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### Efficient Machinery Operation

Cooperative Extension South Dakota State University

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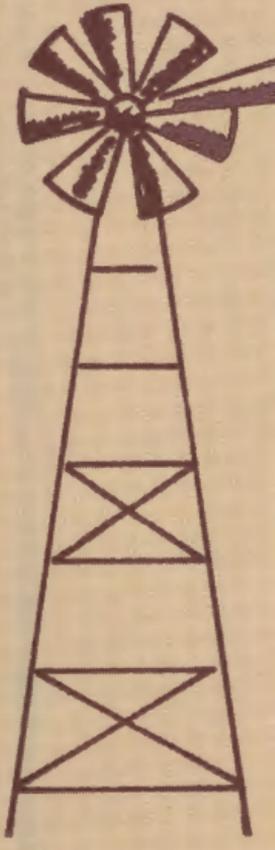
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# South Dakota Cooperative Extension Energy Information

## Efficient Machinery Operation



Cooperative Extension Service  
South Dakota State University  
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and



SOUTH DAKOTA  
OFFICE OF ENERGY POLICY  
ENERGY INFORMATION

# Efficient Machinery Operation

G.R. Durland  
Extension agricultural engineer

Good maintenance and management are the keys to energy conservation in the operation of tractors and farm machinery. Proper maintenance is not complex; it is a simple routine that should be followed to not only save energy but also save the machine.

## Clean air

The air cleaner is possibly the most neglected item on any engine.

It takes approximately 1200 cu ft of air to burn one gallon of gasoline in a gasoline tractor operating at full load. It takes approximately 1850 gallons of air to burn a gallon of diesel fuel in a diesel tractor operating at full load.

The air cleaner has to be clean to permit free air flow to maintain the right engine power and correct air-fuel ratio. A dirty air cleaner reduces air flow, which in turn cuts down on power and increases fuel consumption. Leaks into the intake system should be corrected to prevent dirty air from getting into the engine.

## Optimum operating temperature

An improper engine operating temperature can contribute to energy loss. Engine temperature should be kept at the correct level, usually between 180 degrees F and 190 degrees F, to prevent the wastage of fuel. An engine operating at a lower temperature will use more

fuel, have less power, and have increased cylinder wear.

## Proper ignition

The ignition system is another area that can cause excess consumption. New spark plugs, properly installed, may increase power by 4 to 6 horsepower and decrease fuel consumption by 6 per cent. Ignition points should be clean and smooth and set with the proper gap for smooth operation.

Proper ignition timing is also important. If the timing is set too early in the cycle, severe knocking and engine damage could result. If the timing is too late, the engine may run smooth, but it will waste fuel. Correct ignition timing can increase horsepower 5.3 per cent and decrease fuel consumption by 5.3 per cent.

## Carburetor adjustment

Kansas researchers in a recent study found 46 per cent of the tractors studied had improperly adjusted carburetors; properly adjusting these lowered fuel use by 9½ per cent.

Fuel lines are also another source of fuel wastage. A damp spot or area appearing on the engine can be an indicator of a loose connection on the line allowing fuel to escape. Black smoke coming from the exhaust can mean fuel wastage because of an air shortage, over-fueling, faulty fuel injection, or an overloaded engine.

## Selecting proper oil

Using the proper viscosity of oil is also important in fuel conservation. The oil should be thin enough to lubricate the engine when it is cold and thick enough to lubricate it when hot.

A multi-viscosity oil is better than a single viscosity oil under varying temperature conditions because it maintains almost the same thickness throughout the temperature change and therefore will lubricate the engine when it is hot or cold.

## Fit the tractor to the job

Proper management in the operation of a tractor can also reduce fuel consumption. The engine (tractor) should be sized to the job to be done whenever possible.

Engines operating at light loads are less efficient than when fully loaded. Therefore, it is a good idea to gear up and throttle back on partial loads, yet avoid lugging the engine. Shifting to a high gear can cut fuel consumption by 30 per cent.

The tractor and implement should be matched to the job and the conditions. Tests have shown that maximum fuel efficiency may be obtained at loads requiring only 50 per cent of maximum horsepower, if the engine is run at a slower governed speed. Nebraska Tractor Test data show that tractors operating at 50 per cent load used 20 per cent less fuel at reduced engine speed than was used on the same load at full engine speed. Many

diesel engines are more efficient in the use of fuel at 50 per cent load with reduced engine speed than at 100 per cent load with full engine speed.

For this reason, it will probably require less fuel to use a large diesel tractor at reduced engine speed on light loads than to use a smaller size tractor at full engine speed.

For PTO work we cannot idle the engine, as it is important to maintain the correct operating speed for the PTO-driven equipment to perform properly. Therefore, it is especially important to match tractors to the load when performing PTO work.

#### **Shut off the engine**

Fuel can also be wasted when the engine is not working. An Illinois study showed that tractors ran at idle speed for more than 12 per cent of the total hours of operation.

An engine may use more than 1/2 gallon of fuel per hour at slow idle speed and 42 per cent as much fuel at fast idle as it does under full load. Based on 800 hours of operation per year, this would amount to about 400 gallons of fuel used just during idling of the engine each year.

#### **Improve traction**

Tractor ballasting can also conserve fuel.

Ballasting is the addition of weight to rear wheels for better traction or to the front wheels to provide stability and good steering. In addition to the tractor weight, ballast may be added wheel weights, tire fluid, or weight transferred

from a hitch-mounted implement.

In the lower gears a tractor can pull a load equivalent to 30-70 per cent of its weight at the drive wheels. Slippage of the drive wheels is controlled by adding weight.

Tractors are designed to give maximum performance with 8-15 per cent slippage. Slippage greater than 15 per cent lowers tractor productivity and causes tire wear; less than 8 per cent indicates the tractor is carrying too much ballast, placing stress on tire and power train.

An approximate method of checking traction is: if there is too little weight, the tread marks are wiped out completely from slippage; if too much weight, the tread marks will be sharp and distinct in the soil; and if there is proper weight, the tread pattern will be visible and the soil between the cleats in the tire pattern will be shifted slightly.

Duals do not improve tractor efficiency but radial tires can improve it up to 3 per cent.

#### **Consider diesel**

Selection of equipment is very important in conserving energy. The price difference between diesel fuel and gasoline has been decreasing, therefore smaller diesel tractors are now as economical to operate as gasoline.

A diesel engine is a more efficient user of fuel than gasoline engines, consuming about 70 per cent as much fuel per unit of work as a gasoline

engine does. This, in addition to the narrowing initial price difference between diesel and gasoline tractors, makes a diesel the logical choice for most farmers.

#### **Improve field efficiency**

Implements should always be adjusted properly; and any blades, shares, shovels, disks, or cutting edges should be kept as sharp as possible to reduce draft and power requirements and resultant fuel consumption.

Consideration should be given to combining operations, such as tilling, planting, and application of herbicides, insecticides, and fertilizer. Such combinations cut down on number of trips through the field and reduce fuel consumption. A till-plant system can cut fuel consumption by 50 per cent.

Planning field operations can also affect fuel used. Turning can run as high as 25 per cent of the total field time in some fields. Fields should be combined when possible, to make longer rows which will cut down on turning time. Wide, level turnrows will also cut down on time lost in turning. Other conditions that increase field time are rough fields, obstructions and ditches.

Field operations should be planned to eliminate bottle-necks and to provide for a minimum of road time going between fields.

#### **Good maintenance pays**

Proper and timely maintenance must be performed on all pieces of equipment in order to reduce

heat and energy requirements. Keep the owners' manuals handy, and use them, to insure that the right maintenance schedule is followed.

Good planning in the selection, operating, and scheduling of equipment can result in a sizable reduction in the amount of fuel consumed in the agricultural environment.

**Operation and maintenance practices that result in potential savings in fuel consumption.**

<u>Operation</u>	<u>Change in Fuel Consumption</u>
New spark plugs	Decrease 6%
Correct ignition timing	Decrease 5.3%
Adjust carburetor	Decrease 9.5%
Shift to higher gear and reducing engine speed	Decrease 20%
Stopping engine rather than idling	Decrease 6%
Use diesel rather than gas	Decrease 30%



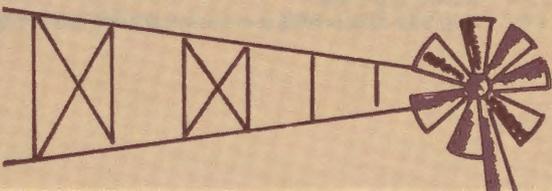
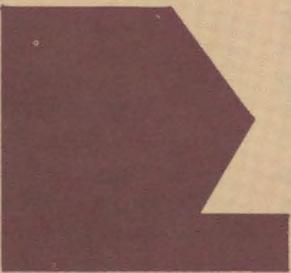
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