

# Field trial shows fuel savings

By DANA SCHWEITZER

**W**HEN it comes to farm energy efficiency, tractors and fuel consumption are two topics that often go hand in hand. Thanks to the assistance of farm manager Ken Pecinovsky, our team had a hands-on opportunity to conduct field trials last spring to measure tractor diesel consumption at the ISU Northeast Research and Demonstration Farm near Nashua.

During spring fieldwork, a tractor is often only partially loaded for the amount of drawbar power available. "Drawbar tractor operations, such as field cultivating, planting and spraying, require different amounts of drawbar force depending on the size of the implement and soil conditions," says ISU Extension ag engineer Mark Hanna.

To identify opportunities for tractor fuel savings, instrumentation was installed on a John Deere 7430 tractor at the farm before the field trials began. Our team decided against using a flowmeter and, instead, used a small, 12-gallon auxiliary fuel tank to be mounted on the front of the tractor using a rock box.

Fuel lines and valves were added to connect the auxiliary fuel tank to the tractor's engine. A load cell was also placed under the auxiliary tank to measure the net weight of fuel consumed: the weight of the fuel supplied to the tractor's engine

## Field cultivation at Northeast Iowa Research Farm with different gear, engine speed combinations (2013)

Operation	No. of replications	Treatment	Gal/acre
		Gear/engine rpm	
Field cultivation, 5 mph	3	C1/2080	0.80
	3	C2/1710	0.66

minus the fuel returned from the engine.

A digital display mounted inside the cab of the tractor allowed the driver to gather data from the load cell during multiple passes with the field cultivator. All the data was collected during one day using the same equipment under the same field conditions. Three replications were completed to ensure accuracy.

As shown in the table, we compared tractor fuel consumption at two different gear and throttle settings. Shifting up from C1 to C2 and reducing the throttle from 2,080 to 1,710 engine rpm, tractor fuel consumption was reduced by 0.14 gallon per acre. That's fuel savings of 17.5%, compared to remaining in the lower gear with the throttle at 2,080 rpm.

### Shift up, throttle back

"The field trials at Nashua illustrate a key point about on-farm energy management," says Hanna. "Many opportunities for energy savings are tied directly to day-

to-day activities, such as driving a tractor. Using the simple 'shift up, throttle back' technique when you're in the driver's seat will reduce your fuel consumption."

This technique is applicable whenever potential tractor drawbar power significantly exceeds the power needed for implement operation.

For example, using a small field cultivator or disk for secondary tillage with a larger tractor results in a mismatch of load vs. horsepower, and an opportunity to improve fuel savings. Another example is a tractor with a pull-behind sprayer using a hydraulic-drive pump.

Shifting up and throttling back with heavier loads can also save fuel, though savings are typically closer to 10%. For partial load operations, the key is not to 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," Hanna explains.

However, the practice is not suited to PTO operations. "PTO shaft speed is directly related to engine speed," he says. "The throttle setting must be maintained at a level to produce standard PTO speed, so the throttle setting can't be reduced."

### Lots of horsepower needed

Naturally, spring fieldwork requires a lot of horsepower. A continuously variable transmission, or CVT, on a late-model tractor can automatically select the most efficient gear and throttle setting according to the drawbar load requirements and the speed determined by the driver.

It may be hard for older tractors to compete with the fuel efficiency of a CVT, therefore shifting up and throttling back is essential when operating an older tractor with a fixed-gear transmission.

The bottom line: Shifting to a higher gear and reducing the throttle setting allows you to conserve fuel for jobs requiring reduced engine loads.

We are planning more field trials this spring, so stay tuned for tips to reduce tractor fuel consumption. To learn more, download the ISU Farm Energy fact sheet, "Shift Up and Throttle Back to Save Tractor Fuel," at [farmenergy.exnet.iastate.edu](http://farmenergy.exnet.iastate.edu), or follow @ISU\_Farm\_Energy on Twitter.

Schweitzer is program coordinator for ISU Farm Energy in collaboration with the Iowa Energy Center.

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