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Energy Conservation in Corn Production

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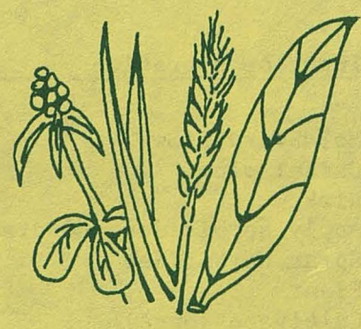

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On-farm production of food and fiber uses about 3% of the annual U.S. energy consumption. About one-third of this energy is directly from fossil fuels used in farm tractors and trucks and for crop drying, while about one-fourth is used in manufacturing and transporting fertilizers. Tillage and N fertilizers are the two largest uses of energy in non-irrigated production of crops which are not dried artifically. Thus, the greatest effects of energy conservation can be achieved in these two areas.

Agriculture produces large quantities of chemically combined energy from the sun in the form of agricultural products--food, feed, oil, fiber, wood and wood products and crop residues. In the case of most crops, energy of the products greatly exceeds the cultural energy required in producing the crop. Because of this, the concept of energy conservation should be mainly one of the improving efficiency in the use of energy and not necessarily less energy use. Attempts to save energy which result in decreased crop yields would be self-defeating.

Energy Conservation through Tillage

Table 1 compares estimated energy requirements for certain inputs and field operations normally associated with corn production by four tillage systems. Four important observations can be made from the table. (1) Of the commonly used primary tillage implements, the moldboard plow requires the most energy, the chisel plow is intermediate, and the disk requires the least. (2) As tillage is decreased, requirements of herbicides increase, but the additional energy required for the herbicides is more than offset by the lower fuel requirements due to reduced tillage. (3) Less machinery is needed for reduced tillage systems, especially no-tillage. (4) Energy requirements with reduced and no-tillage is lower than with conventional tillage, as shown by the lower total values.

Energy Efficiency in Nitrogen Fertilizer Management

Production of N fertilizer requires high amounts of energy; therefore, opportunities are good for conserving energy through improved efficiency in its use. About one-sixth gallon diesel fuel equivalent (DFE) is required to manufacture and transport a pound of fertilizer N. If applied at a rate of 150 lb/acre, N fertilizer alone would account for about 25 gal/acre DFE energy inputs. This is more than three times the amount of energy

Table 1. Estimated Energy Requirements for Several Inputs and Field Operations in Four Tillage Systems

Input or operation	Tillage system			
	Conv. tillage	Chisel plow	Disk	No-Tillage
	------ diesel fuel equivalent, gal/acre -------			
Moldboard plow	1.84			
Chisel plow		1.12		
Disk	0.63	0.63	0.63	
Apply herbicides and disk	0.73	0.73	0.73	
Spray herbicides				0.13
Plant	0.43	0.43	0.43	0.50
Cultivate (once)	0.42	0.42	0.42	
Herbicides	1.75	2.01	2.25	2.88
Machinery and repair	1.86	1.61	1.25	0.60
Total	7.66	6.95	5.71	4.11
Percent of conventional tillage	100%	91%	75%	54%

Source: W. W. Frye and S. H. Phillips. How to grow crops with less energy. 1980 Yearbook of Agriculture. Cutting Energy Costs. p. 16-24.

inputs required for tillage-related operations and inputs using conventional tillage and more than six times greater than that required with no-tillage, as shown in Table 1.

Research results on four soils in Kentucky showed that energy efficiency of N fertilizer (energy output in yield/energy input in N fertilizer) was greater in no-tillage than conventional tillage corn. The average energy efficiency values with 150 lb/acre N were 6.7 with no-tillage and 2.3 with conventional tillage.

Generally, N fertilizer is more efficient if applied near the time when the crop begins to take up the N rapidly. For corn, this means that delaying application of all or most of the N until the corn is about 4 to 6 weeks of age may improve the efficiency on certain soils. In Kentucky, it is recommended that N fertilizer for corn be decreased by 35 lb/acre if as much as two-thirds of the N is applied 4 to 6 weeks after planting no-tillage corn on moderately well drained soils or conventional tillage corn on moderately well and poorly drained soils. In terms of DFE of energy conserved, this is about 5.8 gal/acre.

A substantial savings of energy can be gained by using no-tillage and by improving the efficiency of N fertilizers. In terms of the total U.S. energy budget, the savings seem very small, but they may be quite significant for an individual farmer.