CHAPTER 6

Energy for Agriculture¹
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Modern agriculture strongly relies on fossil fuels and electricity. During the past 40 years, striking gains in productivity have occurred chiefly as the result of energy-dependent technological advances: fertilizers, other agricultural chemicals, and new mechanization for production, processing, and storage. About 43% of the yield gain in midwestern corn (Zea mays L.) hybrids over the past 40 years has been attributed to adoption of new technology (Duvick, 1977). For wheat (Triticum aestivum L.) grown in New York state, 51% of the yield gain in the last 40 years has been attributed to adoption of new technology (Jensen, 1978). In both examples genetic gain contributed the remaining yield advance. Adoption of new technology has propelled U.S. agriculture into third place (Heichel, 1974) among the industrial consumers of energy (Table 1). Only the steel industry and petroleum refining have a larger energy demand.

The 2.8% of the U.S. energy consumption used in agricultural production seems modest compared with the 24% used in transportation, and the 43% used in other industrial production enterprises. Despite agriculture's modest energy use, we are uncertain about what will happen to productivity as the flow of fossil fuels inevitably lessens. I will attempt to sharpen our view of the future by reviewing how the organization of crop production moderates its energy use patterns, by giving a perspective of present agricultural energy use and energy analysis techniques, and by examining some possible future energy use and energy research patterns for agriculture.

THE GEOMETRY AND TIMING OF CROP PRODUCTION

The fact that crop plants are immobile gives agriculture a geometry separate from that of other industries. More intensive industries have improved efficiency by bringing fuels, materials, and manpower together in the closely knit geometry called mass production. Although this concept can be applied to intensive animal production, it fails when applied to crop production. Crops can be congregated just so much and no more. They must be spaced over the land in a regular pattern so that they can capture enough sunlight and carbon dioxide to produce a crop. Clearly

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