Spring 2009

Should fuel prices affect choice of tillage system?

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Meeting the Challenge:
Farming In Uncertain Times
University of Nebraska Lincoln EXTENSION

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Choice of a tillage system is based on a number of factors, and fuel price is certainly one of the important issues. Fuel consumption can be highly variable for a specific tillage operation and for a particular tillage system, depending on tillage depth, soil type, soil moisture, field speed, design of the soil-engaging tool, etc.

Accepting that, let's look at several examples to get a feel for potential differences in only fuel cost within several tillage systems. Assume, for example, the following operations and associated fuel consumption for several tillage systems for planting corn after corn under a pivot irrigation system in western Nebraska:

- **Moldboard plow**
  (disk stalks, plow, rollerharrow twice):
  Diesel fuel use: 3.90 gal./acre
  Fuel cost at $1.80/gal.: $7.02/acre
  Fuel cost at $3.00/gal.: $11.70/acre
  Difference in fuel cost: $4.68
- **Double Disk**
  (Disk two times):
  Diesel fuel use: 1.15 gal./acre
  Fuel cost at $1.80/gal.: $2.07/acre
  Fuel cost at $3.00/gal.: $3.45/acre
  Difference in fuel cost: $1.38
- **Zone Tillage:**
  (Apply herbicide, zone till):
  Diesel fuel use: 1.23 gal./acre
  Fuel cost at $1.80/gal.: $2.21/acre
  Fuel cost at $3.00/gal.: $3.69/acre
  Difference in fuel cost: $1.48
- **No Tillage:**
  (Apply herbicide only):
  Diesel fuel use: 0.18 gal./acre
  Fuel cost at $1.80/gal.: $0.32/acre
  Fuel cost at $3.00/gal.: $0.54/acre
  Difference in fuel cost: $0.22

Although actual fuel consumption will be different for each producer and each field, these typical values demonstrate two points relative to the question of whether fuel price should influence tillage system selection. First, when fuel price increases as much as it did in 2008, this increase alone is significant — $4.68 per acre for the tillage operations in the moldboard plow system in the above example. Second, there are substantial differences in fuel cost and fuel-cost increases between tillage systems with different amounts of tillage inputs. Spread over hundreds or thousands of acres, these cost increases from changing fuel prices are important to a crop producer, and must be considered when selecting tillage systems.

However, fuel price or fuel cost for the tillage operations cannot be the only, or even most important, factor for deciding which tillage system, or more appropriately "production system," a producer should use. Sustainable crop yield, weed control, control of soil erosion, labor availability, management style, soil water conservation, and crop rotation are as important or more important criteria.

Also keep in perspective the relative contribution of the cost of fuel for tillage operations with the cost of fuel for the entire production system (planting, harvesting, spraying, hauling), and the relative contribution of the selected tillage system to net crop income. Saving $15 per acre to eliminate a critical tillage operation is not a good choice if it reduces corn yield by 10 bushel per acre or sugarbeet yield by 1 ton per acre, for example.

We should always ask ourselves how a tillage operation contributes to the outcome of the crop production system, and where applicable eliminate, or change, that operation. But there are ways to reduce tillage fuel cost in addition to eliminating the operation. Does the implement power requirement match the tractor power; can you gear up and throttle back; is the tractor ballast or tire slippage in the correct range; or can you reduce the depth of tillage without decreasing the effectiveness of the operation?

Using a 250-horsepower tractor to pull an implement requiring 100 horsepower will not use fuel effectively. The weight of the oversized tractor requires additional power and fuel just to move the tractor itself through the field, and the high axle weight might contribute to soil compaction. If the implement operation does not require full tractor power, consider gearing up and throttling back to find an engine rpm that has more fuel efficiency.

Use a reasonable balance of tractor ballast with the load being pulled to achieve a 10-15 percent tire slip in most typical soil conditions. Lower slip increases power train wear and reduces traction efficiency. Higher slip increases tire wear and wastes power and fuel. Experiment with tillage depth to find a minimum depth that will still allow desired tillage performance. Generally a change in tillage depth is not proportional to the resulting change in power and fuel input — as you double tillage depth you more than double, probably triple, power and fuel input.

When fuel prices change it is a good time to evaluate tillage systems. We should examine how the fuel price affects input cost, and how each tillage operation contributes to the outcome of the cropping system. But at the same time we should look at how the tillage operation or tillage system contributes to the other important goals of our overall production system, including soil and water conservation.

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