# ESTIMATING FARM FUEL REQUIREMENTS for Crop Production and Livestock Operations

Federal energy experts estimate that 3 to 4 percent of the energy consumed in the United States is required by American agriculture to produce the nation's food and fiber. With the energy supply problems facing our country, every producer should use farm fuels efficiently and be able to adjust to possible reduced supplies.

If shortages become critical, you may be required to apply for a fuel allotment. While you may have all of your gas tickets from the past crop season, would you be able to distinguish what fuel had been used for which crop and how much might have gone to provide mechanization for your livestock operations?

## How to Estimate Your Farm Fuel Requirements

By using the Iowa fuel use tables and good judgment, you can estimate the gallons of gasoline, diesel fuel or LP gas you will need to grow your next crop and maintain your livestock program.

Here's an example of how you can use the Iowa fuel use tables for next year's crop planning. Consider a 480-acre Corn Belt farm. The operator plans to plant 240 acres of corn, 160 acres of soybeans and wants to raise 800 market hogs. The field crop operations are performed *mostly* with his diesel-engine tractors and combines; the livestock chore jobs are done with a gasoline-burning tractor.

From the table, 6.85 gallons of diesel fuel are needed to grow an acre of corn; 6.5 gallons of diesel fuel will produce an acre of soybeans. So,

Corn—6.85 gal/a x 240a planned = 1,644 gallons diesel fuel

Soybeans—6.50 gal/a x 160a planned = 1,040 gallons diesel fuel

Estimated Annual Requirement = 2,684 gallons diesel fuel

### Estimates of Fuel Burned for Crop and Livestock Production Operations Under Average Conditions



| Crop Production | Gallons per acre | | |
|---|---|---|---|
| **Cropping system** | **Gasoline** | **Diesel fuel** | **LP gas** |
| Corn—conventional methods | 9.5 | 6.85 | 11.4 |
| Corn—plowing with minimum tillage planting | 7.5 | 5.40 | 9.0 |
| Corn—no plowing, minimum tillage planting | 6.0 | 4.30 | 7.2 |
| Corn harvested and stored as whole-plant silage | | | |
| Conventional methods | 12.0 | 8.65 | 14.4 |
| Plowing with minimum tillage | 10.0 | 7.20 | 12.0 |
| No plowing, minimum tillage | 8.5 | 6.10 | 10.2 |
| Soybeans—conventional methods | 9.0 | 6.50 | 10.8 |
| Small grains—oats, barley, rye, wheat | 4.25 | 3.00 | 5.1 |
| Small grains—with plowing | 6.50 | 4.70 | 7.8 |
| Hay—dry cured, 3 cuttings, baled | 12.0 | 8.65 | 14.4 |
| Haylage—3 cuttings or dry chopped | 18.0 | 13.00 | 21.6 |
| Using combined type cutting with self-propelled cut, crush, windrow | | | |
| Hay—3 cuttings | 7.2 | 5.20 | 8.6 |
| Haylage—3 cuttings | 13.2 | 9.50 | 15.8 |

Corn drying—with favorable drying conditions—1 gal. propane will dry 7 bu. corn
—with good drying conditions—1 gal. propane will dry 6 bu. corn
—with unfavorable drying conditions—1 gal. propane will dry 5 bu. corn

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**Livestock Production**
(Includes all fuel used to remove feed from storage, process and deliver to feeders)

| Animal | Feeding period | Gallons per animal or 100 birds | | |
|---|---|---|---|---|
| | | Gasoline | Diesel fuel | LP gas |
| Swine | Raise 1 pig to market including feeding of sow and boar | 0.40 | 0.30 | 0.50 |
| Dairy | Cow milking 9,000 lbs. milk/year | 1.00 | 0.75 | 1.20 |
| | Cow milking 12,000 lbs. milk/year | 1.35 | 1.00 | 1.60 |
| | Heifer—1 year | 0.40 | 0.30 | 0.50 |
| Beef | Steers—grown from 400 to 1,200 lbs. | 1.80 | 1.30 | 2.15 |
| | Heavy steers—grown from 700 to 1,200 lbs. | 1.00 | 0.75 | 1.20 |
| | Heifers—grown from 400 to 850 lbs. | 1.35 | 1.00 | 1.60 |
| | Yearlings—grown from 650 to 1,200 lbs. | 1.75 | 1.25 | 2.10 |
| | Cows—winter and raise calf to 400 lbs. | 0.90 | 0.65 | 1.10 |
| Sheep | Lambs—native, from birth to market | 0.60 | 0.45 | 0.70 |
| | Feeder lambs—50 lbs. to market | 0.125 | 0.10 | 0.15 |
| Poultry | Raise 100 broilers from birth to market | 0.75 | 0.55 | 0.90 |
| | Raise 100 pullets from birth to laying | 2.70 | 1.95 | 3.25 |
| | Layers for 1 year—100 birds | 7.50 | 5.40 | 9.00 |
| | Raise 100 turkeys from birth to market | 7.50 | 5.40 | 9.00 |

**Manure Removal and Hauling**

| | Gallons of fuel used per animal produced | | |
|---|---|---|---|
| | Gasoline | Diesel fuel | LP gas |
| Cleaning beef feedlots with bedding used in housing— Per animal marketed | 2.25 | 1.60 | 2.70 |
| Cleaning beef feedlots, no bedding used in housing; for feedlots holding up to 1,000 cattle at one time— Per animal marketed | 1.25 | 0.90 | 1.50 |
| Cleaning beef feedlots without housing, 1,000 to 4,999 cattle on feed at one time— Per animal marketed | 0.50 | 0.35 | 0.60 |
| Cleaning beef feedlots, without housing, over 5,000 cattle on feed at one time— Per animal marketed | 0.40 | 0.30 | 0.50 |
| Cleaning dairy lots with bedding used in housing (includes scraping lots) per year— For each milk cow in herd | 6.75 | 4.85 | 8.10 |
| Cleaning dairy buildings with liquid manure collection, storage and hauling— For each milk cow in herd | 9.00 | 6.50 | 10.80 |
| Cleaning swine confinement finishing barns with liquid manure system, haul and spread— Per pig raised to market | 0.40 | 0.30 | 0.50 |
| Cleaning swine finishing barns and lots; may be bedded— Per pig raised to market | 0.30 | 0.22 | 0.35 |
| Cleaning sow housing, per year (includes cleaning farrowing house) | 2.60 | 1.90 | 3.10 |

The table indicates that 0.4 gallon of gasoline is needed to raise a market pig. It takes 0.4 gallon of gasoline to keep the liquid manure hauled from the confinement finishing house and field spread.

Growing market pigs—0.4 gal. x 800 head = 320 gallons of gasoline

Cleaning finishing building—0.4 gal. x 800 head = 320 gallons of gasoline

Estimated Annual Requirement = 640 gallons of gasoline

The amount of LP gas (propane is the most popular dryer fuel) needed to dry shelled corn can be estimated. The operator in the example planned to dry 20,000 bushels of corn. With good drying weather, 1 gallon of propane will dry 6 bushels of corn.

$$\frac{20{,}000 \text{ bushels}}{6 \text{ bu./gal.}} = 3{,}333 \text{ gallons of LP gas}$$

Now comes the judgment part of the fuel use estimates. The long-range weather forecast for his area predicts that the planting season will be "above normal" for rainfall and with "near normal" daytime temperatures.

With those conditions, a farmer needs to anticipate more fuel for planting, so should add 10 percent to the diesel fuel estimate. Adding 268 gallons to 2,684 gives 2,952 gallons of diesel fuel needed to grow the corn and soybean crops. He would not need to increase the gasoline required to raise 800 market pigs because a pig grown in confinement is not greatly affected by the weather.

If he used both diesel fuel and gasoline-burning tractors to grow the crops, he must adjust his estimates. In one example, suppose that about half of each type of fuel was used to produce corn. This means that he grew *120 acres of corn using all diesel fuel* and *120 acres using only gasoline.* So:

Corn—6.85 gal/a x 120a planted = 822 gallons of diesel fuel

Corn—9.5 gal/a x 120a planted = 1,140 gallons of gasoline

Total 240a planted

The amount of fuel burned between Jan. 1 and Dec. 31 to produce an acre of any crop might vary in different parts of Iowa or the Corn Belt due to many unforeseen conditions beyond the producer's control.

These figures provide estimates of fuel required to do jobs under typical Iowa conditions. In any given year, fuel consumption on a particular farm may be either larger or less than the values given in the tables.

## Basis for Fuel Use Estimates in Crop Production

The system used to develop the fuel use estimates was to, first, list the various field operations required to produce an acre of crop beginning with land preparation and continuing through planting and harvest into storage; then to determine the horsepower hours required for each operation and, finally, to divide the horsepower hours by the typical number of horsepower hours per gallon of gasoline to get the estimates on a gallons-per-acre basis.

The fuel consumption estimates for field operations are based on studies by the Iowa State University agricultural engineering research group. Crop production studies were conducted by James C. Frisby, formerly assistant manager, University Farm Services. All field operations were time-and-motion studies to determine typical rates of travel with various sizes of field machines, field operating efficiencies and tractor-implement size relations versus timeliness.

Fuel consumption rates by the various tractors and self-propelled implements are based on a 10-year summary of Nebraska Tractor Test data for tractors operating at 50 and 75 percent of maximum load both on power take-off and drawbar. An Illinois study disclosed that tractors operate at approximately 55 percent of maximum load while performing field work.

When determining fuel consumption rates for the various operations, the 50 to 75 percent of maximum load figures were interpolated to match field speed and type of load based on experience with farm operations. The fuel consumption rates for minimum tillage operations were evaluated in the preparation of a master's thesis by Allan J. Wald, now farming in North Dakota.

The fuel consumption estimates for the production of corn, soybeans, small grain, hay and silage have been checked against actual fuel consumption records by many Iowa farmers at the time field representatives of the Iowa Department of Revenue, Motor Vehicle Fuel Tax Division, responsible for checking refunding of gasoline taxes, audited their fuel consumption records. The Motor Vehicle Fuel Tax Division reports a close correlation between our research-based figures and actual farm performance.

## Fuel Use in Livestock Exterprises

Livestock production—particularly finishing beef, cow-calf herds, market hogs and dairy—are important livestock enterprises throughout the Corn Belt. Estimates given are based on amount of fuel needed to grind, mix, haul and deliver to the bunk the feed required to grow an animal from birth to market in the case of swine or beef cattle.

Fuel used to feed a dairy cow through 1 year's production, including the dry period, is on an annual basis. Estimates for poultry are based on amount of fuel used in the production of 100 birds.

Tons of feed required to finish meat animals and poultry and to maintain dairy cows in production were obtained from the department of animal

science at Iowa State University. These figures are based on many years of research in nutrition and production of livestock.

One of the large chore jobs with livestock is the cleaning and maintenance of buildings and lots and the handling of liquid manure from confinement livestock systems. Waste production volumes used in manure removal and hauling estimates for all farm livestock have been well established by research people working in environmental quality. Allowances were made for a system where large amounts of bedding are being used.

## Limitations

These estimates of fuel used in field crop and livestock production are based on the most reliable experimental data available and are tempered by practical experience.

The estimates given in this report are typical considering soil, field, crop and weather conditions; but the values might be adjusted 10 percent up or down providing good judgment is exercised by the farm operator.

*Some of the estimates in this publication are used by courtesy Iowa Department of Revenue, Motor Vehicle Fuel Tax Division, and* **Farm Journal.**



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