

Energy Efficiency in Agriculture
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The energy used to drive farm machinery represents 10 to 50 percent of the total energy consumed in producing crops in the United States, depending on the crop species and cultural practices. Machinery designers continue to improve the efficiency of their machines and the accuracy with which they apply other energy-bearing chemicals, contributing to a steady improvement in the energy efficiency of crop production.

Energy consumption on U.S. farms reached its peak about 1979. Since then it has come down about 30 percent, while crop production has grown by 20 percent. The 1970s and '80s showed a dramatic shift from gasoline powered engines to diesel, whose greater fuel efficiency led to a reduction in total liquid fuel consumption.

Taking a look specifically at corn, nitrogen fertilizer is the largest energy input, representing nearly half of the 50,000 BTUs put into each bushel. Diesel fuel and gasoline make up about a quarter, with other fertilizers and chemicals, natural gas, LP gas, and electricity making up the balance. Other crops show a different distribution, with legumes like soybeans having virtually no requirement for nitrogen fertilizer. But, regardless of the crop, all of them can benefit from improvements in machinery efficiency and more accurate, precise chemical placement.

Fertilizer use efficiency has improved over the past twenty years, mainly due to improvements in plant genetics, but somewhat due to more accurate placement. Precision guidance systems will help that continue, allowing the farmer to know exactly where the fertilizer opener went through the soil, and placing his planted row in the best relationship to it. That same guidance system can keep tramlines narrow and precise, encouraging nitrogen application through the growing season with minimal crop injury.

Tillage equipment designers have combined the working elements of discrete implements into new, combination machines, reducing the number of trips across the field. Those working elements do the same job as they did before, and need just as much energy to do it, but combining them saves the energy required to move the tractor across the field in separate trips. It isn't unusual to see a tillage tool doing three jobs at once, saving two tractor trips across the field. And, higher clearance frames have greatly reduced the need for one task, stalk shredding, an energy-intensive operation.

Tractor fuel efficiency begins with the engine, but the final result also depends on the transmission and tires or tracks, as well. Fuel efficiency measurements, such as the Nebraska Tractor Tests, show a steady improvement with each new model introduction. The long footprint that radial tires and tracks put on the ground increases their efficiency compared to bias-ply tires.

For years, engineers have urged farmers to "Shift up and throttle back" when operating under light loads, to reduce fuel consumption. It seldom happened, because it added another task to the tractor driver's workload. Now, we've built that capability into our Infinitely Variable and Power Shift transmissions. The operator selects that mode of operation with a knob or switch, and the controller manages both the engine and transmission to save fuel and reduce noise. We've added an Implement Management System that can learn and then control the sequence of events that occur at the end of each pass through the field, allowing the operator to concentrate on guiding the tractor to the next pass, reducing unproductive time.

Precision farming concepts from yield mapping to vehicle guidance all contribute to agriculture's energy efficiency by documenting the return on investment in fuel, fertilizer, and chemicals and eliminating skips and double coverage in field operations.

Even though our session's tag line is "Well beyond tune-ups", we continue to remind farmers that timely maintenance, such as changing filters, changing oil, replacing worn sweeps or chisels, will save energy and extend the life of their equipment. The operator's manual is worth many times its weight in diesel fuel.