

Grain Drying Energy Use

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Introduction

Direct energy expenses (diesel, gasoline, propane, electricity) total more than \$1 billion annually for Iowa's farmers. When it's required, grain drying energy can be significant for corn. This study measured propane and electrical energy used in high-temperature bin drying of corn on the research farm.

Materials and Methods

Corn is dried in two stir-batch drying bins on the farm. Load cells under the propane tank measured weight of propane consumed, and current transducers measured electricity used for fan and stirrator use.

Corn harvest is relatively slow from small plot areas, so drying typically began with a partially full bin. Measurements were recorded from seven bin batches of about 6,000 to 8,000 bushels each at 130°F drying temperature during 2013-15.

Results and Discussion

Most of the drying energy used was 95 percent from propane with the remaining electricity used for the fan and stirrator. Propane use averaged 0.018 gal/point of grain moisture content removed per bushel of dried

corn (Table 1). Electricity used averaged 0.022 kWh per point of grain moisture removed per bushel of dried corn.

Total energy used for drying per pound of water removed from grain is a measure of energy efficiency and ranged from 2,470 to 2,960 Btu per pound of water removed.

Grain drying energy also was measured at locations in central and southwest Iowa. Considering all locations, energy used for drying increased somewhat as outdoor air temperatures decreased during drying (Figure 1).

Conclusions

Propane was the predominant energy expense for high-temperature drying. Approximately 150 gallons of propane were used per 1,000 bushels dried with incoming moisture content of 23 percent, but this value reduced to about 75 gallons per 1,000 bushels with initial moisture content of 18 percent. Energy use tended to increase with colder air temperatures.

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Table 1. Conditions and energy used for corn drying during 2013-15 at the ISU Northeast Research and Demonstration Farm, Nashua, Iowa.

Bushels	Outside	Moisture content, %		Energy per	Propane	Electricity
	temp.	Initial	Final	water removed		
	°F			Btu/lb	Gal/pt/bu ^a	kWh/pt/bu ^b
6,790	36.7	23.6	15.0	2800	0.019	0.024
7,190	42.2	23.5	14.8	2480	0.017	0.021
7,980	32.3	25.4	14.8	2910	0.020	0.018
5,884	49.5	24.4	15.2	2470	0.017	0.019
5,634	42.7	22.3	14.5	2880	0.020	0.023
7,886	44.5	20.5	14.7	2960	0.020	0.021
6,820	48.9	18.3	15.0	2750	0.016	0.025

^aGallons propane per percentage point moisture removed per bushel dried.

^bKilowatt hours per percentage point moisture removed per bushel dried.

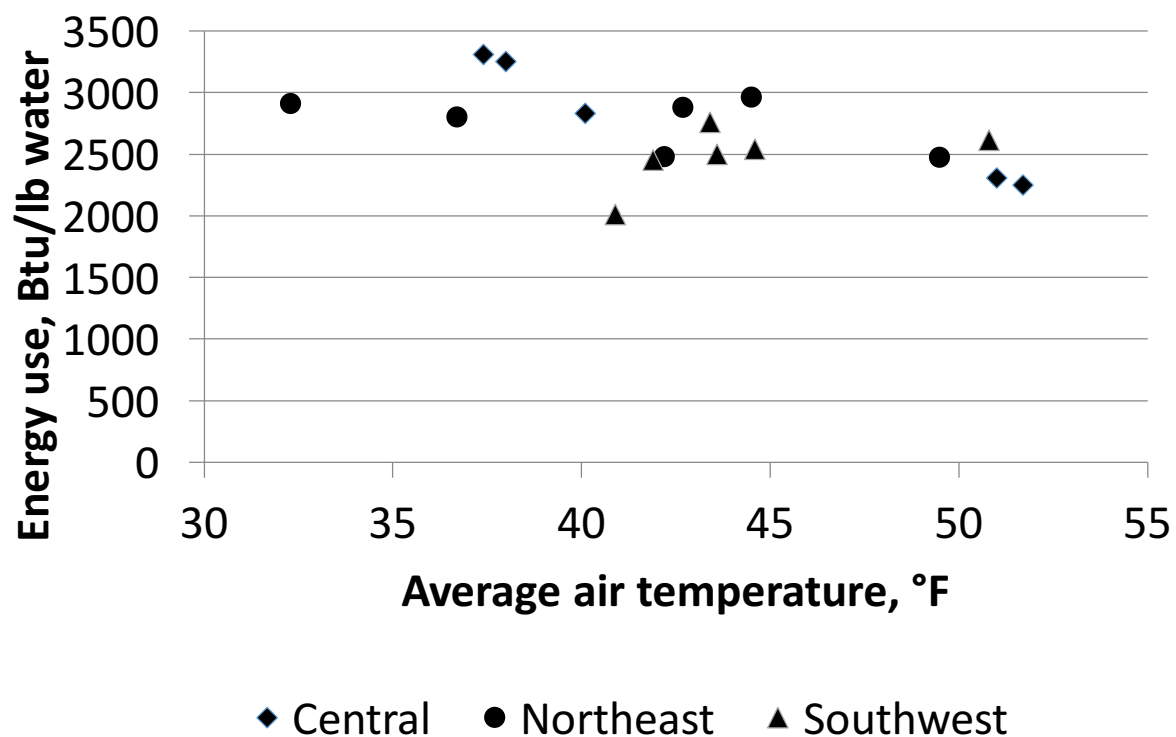


Figure 1. Energy used per pound of water removed during grain drying versus outside air temperature at the Ag 450 Farm near Ames (Central), Northeast Research Farm (Nashua), and Armstrong Research Farm near Atlantic (Southwest).