FARM ENERGY

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Tractor and Field Operations Energy Efficiency Checklist and Tips

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Introduction

Tractor and Field Operations is part of a series of Efficiency Checklists and Topics that can help you to assess all areas of your farming operation for energy efficiency and find ideas to save energy and reduce costs. For links to other articles in the Efficiency Checklists and Topics series, see Additional Resources at the end of this article.

Tractor and Field Operations

Field operations are one of the largest uses of energy on most farms, so it is helpful to examine reducing or eliminating operations for reductions in energy use. Conservation tillage systems conserve fuel by cutting down on the number of passes across fields. No-till or reduced-till systems allow farmers to prepare the seedbed, apply fertilizer, and plant the crop in one operation.

No-till drills or air seeders use approximately 0.7 gallons per acre. A common conventional tillage system for crop production includes a chisel plow operation using 0.6 gallons per acre, a field cultivator using 0.3 gallons per acre, and a drill using 0.5 gallons per acre for a total of 1.4 gallons per acre. In this example, conservation tillage requires half the fuel of the conventional tillage system.

Questions to Ask:

- Are you using radial tires, and are they properly inflated?
- Is your tractor properly matched to the implement you are using?
- Are you reducing the engine RPM speed when a larger tractor is used with a smaller implement?
- Is your tractor wheel slippage excessive?
- Is a change or reduction in tillage practices possible?
- Is fuel storage shaded?
- Have your engine fuel filters and air cleaner been replaced or serviced as recommended by the manufacturer?
- Have your engine fuel injectors been cleaned and serviced properly?
- Are you using a timer on your tractor's engine heater?

Facts and Actions: Tractor Operation

- Proper maintenance as recommended by the manufacturer should be performed regularly on all field equipment. This includes replacing fuel filters, changing oil and filter, lubricating bearings, and having regular engine tune-ups. The tractor

maintenance programs provided by implement dealers are an excellent way to have equipment (especially tractors and combines) checked and maintenance operations completed by professionals.

- Properly inflate radial tires to significantly reduce slippage compared to bias ply tires.

- Check the Nebraska Tractor Test Laboratory to find the efficiency of tractors in horsepower hours per gallon, which is similar to the miles per gallon rating for cars and pickups. This allows buyers to check and compare tractor efficiencies before purchasing. A common efficiency rating for field tractors is 17 to 19 horsepower hours per gallon. The higher the number, the more power produced from a gallon of fuel.

- Use a machinery cost calculator to assist with selecting the most fuel-efficient combination of tractor size and equipment width. For example, a 23-foot chisel plow and 200-hp tractor consume 0.68 gal./acre of fuel. A larger 37-foot chisel plow and 310-hp tractor consume 0.57 gal./acre of fuel.

- Avoid using small implements with large tractors. For the most efficient operation, the implement should be operated using the best matched tractor. If a larger tractor is used with small implements, use the principle of gearing up and throttling down to maintain proper ground speed will reduce fuel consumption. Be careful not to overload the engine when using this method.

- Aim to maintain wheel slippage generally between 10% and 15% for two-wheel drive tractors and 8% to 10% for four-wheel drive tractors. Wheel slippage outside this range means the tractor is not weighted properly. If wheel slippage is greater than the recommended amount when a heavy load is pulled, more weight should be added in the form of cast iron wheel weights or fluid in the tires. Either form of weight is as effective as the other. If wheel slippage is less than the recommended amount, the tractor is carrying too much weight. This will cause the tires to sink in deeper than necessary and increase power requirements to move the tractor across the field, resulting in lower efficiency.

- To significantly reduce tractor use and therefore save energy, money, and machinery wear and maintenance, use minimum or no-till practices. Other strategies for reducing fuel use include combining operations into one pass over a field or reducing the depth of tillage equipment.

- Constantly variable transmissions (CVT) or infinitely variable transmissions (IVT) are new technologies that help improve fuel efficiency by using electronic control of transmission and engine speed for the most efficient operation. The operator sets the operation speed, and the controller determines engine speed and transmission setting based on load. These systems automatically perform shift up/throttle down.

- Use guidance and auto-steer systems to reduce overlap on field operations, increase the ability to operate longer hours (darkness), reduce operator fatigue, and improve efficiency of operations.

- Don't leave engine heaters plugged in overnight, if possible. Diesel tractor engines generally require 1 to 2 hours of heater operation before cold weather starts. A 1,000-watt engine heater will cost $150 a season to use (based on 10 hours per night, and $0.10/KWh, heating season 150 days long). Operating that same 1,000-watt heater for only 2 hours each morning will save $120, more than enough to pay for the cost of the timer.

Additional Resources

- Introduction to Energy-Efficient Tractor and Field Operations

- Tractor Test Reports. Nebraska Tractor Test Laboratory.

- Decision Tools. University of Minnesota.

- Machinery Publications List. North Dakota State University Extension Service.

- Conservation Tillage Seeding Equipment. AE-1351, North Dakota State University Extension Service. 2007.

- Tractor Heater Timer Calculator. Wisconsin Public Service.

Efficiency Checklist and Topics:

- Farm Energy Efficiency Checklist and Tips

- Farm Lighting Energy Efficiency Checklist and Tips
- Farm Shop Energy Efficiency Checklist and Tips
- Grain Drying Energy Efficiency Checklist and Tips
- Greenhouse Energy Conservation Checklist
- Home Energy Efficiency Checklist and Tips
- Irrigation Energy Efficiency Checklist and Tips
- Livestock Buildings Energy Efficiency Checklist and Tips
- Livestock Watering Systems Energy Efficiency Checklist and Tips
- **Tractor and Field Operations Energy Efficiency Checklist and Tips**

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