

Gear-up and Throttle - down to Save Fuel

R.K. Koelsch, Cornell University

Proper matching by size of every implement you own to your tractor represents an ideal situation for maximum fuel economy and work done; however, other considerations make this impractical:

- Replacement of a tractor with a larger machine will leave you overpowered for your present tillage equipment. Increasing the size of the tillage implements to match a new tractor may take years to accomplish.
- Some light tillage equipment may be impossible to match to a tractor because of the unusually large size required.

For any situation where a tractor is not heavily loaded, it is possible to improve fuel economy by reducing engine RPM up to 20 percent and shifting to a higher gear. This practice should not be applied to Power Take-Off (PTO) equipment which must be operated at rated speed.

General Guidelines

Certain guidelines need to be followed to obtain potential fuel economy and to avoid overloading a tractor's engine.

1. Reduce engine RPM up to 20 percent, depending on load. For very light loads, a greater RPM reduction may be possible. Check your owner's manual to make sure that the engine is operating within the specified *Working RPM Range* of your tractor.
2. Shift to a higher gear to maintain desired ground speed.
3. Use gear-up and throttle-down for moderate or light loads. When a tractor is operated at 75% of maximum power or less, this practice can be used for fuel savings.
4. Do not overload the engine. Check for overloading after you have geared-up by simply opening the throttle. If the engine responds readily, it is not overloaded.

Fuel Savings

Fuel savings occur at slower engine speeds, provided an engine is not overloaded. Generally, for a 20 percent drop in engine RPM, fuel savings of 15 to 30 percent can be realized. Greater fuel savings will occur if the engine is throttled back more than 20 percent. However, the possibility of overloading an engine is much greater. Most tractors lose very little power for an RPM drop of less than 20 percent, and engine overload is not often a problem; however, engine speed reduction beyond this point is usually accompanied by significant loss of power.

Improved fuel economy from gear-up and throttle-down can be realized for almost any size and make of tractor. The Nebraska Tractor Tests report fuel savings possible from this practice for all recent tractor models.

A summary of Nebraska's reduced throttle tests for recent tractor models is provided in Table 1. Note the fuel efficiency of a tractor operating at less than full load. Every tractor does more work per gallon of fuel at a reduced throttle setting than at full throttle. Also note that fuel efficiency is better at a reduced throttle setting for a 50 percent load than at maximum available power. In general fuel economy when practicing gear-up and throttle-down will be as good or better than when the tractor and implement are matched.

Table 1. Tractor Fuel Efficiency for Various Operating Conditions

Tractor Size Class	Fuel Efficiency, Horsepower per Gallon			% Increase of reduced throttle over wide open throttle
	Maximum Power	50% Load, wide open throttle	50% Load, reduced throttle	
80 hp	12.69	10.70	13.60	2 7 %
100 hp	12.37	10.34	12.69	2 3 %
125 hp	13.23	10.56	13.47	2 8 %

Bear in mind as you practice gear-up and throttle-down with your tractor that the optimum operating point for fuel economy rarely coincides with a manufacturer's rated conditions. In recent years, with steadily increasing RPM ratings for new tractor models, the optimum engine speed for fuel economy and the rated speed have grown further apart.

A 100 hp tractor operating at a moderate load level will burn about 5 gallons of diesel fuel per hour. By throttling back 20 percent and shifting to a higher gear, you can expect to burn about 4 gallons of diesel fuel per hour and still get the same amount of work done.

Misconceptions

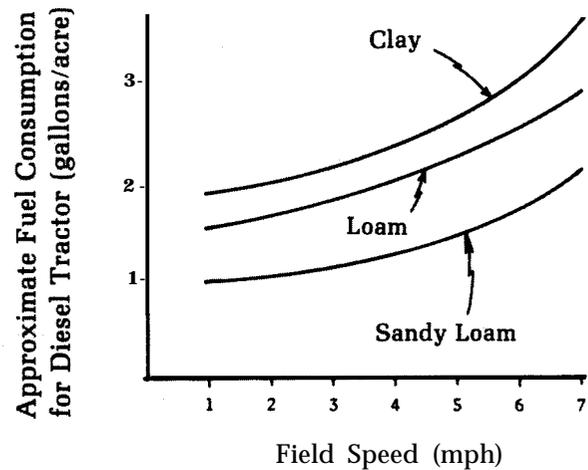
Several misconceptions exist concerning the practice of gearing-up and throttling-down. The popular belief that turbocharged or naturally aspirated engines cannot be operated below their rated RPM is not true. Many tractor manufacturers recommend gearing up and throttling back for light and moderate loads in turbocharged and naturally aspirated engines. Check your engine manual. The most important thing to remember is: **Avoid overloading the engine.**

As you practice gear-up and throttle-down, occasionally open the throttle. As long as the engine readily picks up speed, overloading is not a problem.

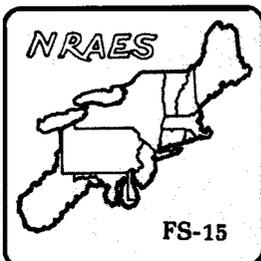
In an effort to counter the problem of a tractor overpowered for its tillage tools, some farmers increase their field speed. Try to avoid this. Increased field speed causes a significant increase in fuel consumption per acre. Figure 1 illustrates the relationship between fuel consumption and speed for

one particular implement, the moldboard plow. You should also avoid operating your tractor at low speeds while pulling heavy loads. This places excessive strain on the drive train and will noticeably shorten its lifetime. For most tillage operations, field speeds in the range of 4 to 6 mph will minimize these two problems.

Figure 1. Relationship between Fuel Consumption and Speed for a Moldboard Plow.



Basic to the operation of field machinery is the importance of matching the power requirements of your tillage implements to the available power of your tractor in order to make optimum use of your time, fuel, and capital investment. If your tractor is overpowered for a tillage implement, try throttling down the engine and gearing up.



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