


FARM ENERGY

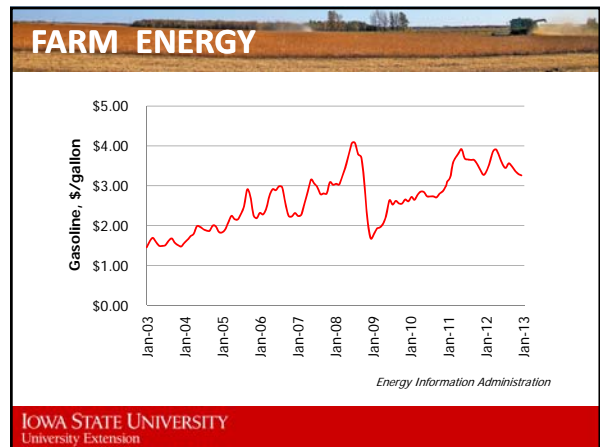
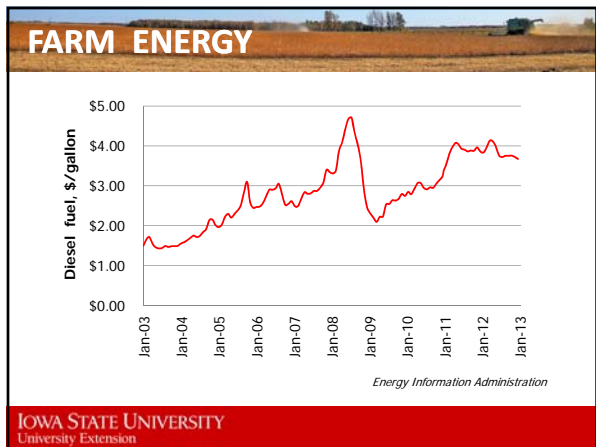
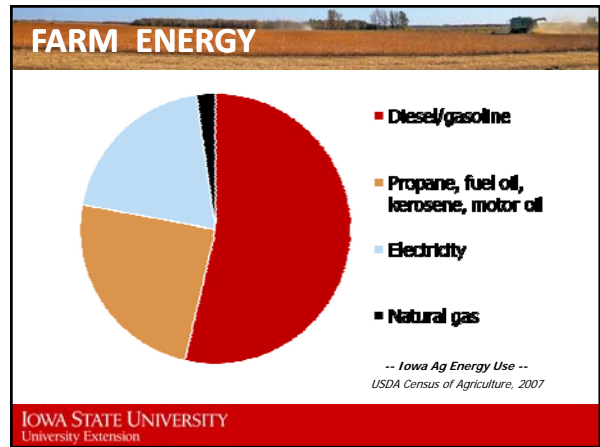
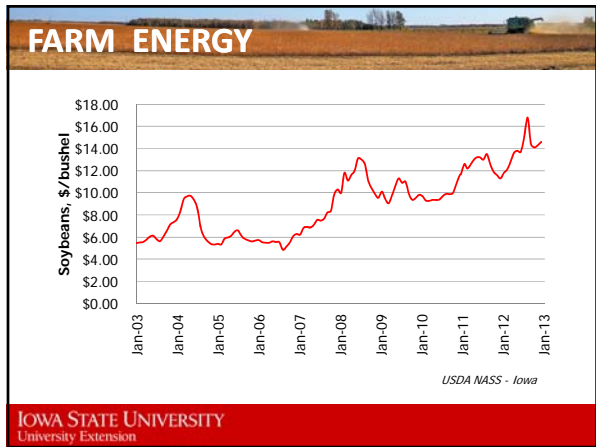
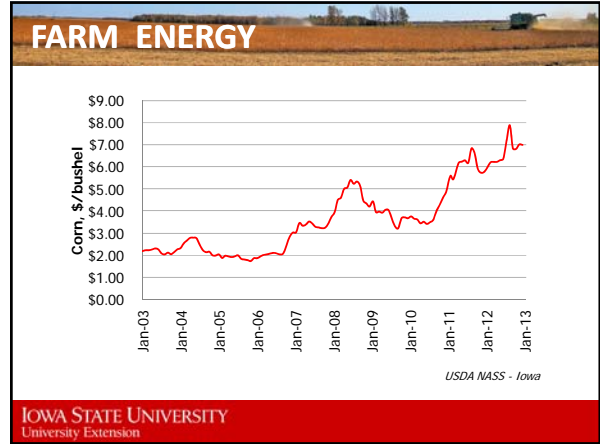
Managing Field Operations to Reduce Energy Costs

MARK HANNA,
EXTENSION AG ENGINEER



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<http://farmenergy.exnet.iastate.edu>



FARM ENERGY

Field Operations

Subsoil/rip	1.70 gal/acre
Field cultivate	.65
Plant	.40
Spray (2x)	.20
Combine	+ 1.45
Total	4.40 gal/acre

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Drying Corn (175 bu/acre, 5 pts removed)

<i>High-temperature</i>	
LP	15.8 gal
Electricity	17.5 kwh
Total diesel equivalent:	10.7 gal
<i>Low-temperature</i>	
Electricity	280 kwh
Total diesel equivalent:	6.9 gal

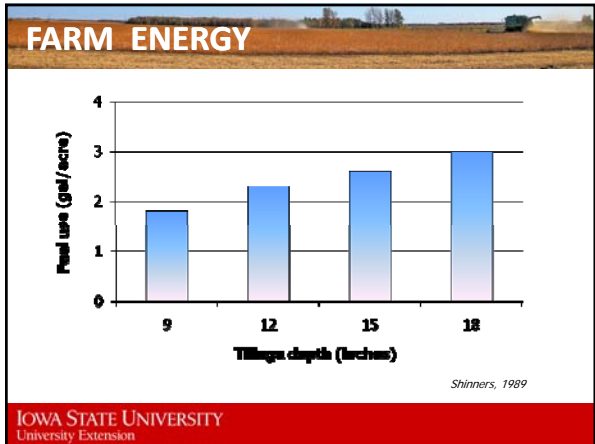
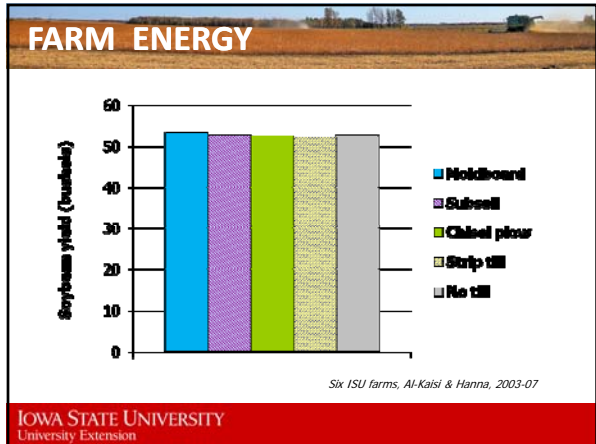
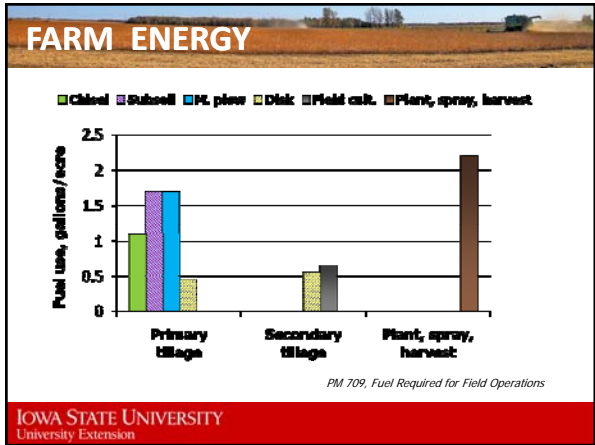
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FARM ENERGY

Five ways to save energy and \$\$\$ in crop production:

- Limiting tillage operations
- Ballasting tractors for energy efficiency
- Nitrogen fertilization in corn production
- Tractor maintenance
- 'Shift-up, throttle-back' (transmission)
- Forage harvesting

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Savings potential for 1000 acres

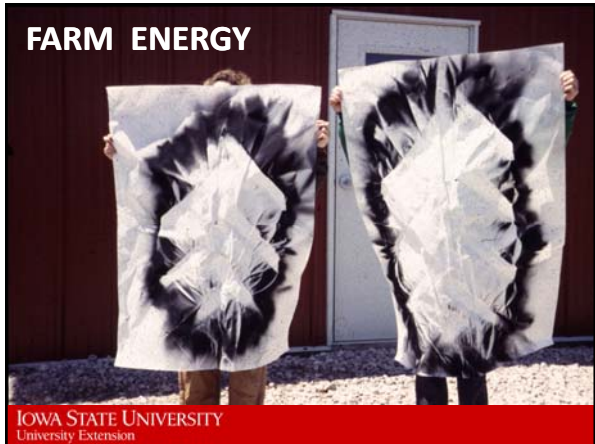
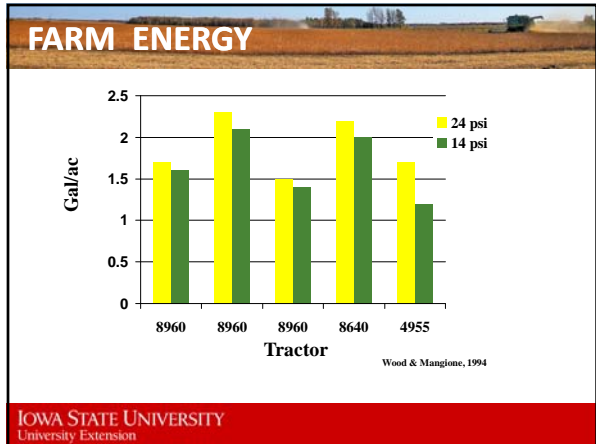
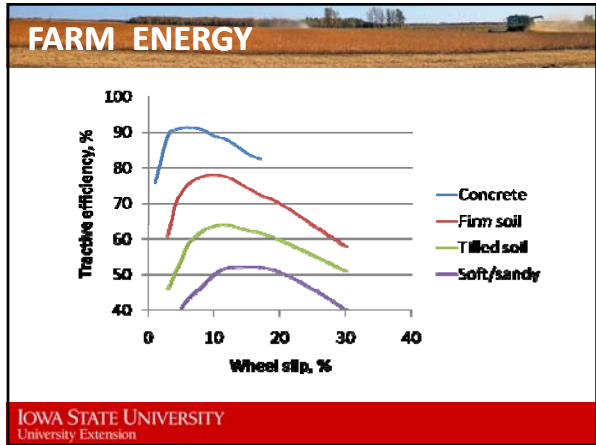
Eliminate one primary or two secondary tillage passes (1.5 gal/acre)

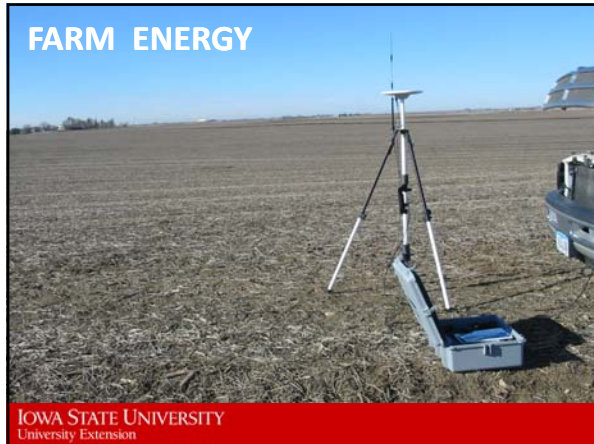
1.5 gal/acre x 1000 acres x \$4/gal = **\$6000**

Eliminate secondary tillage pass or raise tillage depth from 15 to 9 inches (0.75 gal/acre)

0.75 gal/acre x 1000 acres x \$4/gal = **\$3000**

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Savings potential for 1000 acres

Determining/correcting ballast and tire inflation

- \$4/gal diesel with 10% savings = **\$2000**

Maintaining correct ballast/tire inflation

- \$4/gal diesel with 3% savings = **\$600**
- Time (labor, depreciation) = additional savings

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Energy required to manufacture fertilizer (diesel fuel equivalent)

Fertilizer	Gal/lb N, P ₂ O ₅ , or K ₂ O
Ammonia	0.107
Urea	0.129
UAN	0.113
Ammonia (1998 plant)	0.143
Muriate of potash	0.008
MAP, DAP	- 0.044

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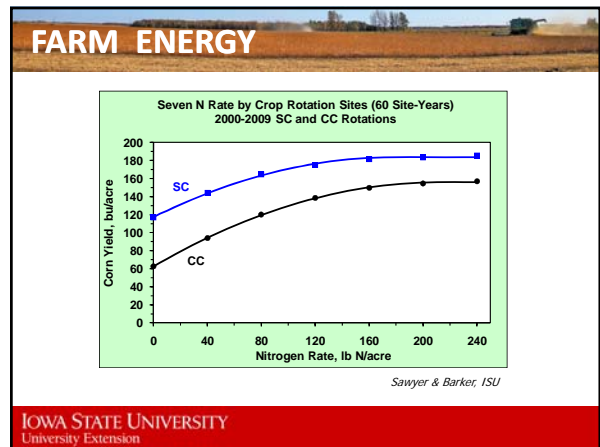
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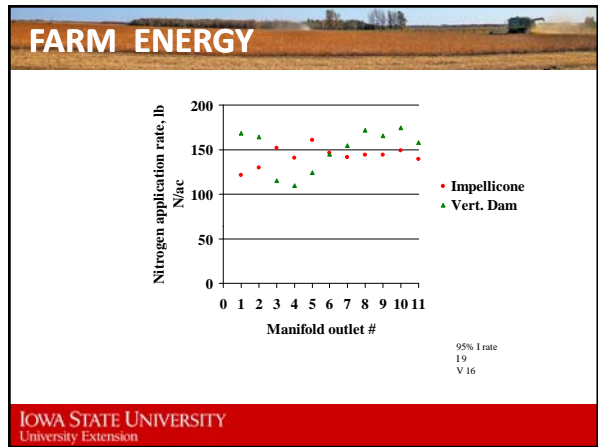
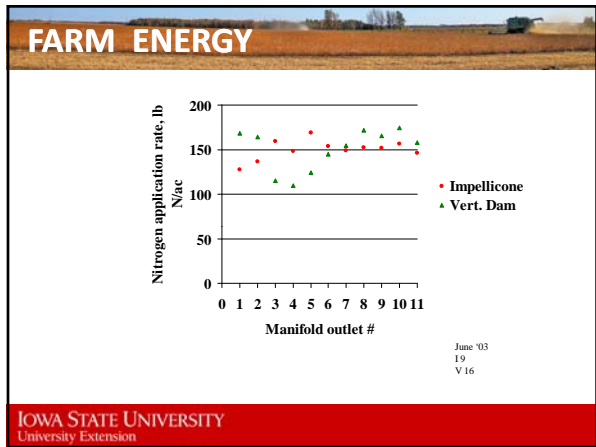
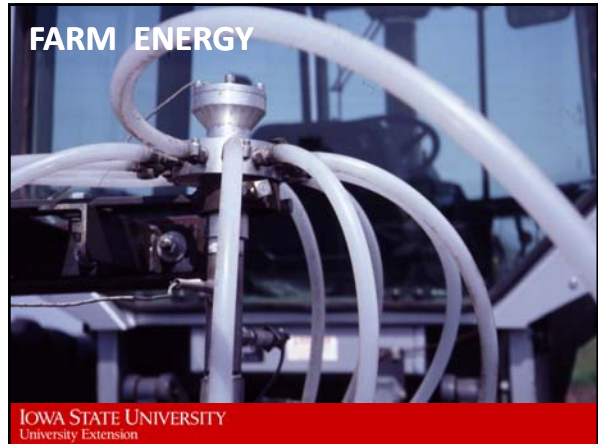
Energy equivalent of N fertilization with ammonia

125 lb N/acre -----> **15.2 gal diesel/acre**

175 lb N/acre -----> **21.4 gal diesel/acre**

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FARM ENERGY

Savings potential for 1000 acres

Assuming \$600/ton NH₃ and reducing N application by 10 lb N/acre:

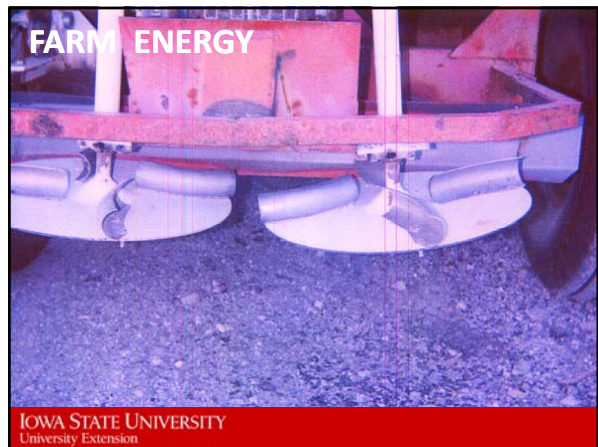
\$600/ton NH₃ = **\$0.37/lb N**

\$0.37/lb N x 10 lb N/acre x 1000 acres = **\$3700**

Equivalent diesel fuel savings = **1220 gal**

Maximum economic return to nitrogen:
extension.agron.iastate.edu/soilfertility/nrate.aspx

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Tractor maintenance schedule

- Follow manufacturer recommendations
- Filter and fluid changes

Missouri study of 99 tractors
After changing fuel and air filters:

- Power increased by **3.5%**
- Fuel savings estimate of **105 gal/year**



FARM ENERGY

Tractor engine block heater for cold weather operation

1000 watt heater @ \$0.10/kwh = **\$0.10/hr**
 Operated (overnight) for 12 hrs = **\$1.20**
 Operated for 2 hrs on a timer = **\$0.20**

SAVE \$1.00/DAY OR \$100/SEASON

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Tractor idling time

Assume 200 hp for the idling tractor

Idle fuel use (from tractor test) = **3.67 gal/hr**

Idling for an extra 10 minutes = **0.61 gal** or
\$2.45 @ \$4/gal

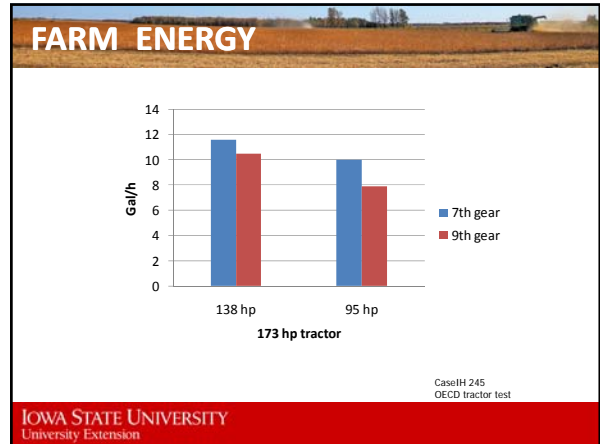
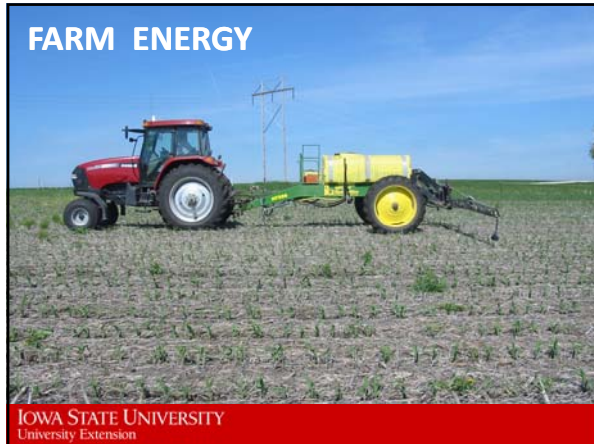
50 "long" idles per year = \$125/year

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Savings potential for tractor use

Assume 200 hp tractor operated 400 hr/year
 Assume \$4/gallon diesel and \$0.10 kwh electricity

On-time scheduled filter maintenance = **\$400**
 Block heater on timer = **\$100**
 Limit cool down idling = **\$125**



FARM ENERGY

Savings potential for 1000 acres:

Assume: reduced tractor load for 2 lighter secondary tillage/planting operations and spraying

15% fuel savings x 1.3 gal/acre = 0.2 gal/acre
 1000 acres x 0.2 gal/acre = 200 gallons
 200 gallons x \$4/gal = **\$800**

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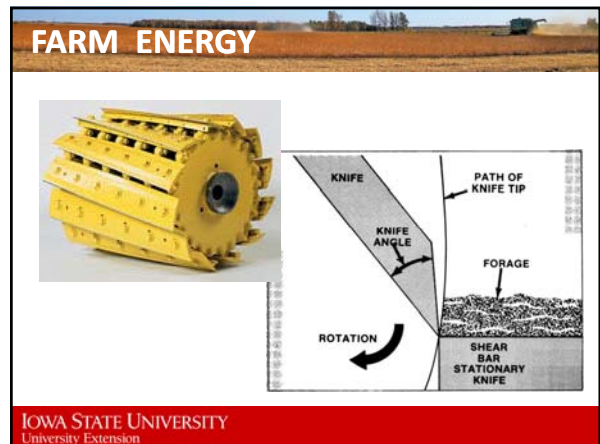
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Summary of potential annual savings

- Limiting tillage: **\$3000 - \$6000**
- Optimal ballasting/tire inflation: **\$600 - \$2000**
- N fertilizer adjustment by 10 lb/acre: **\$3700**
- Engine maintenance and management: **\$600**
- Use proper transmission gear: **\$800**

Crop farm, 1000 acres: **\$9,000 - \$13,000**

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Savings potential for forage harvest

Assume: 1.5 gal/acre with cutterhead using 50% of energy

Cutterhead energy use = 0.75 gal/acre
 Dull/misadjusted knives double cutting energy
 adding 0.75 gal/acre

Dull/misadjusted knives cost = 0.75 gal x \$4/gal
 = **\$3/acre**

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FARM ENERGY

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Electricity													
kWh	4750	4314	4993	4790	4700	4600	4647	4900	5220	4900	5400	4911	51100
price per kWh	\$0.1000	\$0.0960	\$0.0960	\$0.1034	\$0.1054	\$0.1087	\$0.1088	\$0.1062	\$0.1094	\$0.1060	\$0.1270	\$0.1470	
Total													\$5,132

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Farm energy savings

- Many ag inputs are subject to variability
- Energy use can be managed and adjusted
- Energy savings improve overall profitability

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Iowa farm energy site: <http://farmenergy.exnet.iastate.edu>



E-extension national site:

www.extension.org

Search "energy, farm energy, efficiency & conservation"

NRCS
energy calculator tool:

energytools.sc.egov.usda.gov

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<http://farmenergy.exnet.iastate.edu>