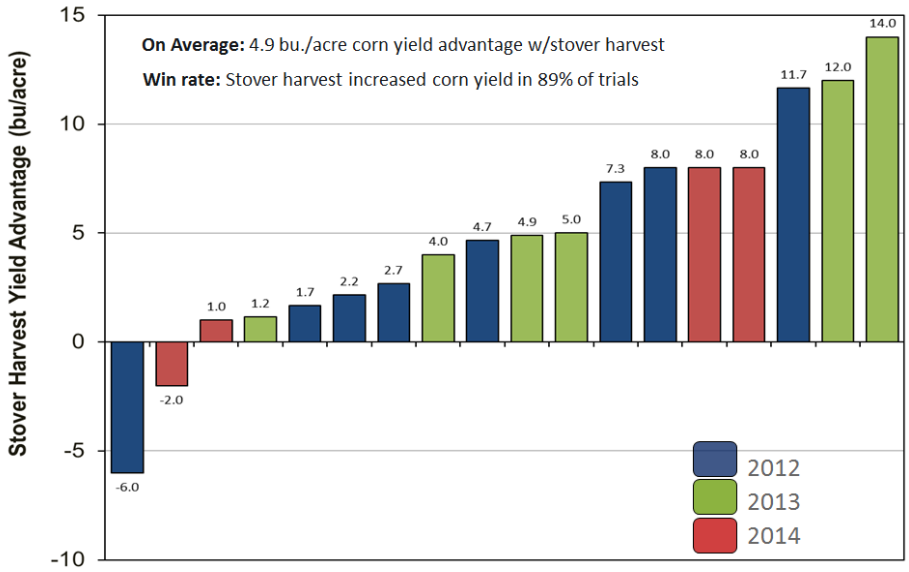
Crop Rotation Change



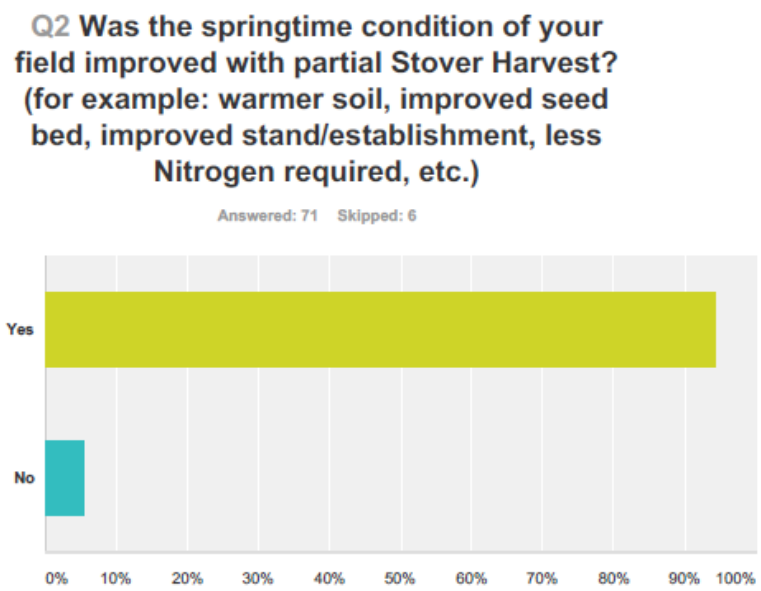
- The ability to raise corn f/b corn vs corn f/b soybeans
  - 2016 Corn guarantee is $656.20 vs 2016 Soybean guarantee is $376.00
- Weed management opportunities in corn are more numerous than in soybeans
- Fewer harvest delays

Yield Increase

- Where does the yield increase come from?
  - Even Corn Emergence
  - Greater Final Population
  - Less Corn Seedling Disease
  - More Available Nitrogen
- The Stover Strip Trials are showing nearly a 5 Bu/Acre yield advantage on average since 2011



Field Condition Improvement



- The Stover Strip Trials are showing a 5 Bu/Acre yield advantage on average since 2011.
- Current new crop corn contract (Oct/Nov delivery) is $3.35-3.50/Bu
- Additional revenue from yield bump could be $16.75-17.50/Acre

- Improved Stand
  - Warmer Soils
- Reduced Pathogen Load
  - Less residue for over wintering pests

Improving crop production profitability

> “We’re doing corn stover bales on about a third of our acres, and I would do all the acres if I could. It’s a tremendous cost benefit – we feel that there’s **probably a $100 dollar per acre benefit for us.**”

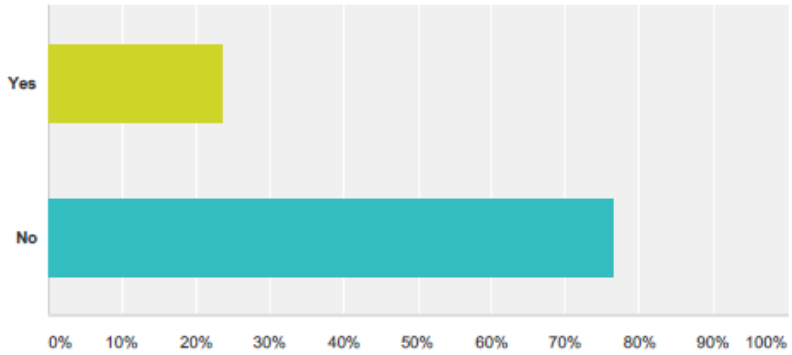
Expense Reduction

- Nitrogen Expense
  - Rate reductions of #25/acre can save $8.50 - $10.00/acre depending of the form of Nitrogen Used
- Fuel Expense
  - Nearly ½ of the fuel for field operations in growing a corn crop is consumed by tillage operations
- Machinery Expense
  - Eliminate the need for high horsepower tractors that pull tillage equipment
  - Eliminate the need for the heavy disk rippers that size and burry residue

Nitrogen Expense Reduction

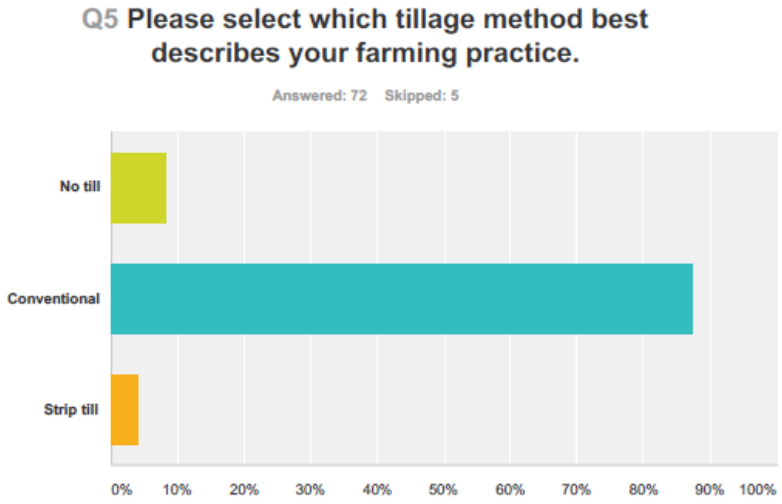
Q32 Corn stover ties up soil nitrogen as it breaks down. It has been demonstrated that Partial Stover Harvest increases the amount of available Nitrogen in the soil. Have you reduced your Nitrogen application rate as a result of participation in Partial Stover Harvest?

Answered: 68 Skipped: 9



- Dr. Sawyer ISU
  - 25# less N is needed where 2 ton Stover Is Removed from the field in and Corn/Corn rotation
- **NH3** User could save **$8.50/Acre**
  - $555/Ton NH3 cost
- **32%** User could save **$10.00/Acre**
  - $260/Ton UAN cost
- Less N immobilization where stover is removed
  - More N is available for the corn plant
- N immobilization occurs when the corn residue ties up the nitrogen rendering in unavailable for the corn plant to utilize

Opportunity For Tillage Expense Reduction

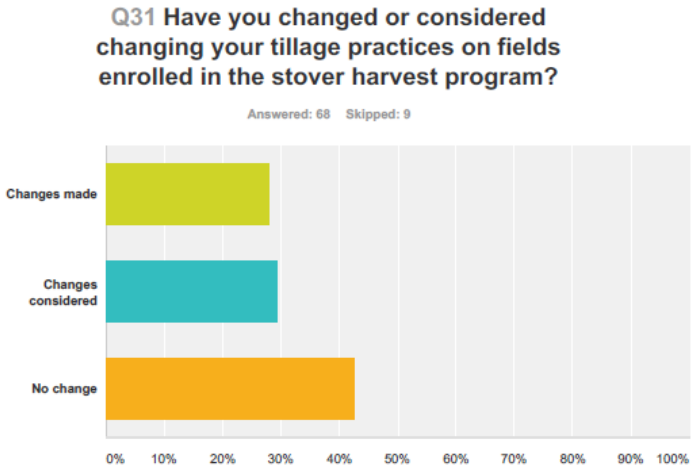


- ISU 2016 Custom Rates
  - Disk Chiseling $17.80/Acre
  - Field Cultivation $14.05/Acre
  - Strip Till $17.00/Acre

- By managing residue by removal and moving from a Fall Disk Chisel followed by a spring field cultivation could decrease tillage expenses from $31.85/Acre to $17.00/Acre for Strip Till saving up to $14.85/Acre

- In a corn f/b soybean rotation soybeans could be no-tilled saving $31.85/Acre

Opportunities For Machinery Cost Reduction

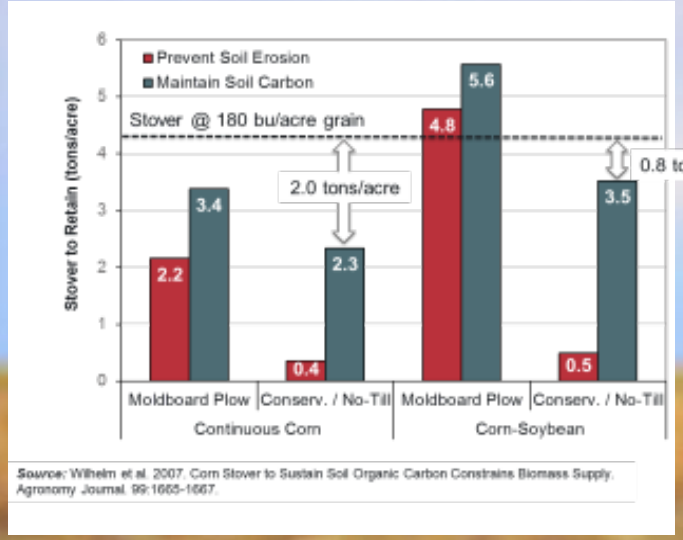


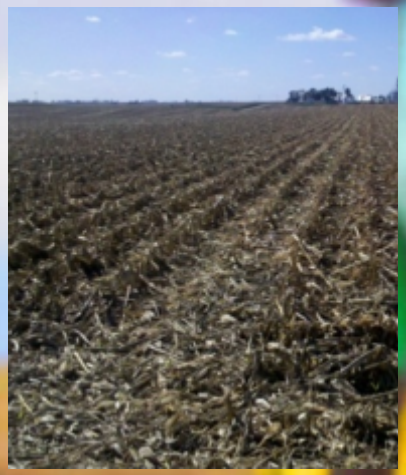
- ISU 2016 Custom Rates
  - Stalk Chopping $11.85/Acre
  - Combine Chopping Head $5.35/Acre
  - Chisel Plowing $16.45/Acre
  - Disk Chiseling $17.80/Acre
  - Vertical Tillage $16.05/Acre
  - Field Cultivation $14.05/Acre

- By managing residue by removal the potential savings on not chopping residue ranges from $5.35 to $11.85/Acre
- By managing residue by removal the potential savings on not tilling residues ranges from $30.10 to $31.85/Acre
- Horse Power reduction
- Saving nearly half the fuel to plant and harvest the corn crop.
- Less fall labor required

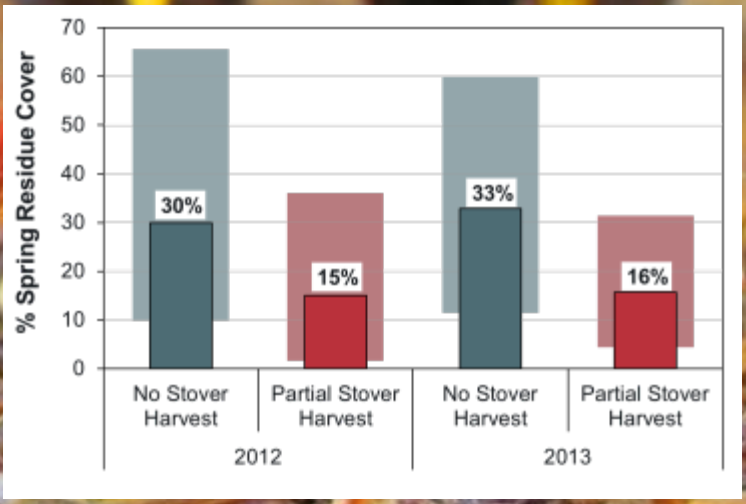
DUPONT

Collaboration with the USDA Natural Resource Conservation Service and Iowa State University





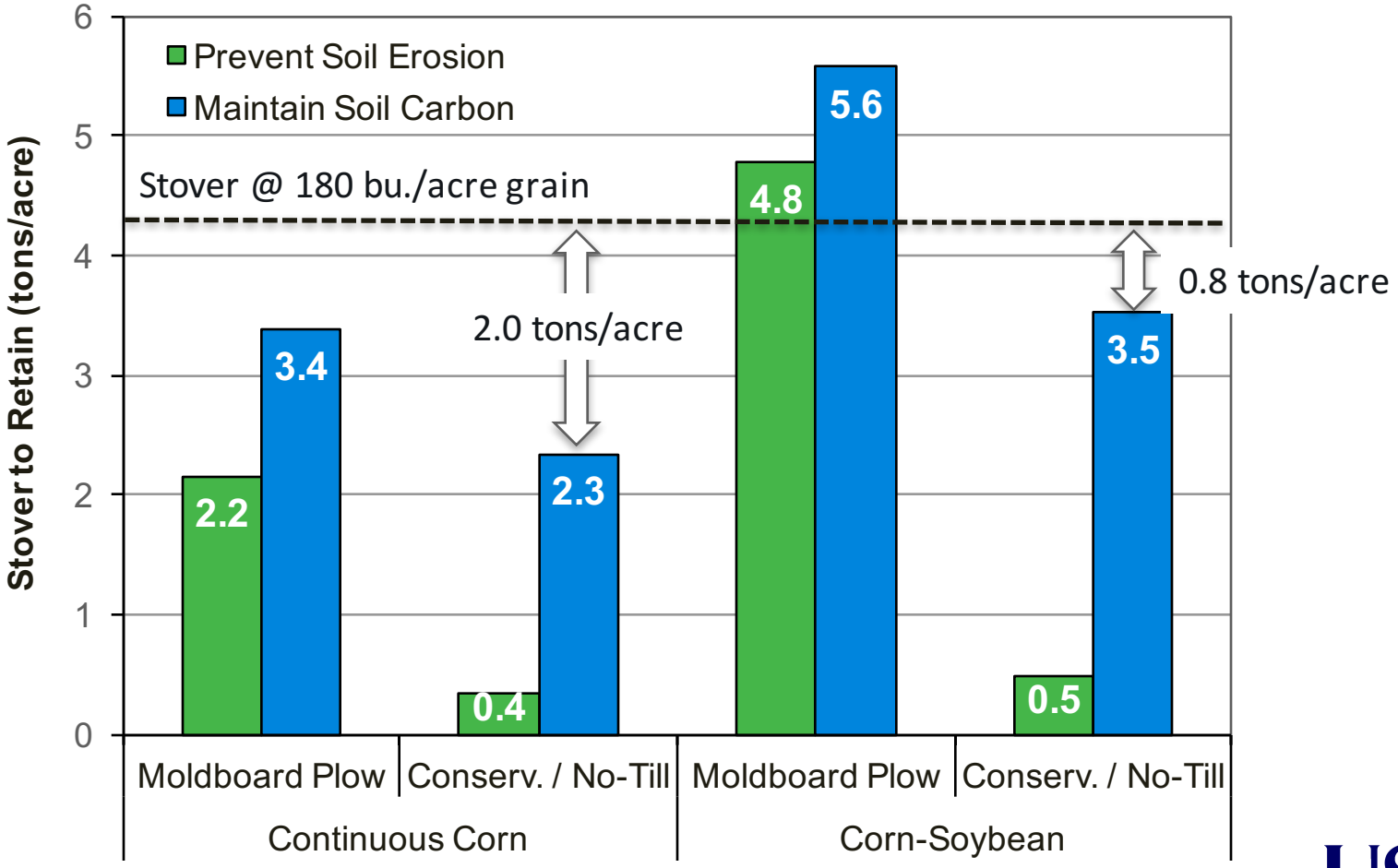
USDA



Sustainable Biofuels Awards
2012 Winner
Sustainable Feedstock Innovation

IOWA STATE UNIVERSITY

How Much Stover can be Harvested Sustainability?



Source: Wilhelm et al. 2007. Corn Stover to Sustain Soil Organic Carbon Constrains Biomass Supply. Agronomy Journal. 99:1665-1667.

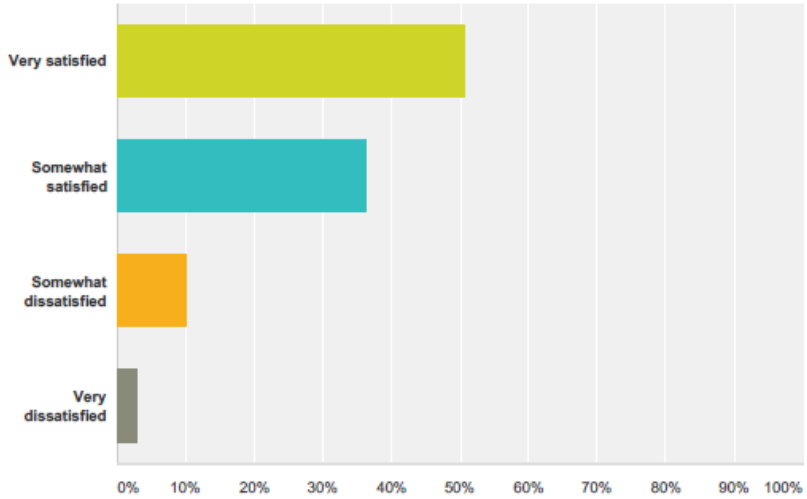
DuPont Soil Health Plans

- **Soil Health Plans are generated within DuPont's geospatial feedstock supply chain management system (StoverStudio)**
  - » Address a subset of NRCS conservation metrics
  - » Focus on soil erosion and soil quality
  - » Based on grower reported management practices
  - » Created using LEAF software extension
- **LEAF** (**L**andscape **E**nvironmental **A**nalysis **F**ramework)
  - » Connects NRCS tools to publically available soil and climate databases to calculate soil health metrics for specific fields and field areas under defined set of management practices
  - » Originally developed by scientists at Idaho National Labs
  - » Incorporated into DuPont StoverStudio by AgSolver, Inc. in 2013

Grower Satisfaction & Field Access

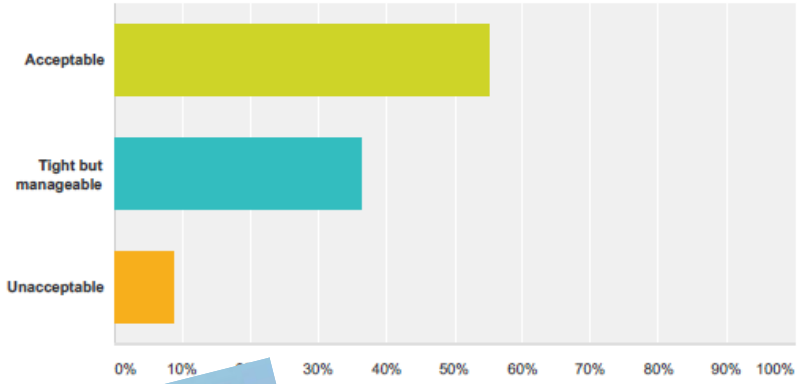
Q14 Please rate your overall satisfaction with the 2015 Stover Harvest Program? (select one)

Answered: 69 Skipped: 8



Q20 How would you describe your ability to manage your fall field operations, given the time it took to complete the stover harvest?

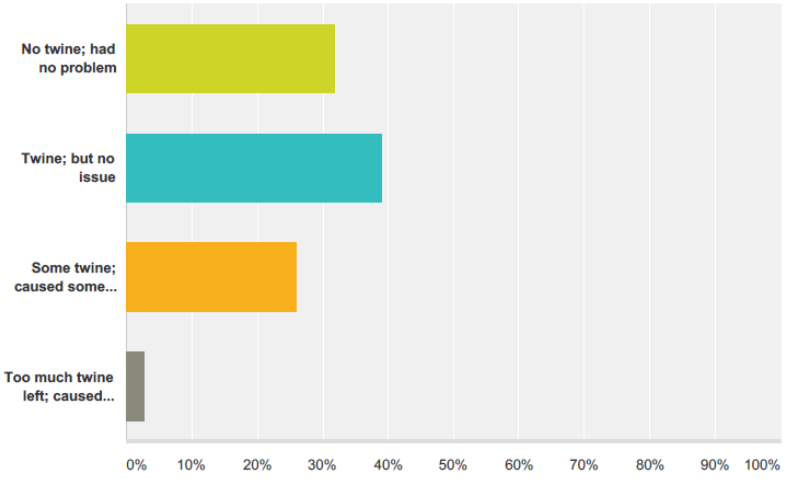
Answered: 69 Skipped: 8



Grower Satisfaction & Twine

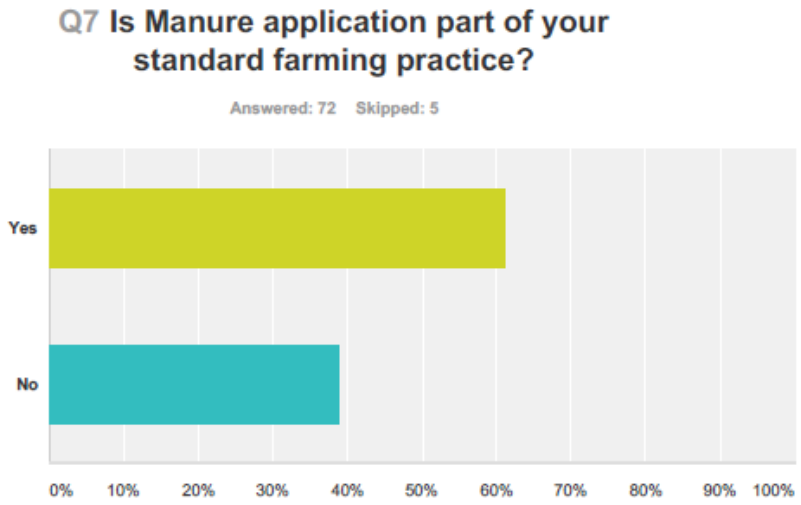
Q25 Some twine in the field is an expected outcome of baling. DuPont took several actions to mitigate twine being left in your fields including twine strength, color selection, crew training, process enhancements and a two-step audit. How well did we eliminate twine in your field?

Answered: 69 Skipped: 8



Twine needs to be managed!

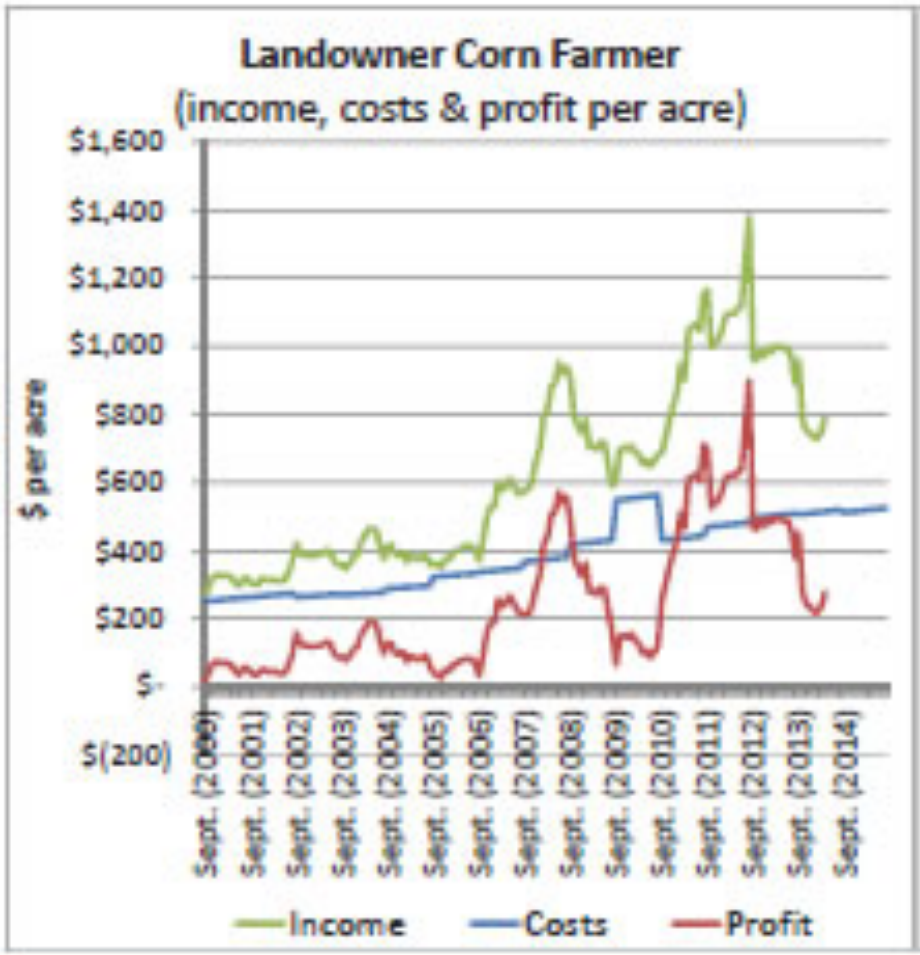
Grower Satisfaction & Nutrient Costs

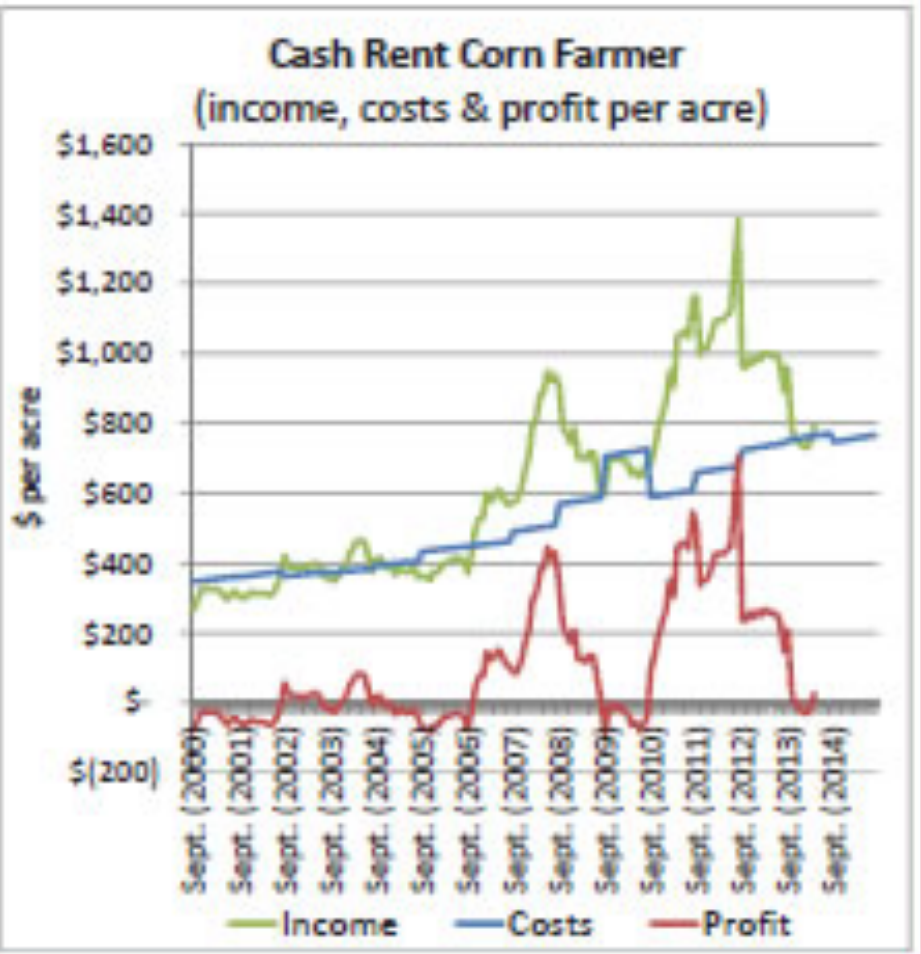


- If manure is available nutrient replacement costs can be minimized to the application cost of the manure.

- **Potash**
  - March 0-0-60 $385/Ton
  - 1200# actual/Ton
  - $.32/LB.
- Potash Removal 20#/Ton of Stover
- 2 Ton Stover (4 bales) Removal/Acre = $12.80
- **Phosphate**
  - March 11-52-0 $525/Ton
  - 1040# actual/Ton
  - $.50/LB.
- Phosphate Removal 5#/Ton of Stover
- 2 Ton Stover (4 bales) Removal/Acre = $5.00

Farm Profitability Is Challenging





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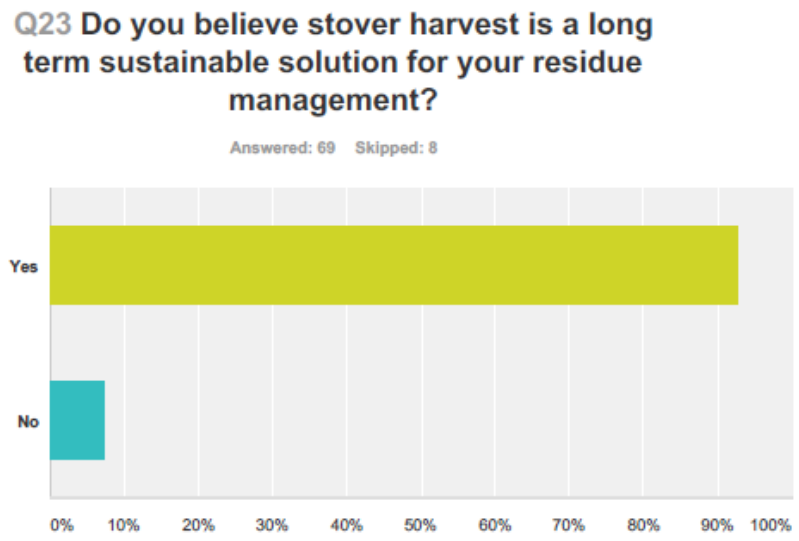
Changing How Stover Is Managed

"I think that the Stover Program has really changed our way of thinking. Where we used to think of stover as trash—residue that we had to bury—**now it's an asset that we can manage.**"

Summing Up The New Way To Manage Residue



- Take advantage of it!

- Yield Bump +$16.75
  - 5 Bu @ $3.35
- Machinery Reduction +$18.20
- Nitrogen Reduction +$8.50
- Total Gross Value +$43.45
- P & K Removal -$17.80
- Total Net Value +25.65

Questions

- Questions / Comments