Wyoming Agricultural Economics

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Energy Use Within Agriculture

by

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The American agricultural sector has achieved a high level of production. This high level of production is the result of increases in per unit productivity of agriculture over the past three decades. As a result of this high level of production, American farmers and ranchers are able to produce abundant supplies of food not only for domestic consumption but also for export. The on-farm agricultural sector employs a small and declining percentage of the total U.S. labor force (amounting to less than 5%) and a relatively constant land base. Given a constant land base and the small percentage of the total labor force employed in agriculture, to what may the aggregate and per unit increase in productivity be attributed?

A principal factor has been the substitution of machines and fossil fuel energy for human and animal power. This has allowed less labor to farm the same land base. Also, increased use of selected inputs, such as fertilizers and pesticides have contributed to the overall increase in productivity. The feasibility of the advances mentioned above has been made possible by relatively cheap and abundant energy sources. Not only are petroleum and natural gas used to generate mechanical power, but they are also used in manufacturing fertilizers (nitrogen) and pesticides. Thus, dwindling supplies of energy, with concurrent price increases, are issues of concern to agriculturalists as well as to the general public.

Use of Energy in American Agriculture[1/]

Agriculture within the U.S. consumes a small share of total energy used by the economy, about 3 percent of the total.[2/] However, in absolute terms,

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1/ Data presented in this section were derived from Energy and U.S. Agriculture: 1974 Data Base, Vol. 2, published by the U.S. Department of Agriculture, April 1977.

2/ This is exclusive of the 13% of total energy used in processing, distribution and preparation of food.

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the level of consumption is high, amounting to an estimated 2 quadrillion Btu's (or 2,000 trillion Btu's). Of this, 89 percent was used in crop production, with the remaining 11 percent being used in livestock operations. Of the total used in agriculture, the manufacture and use of fertilizers and pesticides represent the single largest component, amounting to the equivalent of 700 trillion Btu's. The operation of machinery is second in terms of Btu equivalents (about 400 trillion Btu's).

The energy use patterns by agriculture in Wyoming are presented in Table 1. As is evident, the amounts of various types of energy used within Wyoming are a small percentage of total U.S. agricultural use, constituting less than one-half of one percent for most types of energy. For the State, the bulk of agriculture's energy use occurs within the crop sector (82 percent) with the remaining 18 percent used by livestock operators. However, the majority of this cropland is devoted to hay production, which makes the comparison of energy use between crop and livestock sectors somewhat tenuous. Wyoming's agriculture is one of the least energy intensive in the U.S., 3430 Btu's per acre, compared with the U.S. average of 5255 Btu's per acre, because of Wyoming's extensive livestock operations.

Table 1. Energy Use Patterns Within Wyoming.

Type of Energy	Amounts used in: Crop Production	Livestock Production	Total	Wyoming use as a percentage of the U.S. total
Gasoline (1000 gals)	10,924	6,652	17,576	.5
Diesel (1000 gals)	10,847	3,402	14,249	.5
L.P. Gas (1000 gals)	1,609	149	1,758	.1 1/
Natural Gas (million cf)	122	--	122	.1 1/
Electricity (million KWH)	218	9	227	.7
Btu's 2/ (billions)	6,170	1,353	7,523	.4

Source: USDA Energy and U.S. Agriculture: 1974 Data Base, Vol. 2, April 1977.

1/ Less than one-tenth of one percent.

2/ British thermal units.

The above energy consumption data are aggregative in nature. Fuel usage, for the major crops and production regions within Wyoming, is presented in Table 2. As is evident from the table, total fuel use varies widely across crops and regions. Sugar beets are the most energy intensive crop in terms of fuel usage, followed by corn silage and dry beans. The South-East production region uses less fuel per cropped acre than other production regions. Given such differentials, one might expect various adjustments in cropping patterns in response to rising energy costs or reduced fuel supplies.

Effects of Energy Cost Increases

One reason for agriculture's dependence on various fossil fuels is the relatively low price structure for fuel that existed during the last three decades. While fuel prices in general have escalated since 1973, prior to that time the real cost of energy actually decreased. It is not surprising, therefore, that agricultural producers would be motivated to use energy-intensive inputs. In fact, certain government policies such as controlling the price of natural gas, have contributed to the widespread dependence on this form of energy. As a result, the current structure of agriculture is capital and energy intensive, and even in the face of rising energy prices farmers are not likely to make a significant change in the short run, until current capital is depreciated. Further, because energy has been relatively cheap, the percent of total production costs attributable to energy inputs has been rather low, in the range of 5-10%. While energy costs have risen more rapidly than the Consumer Price Index since 1973, energy is still a relatively small percent of total costs.

Table 2. Summary of Fuel Requirements for Wyoming Crops.

Crop	Worland Gas	Worland Diesel	Riverton Gas	Riverton Diesel	Powell Gas	Powell Diesel	S.E. Wyoming Gas	S.E. Wyoming Diesel
	Gallons per acre							
Sugar beets	9.63	47.39	--	--	10.60	49.80	7.46	36.11
Corn for grain	4.17	20.76	5.98	20.70	--	--	8.22	15.34
Corn for silage	6.27	32.64	5.90	31.00	9.10	25.70	7.91	26.92
Dry beans	5.80	23.81	6.01	24.15	10.60	21.30	8.76	20.40
Barley	3.98	9.10	6.09	15.91	12.50	3.20	10.29	8.29
Alfalfa (baled)	6.35	13.12	4.72	12.98	--	--	8.00	13.71
Alfalfa (cubed)	--	--	6.96	10.96	7.50	10.50	8.60	11.63
Alfalfa (loose)	6.35	12.73	--	--	--	--	--	--
Potatoes	--	--	--	--	--	--	3.56 1/	20.22 1/
Irrigated Pasture	--	--	--	--	--	--	2.00 1/	.98 1/

Source: University of Wyoming, College of Agriculture, Bulletins 644, 619R, 642 & 665.

1/ Fuel use under sprinkler irrigation systems. All other crops are assumed to be surface irrigated. Petroleum fuels for pumping water, if any, are not included.

What then are the consequences of rising energy costs due to reduced supplies? The answer to this question is rather complex and depends somewhat on individual perspective. Some researchers argue that current, energy extensive agricultural practices are ecologically unsound and therefore any event which reduces total energy use is beneficial to society in the long run. However, this viewpoint tends to ignore the implications of probable reduced food production and resulting higher food prices for the consumer as well as potential negative impacts on the economic development of other countries.

Research dealing with the economic effects of rising energy costs found that the effects will be felt by both producers and consumers, depending on the nature of the crop or commodity being produced. For example, producers of feed grains and cotton on the plains of Texas and Oklahoma are forecast to suffer greatly reduced returns in the face of rising energy prices, because most acreage in this region is irrigated by pumping from deep wells. Thus, while these plains producers may be forced to adopt less profitable cropping practices, producers in areas less dependent on deep pumping may increase their market share of these crops at the expense of Texas and Oklahoma producers. This observation would hold for parts of Wyoming such as the southeastern part, that rely on ground water supplies. Similarly, a study in California found that for many vegetable commodities, the effects of rising prices and reduced quantities of energy may adversely affect consumers more than producers, through much higher market prices resulting from the nature of the market for most agricultural crops and the concentration of production within the region.

Within Wyoming, the net effects of rising energy prices are uncertain, but one may hypothesize that for most commodities the overall effect will be reduced net returns, unless offset by an increase in the price of the commodities. Generally, producers have few alternatives to the use of fossil fuel energy. A study of the impacts of reduced energy supplies on the Big Horn Basin of Wyoming found that producers will be better off to pay higher prices than to do without the energy. Thus, while the incentive to conserve will increase with rising fuel prices, producers will continue to use conventional energy sources to carry out their operations.

In the short run, producers may expect to see higher energy prices, which will have to be absorbed as part of total operating costs. However, given the importance of stable food supplies, both domestically and abroad, government policies aimed at preventing energy shortages at the farm level may be particularly beneficial to society.