FARM ENERGY

Diesel: Managing Energy Use on the Farm

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http://farmenergy.exnet.iastate.edu

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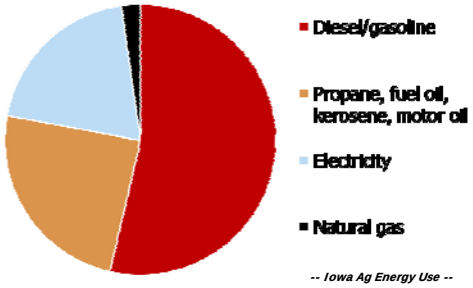

-- Iowa Ag Energy Use --

USDA Census of Agriculture, 2007

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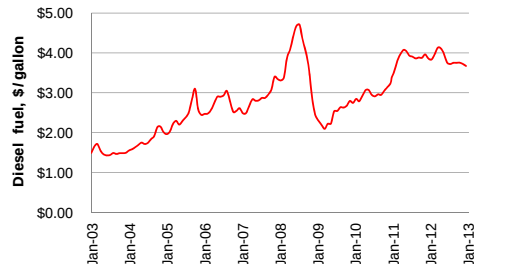

Energy Information Administration

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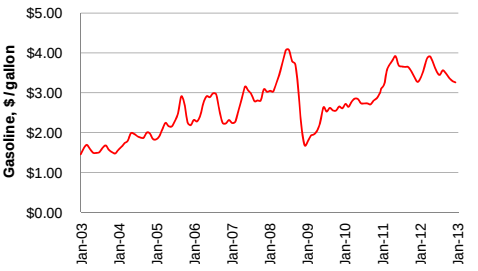

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Field Operations

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)

High-temperature

LP	15.8 gal
Electricity	17.5 kwh
Total diesel equivalent:	**10.7 gal**

Low-temperature

Electricity	280 kwh
Total diesel equivalent:	**6.9 gal**

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

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

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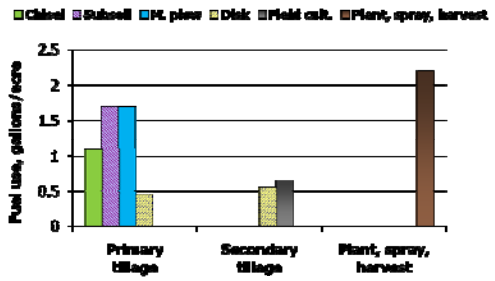

PM 709, Fuel Required for Field Operations

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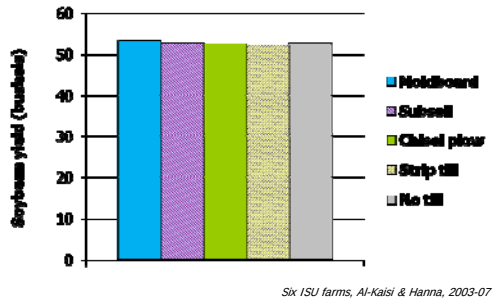

Six ISU farms, Al-Kaisi & Hanna, 2003-07

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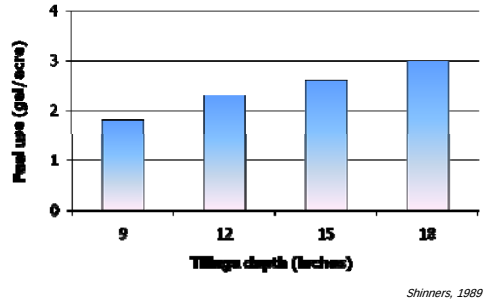
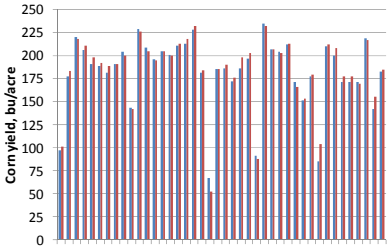
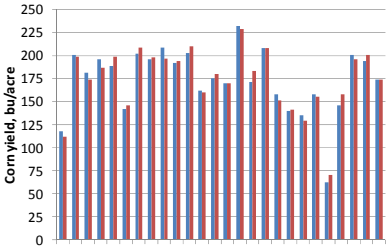


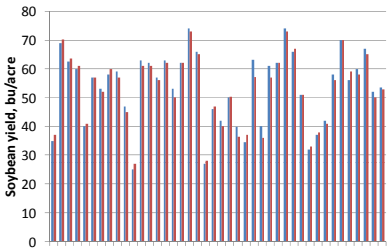
Shinners, 1989



Corn after soybean
Subsoil/rip & chisel
41 site years
Al-Kaisi & Hanna



Corn after corn
Subsoil/rip & chisel
25 site years
Al-Kaisi & Hanna



Soybean after corn
Subsoil/rip & chisel
41 site years
Al-Kaisi & Hanna

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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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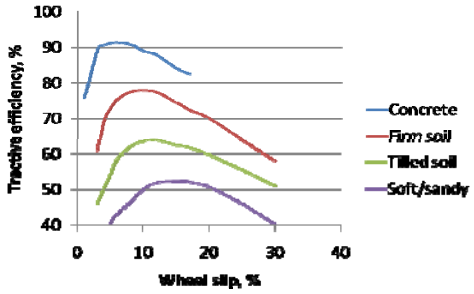

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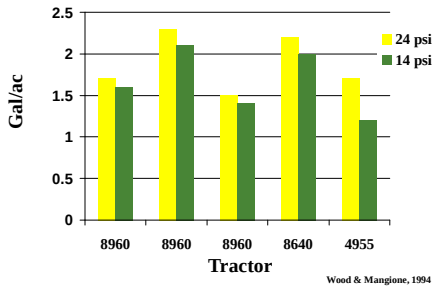

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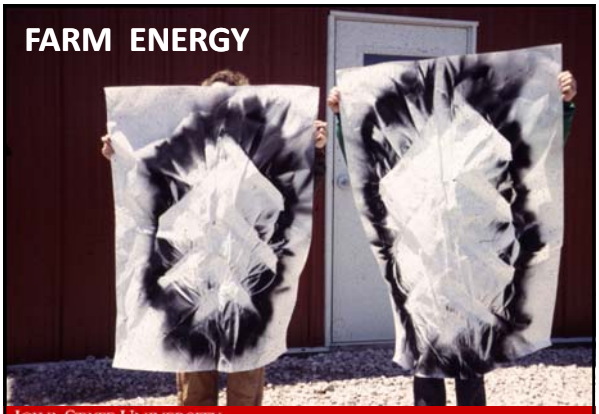

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Savings potential for 1000 acres

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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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**

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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**

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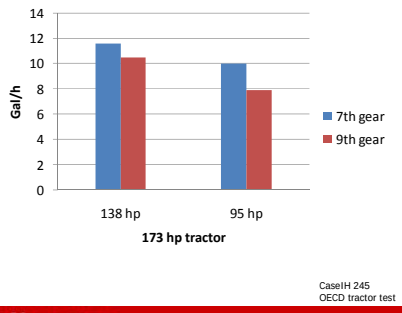

CaseIH 245
OECD tractor test

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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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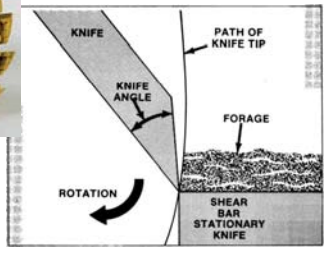

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Savings potential for forage harvest

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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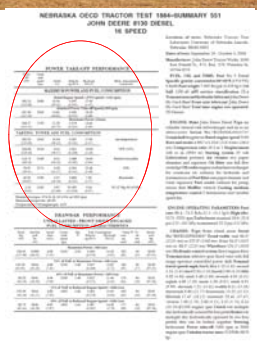

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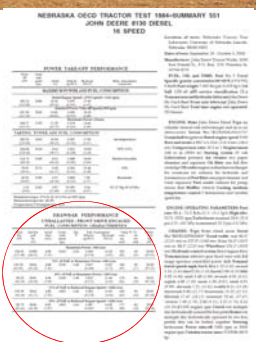

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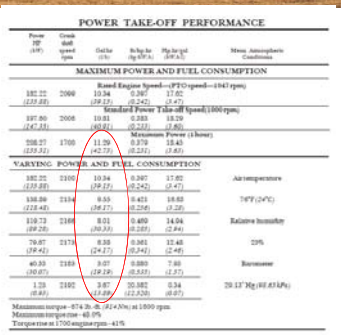
POWER TAKE-OFF PERFORMANCE



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DRAWBAR PERFORMANCE
UNBALLASTED - FRONT DRIVE ENGAGED
FUEL CONSUMPTION CHARACTERISTICS

Power Hp (kW)	Drawbar pull lbs (kN)	Speed mph (km/h)	Crank-shaft speed rpm	Slip %	Fuel Consumption lb/hp.hr (kg/kW.h)	Fuel Consumption Hp.hr/gal (kW.h/L)	Temp.°F (°C) cool-ing med	Air dry bulb	Barom. inch Hg (kPa)
Maximum Power—8th Gear									
158.03 (117.86)	12660 (56.32)	4.68 (7.53)	2100	3.50	0.458 (0.279)	15.28 (3.01)	182 (83)	59 (15)	28.80 (97.53)
75% of Pull at Maximum Power—8th Gear									
123.29 (91.94)	9504 (42.28)	4.86 (7.83)	2156	2.48	0.507 (0.308)	13.82 (2.72)	185 (85)	63 (17)	28.80 (97.53)
50% of Pull at Maximum Power—8th Gear									
83.52 (62.28)	6341 (28.20)	4.94 (7.95)	2169	1.49	0.612 (0.372)	11.44 (2.25)	178 (81)	64 (18)	28.81 (97.56)
75% of Pull at Reduced Engine Speed—10th Gear									
123.59 (92.16)	9504 (42.27)	4.88 (7.85)	1623	2.48	0.454 (0.276)	15.42 (3.04)	182 (83)	64 (18)	28.81 (97.56)
50% of Pull at Reduced Engine Speed—10th Gear									
83.73 (62.44)	6340 (28.20)	4.93 (7.97)	1633	1.41	0.497 (0.302)	14.09 (2.78)	177 (80)	64 (18)	28.81 (97.56)

Fuel economy index

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Summary of potential annual savings

- Limiting tillage: **$3000 - $6000**
- Optimal ballasting/tire inflation: **$600 - $2000**
- Tractor selection: **$1200**
- Engine maintenance and management: **$600**
- Use proper transmission gear: **$800**

Crop farm, 1000 acres: **$6,200 - $10,600**

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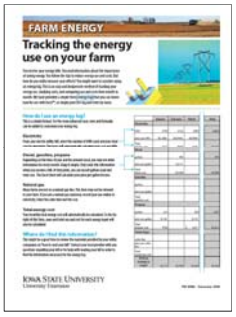

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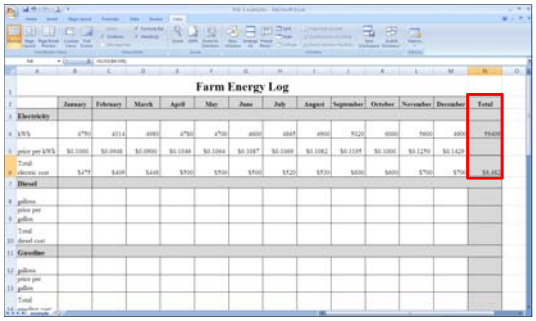

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Farm energy savings

- 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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