Diesel Fuel Consumption during Field Operations

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Introduction

Direct energy expenses (diesel, gasoline, propane, electricity) total more than $1 billion annually for Iowa's farmers. Day-to-day farm management techniques such as adjusting tractor gear and throttle settings or monitoring tractor tire inflation pressures can reduce diesel fuel consumption for row crop production. This study is being conducted over multiple years to measure the effects of energy management techniques on tractor fuel consumption during field operations.

Materials and Methods

A small auxiliary 12-gallon fuel tank was mounted on a John Deere 7410 tractor. Plumbing was added for diesel fuel to be supplied and returned from the engine via either the main or auxiliary fuel tank, depending on the setting of a single flow control valve. A load cell under the auxiliary fuel tank measured the net (supply–return) weight of fuel consumed.

Most field work on the farm was conducted in smaller plot areas. One objective was to measure fuel consumption in areas of 0.7 to 1 acre when possible; the auxiliary tank measures fuel use within 0.1 lb increments. Another objective was to obtain multiple replications if land area and timing of trials allowed. Small plots and farm scheduling frequently conflicted with these objectives, limiting the ability to measure statistical significance beyond overall trends in data.

Fuel consumption was measured as gallons/acre. Although larger equipment consumes fuel at higher rates, field work also is completed at a faster rate (acres/hr). Gallons/acre generally remains consistent and is a common, useful measure for farmers.

Results and Discussion

Effects of shifting up to a higher transmission gear and throttling back the engine's speed were compared during field cultivation (Table 1). As expected, maintaining travel speed but using a slower engine speed in a higher transmission gear shows a trend of reduced fuel consumption. During field cultivation, fuel consumption decreased approximately 30 percent.

Effects of chisel plowing were measured at two tire inflation pressures (Table 2). Fuel use decreased approximately 3 percent at the lower, proper tire inflation pressure for this tractor and wheel load conditions.

Conclusions

Results indicate reduced diesel fuel consumption when using a 'shift-up/throttle-back' strategy with drawbar loads that are less than the available maximum tractor horsepower. Using correct tire pressure and avoiding over-inflation reduced fuel use by 3 percent. Research farm staff plan to continue further fuel consumption comparisons next year.

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Table 1. Fuel use at the ISU Northern Research Farm, spring 2014.

Operation	No. of replications	Treatment gear/engine rpm	Gal/acre
Field cultivation, 6.3 mi/h	2	C2/2170	0.43
	1	C4/1480	0.30

Table 2. Fuel use at the ISU Northern Research Farm with varying rear tire inflation, fall 2014.

Operation	No. of replications	Rear tire pressure	Gal/acre
Chisel plowing, 3.6 mi/h	3	14	1.09
	3	20	1.12
LSD $_{\alpha=0.05}$[a]			NS[b]

[a]Least significant difference between treatments at a 95 percent confidence level.
[b]No significant difference at the 95 percent confidence level.