

Shift up, throttle down, save fuel

NEW technology should probably come with a warning label for the headaches and rising blood pressure that follow the learning curve. Take heart that the new “infinitely” and “continuously” variable transmissions in late-model tractors are an exception to this rule. If you’re using one this spring, you’ll also reap the benefits of improved fuel efficiency.



Farm Energy

By DANA PETERSEN

If you’re operating an older tractor, shift up and throttle back to reduce fuel

consumption for lighter drawbar loads.

Large tractors used for field operations must transfer power from the engine to the drive wheels through the transmission. During this process, speed and torque from the engine crankshaft are converted to drive axle speed and torque. A continuously variable transmission, or CVT, automatically selects the most efficient

gear and throttle setting according to the drawbar load requirements and the traveling speed determined by the driver.

Capturing fuel savings with a fixed-gear transmission depends on using the right gear for the job at hand. Shifting to a higher gear and reducing the throttle setting conserves fuel for jobs requiring reduced engine loads. “The concept is similar to an accelerating car,” says Mark Hanna, Iowa State University Extension ag engineer. “As the mass of the vehicle is being accelerated up to road speed, load on the engine can be gradually reduced as the transmission is shifted to a higher gear, and the accelerator or throttle setting is reduced.”

Fuel savings will add up

During spring fieldwork, a tractor is often only partially loaded for the amount of drawbar power available. “Drawbar tractor operations, such as chisel plowing, planting and spraying, require different amounts of drawbar force depending on the size of the implement and soil conditions,” says Hanna.

Tractor test data from the Nebraska Organization of Economic Cooperation and Development finds fuel conservation at reduced drawbar loads. For example, the Case IH Magnum 245 produces maximum drawbar power in seventh gear. If the tractor continues to use seventh gear for a reduced load of 75% of maximum drawbar power, fuel consumption is 11.6 gallons per hour at 2,090 engine rpm. If the same load is pulled in ninth gear, but with a reduced throttle of 1,580 engine rpm (to maintain identical travel speed and drawbar power output), only 10.5 gallons per hour is consumed, saving 10% in fuel.

This effect increases more for lighter drawbar loads. The same tractor pulling at 50% of drawbar power consumes 10 gallons per hour in seventh gear at 2,150 rpm. Fuel consumption is reduced to 7.9 using ninth gear and a lower throttle setting of 1,620 rpm. That’s fuel savings of 20%!

For partial loads, don’t shift too high or reduce the throttle too much. “A significant increase in black smoke or the sound of the engine lugging down are both indicators to shift back down a gear and increase engine speed slightly,” says Hanna.

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The “shift up, throttle back” technique is applicable whenever potential tractor drawbar power significantly exceeds the power needed for operation. “A classic example is a tractor with a pull-behind sprayer using a hydraulic-drive pump,” says Hanna. Similarly, using a small field cultivator or disk for secondary tillage with a larger tractor results in a mismatch of load vs. horsepower and fuel savings.

However, the practice is not suited to PTO operations. “PTO shaft speed is directly related to engine speed,” says Hanna. “Engine speed must be maintained at a level to produce standard PTO speed, so tractor engine speed can’t be reduced.”

New technology can regulate fuel use, but tried-and-true techniques can cut fuel use for older gear, too. To see the publication “Shift Up and Throttle Back to Save Tractor Fuel” and to register for the webinar, see farmenergy.exnet.iastate.edu.

Petersen is with the Farm Energy Initiative.

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