

## **On-farm Energy Savings for Field Operations**

**Mark Hanna  
Extension Ag Engineer  
Iowa State University**

### **Field energy savings**

- 1. Is this trip really necessary?  
Save 100% of fuel**
- 2. Necessary field operation  
Maintenance  
Shift up/throttle back  
Ballast/tire inflation**



<b>Field operation</b>	<b>Diesel, gal/ac</b>
<b>Subsoil</b>	<b>1.7</b>
<b>Field cultivate</b>	<b>0.7</b>
<b>Plant</b>	<b>0.6</b>
<b>Spray</b>	<b>0.2</b>
<b>Harvest</b>	<b>1.4</b>



### **Maintenance schedule**

- **Follow manufacturer recommendations**
- **Filter and fluid changes**
- **Missouri study: 99 tractors**
- **After changing fuel and air filters:**
  - **Power increased by 3.5%**
  - **Fuel savings estimate of 100 gal over 500 h**

## **Gear up/Throttle down**

- **Similar to over-the-road travel**
- **Lighter drawbar loads (<65% rated power)**
- **Strategy not suitable for PTO work**
- **Fuel savings can be significant**
  - **5 – 15% at 75% power**
  - **15 – 30% at 50% power**
- **Don't lug engine**

### **Deere 7600, 111 Hp, MFWD**

<b>Pull</b>	<b>Hp</b>	<b>Gear</b>	<b>Fuel use, gal/h</b>
<b>75%</b>	<b>80</b>	<b>7(B3)</b>	<b>5.60</b>
<b>75%</b>	<b>80</b>	<b>10(C2)</b>	<b>4.97</b>
<b>50%</b>	<b>54</b>	<b>7(B3)</b>	<b>4.50</b>
<b>50%</b>	<b>54</b>	<b>10(C2)</b>	<b>3.73</b>

**Deere 8570, 208 Hp, 4WD**

<b>Pull</b>	<b>Hp</b>	<b>Gear</b>	<b>Fuel use, gal/h</b>
75%	150	8(C1)	9.82
75%	150	13(B4)	8.98
50%	102	8(C1)	7.63
50%	102	13(B4)	6.63

**Comparing tractor size for same operation**

	<b>Small MFWD</b>	<b>Large 4WD</b>	<b>Large 4WD</b>
<b>Thottle setting</b>	<b>Full</b>	<b>Full</b>	<b>Reduced</b>
<b>Percent load</b>	<b>100%</b>	<b>50%</b>	<b>50%</b>
<b>Drawbar hp</b>	<b>100.6</b>	<b>101.7</b>	<b>101.5</b>
<b>Fuel, gal/h</b>	<b>6.48</b>	<b>7.63</b>	<b>6.63</b>

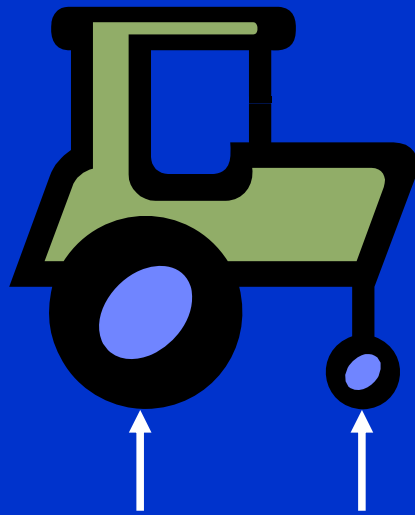
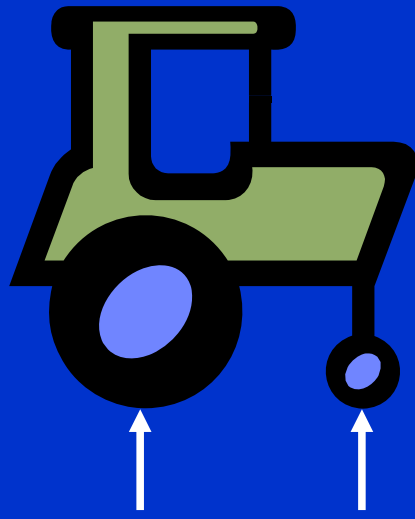


Tractor type	Lb/Hp		
	Speed		
	< 4.5 mi/h	5 mi/h	> 5.5 mi/h
2WD	130	120	110
FWD	130	120	110
4WD	110	100	90

**Example:**

**300 hp 4WD tractor pulling subsoiler/ripper at 5 mi/h**

**$100/\text{lb}/\text{hp} \times 300 \text{ hp} = 30,000 \text{ lb total tractor weight}$**



**%Front/%Rear**

**Hitch**

<b>Tractor type</b>	<b>Pull type</b>	<b>Semi-mounted</b>	<b>Vertical load</b>
<b>2WD</b>	<b>25/75</b>	<b>30/70</b>	<b>NR</b>
<b>FWD</b>	<b>35/65</b>	<b>35/65</b>	<b>40/60</b>
<b>4WD</b>	<b>55/45</b>	<b>55/45</b>	<b>65/35</b>

**Example:**

**300 hp 4WD tractor pulling subsoiler/ripper at 5 mi/h**

**$100\text{ lb/hp} \times 300\text{ hp} = 30,000\text{ lb total tractor weight}$**

**$\text{Front-axle weight} = 0.55 \times 30,000\text{ lb} = 16,500\text{ lb}$**

**$\text{Rear-axle weight} = 0.45 \times 30,000 = 13,500\text{ lb}$**

**When is maximum drawbar power needed?**

**Primary tillage?**

**Secondary tillage?**

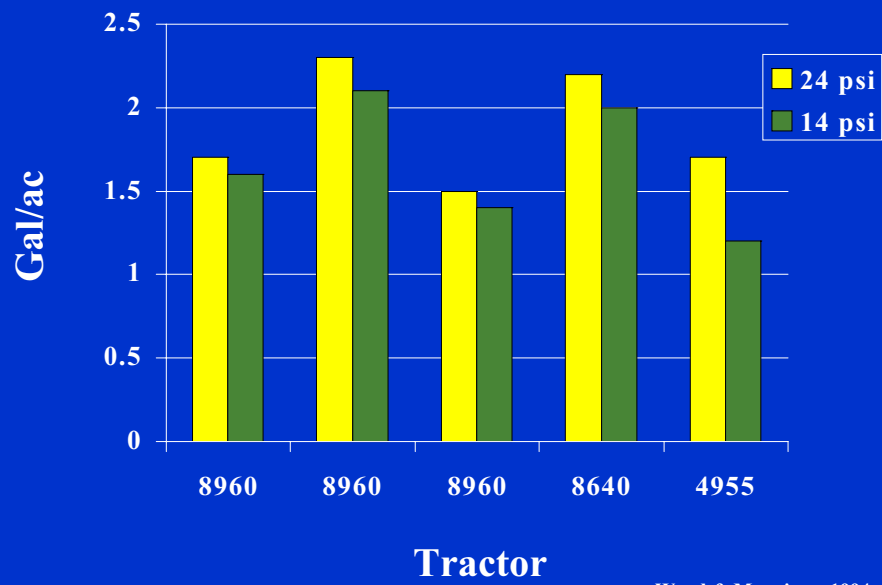
**Strip tillage?**

**Planting?**

**Spraying?**

**Fertilizer application?**





## **Biodiesel use in farm tractors**

- **Supported by major manufacturers up to B5**
- **Biodegradable fuel**
- **Challenges:**
  - **storage**
  - **cold weather**
  - **filter maintenance**
  - **seals**
  - **water affinity**
  - **paint**
  - **blends, ASTM standards**

## **Summary**

- **Is trip necessary?**
- **Follow good maintenance schedule**
- **Gear up/throttle down with lighter drawbar loads**
- **Manage tractor ballast**
- **Manage tire inflation pressure**

**[www.abe.iastate.edu/machinery.asp](http://www.abe.iastate.edu/machinery.asp)**