UNIVERSITY OF FLORIDA
Florida Cooperative Extension Service

Fact Sheet EES-79
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Energy in Florida Agriculture[1]

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INTRODUCTION

The data presented in this fact sheet were developed using the Florida Agricultural Energy Consumption Model (FAECM), a computer model. FAECM uses acres of production or livestock numbers and the energy used to make the production inputs required per acre or per head to quantify the primary energy used in Florida for agricultural production. This primary energy consumption included fuels, lubricants and electricity, called direct energy inputs, as well as the energy used in providing all production inputs (indirect energy inputs).

It takes energy to drill an oil well, pump the crude oil out, refine it and transport the diesel fuel to the grower. It takes the energy in the natural gas feedstock plus the energy used to construct the production plant, power the production plant and drive the truck to get the nitrogen fertilizer to the grower. FAECM quantifies the eight direct energy sources (diesel fuel, LP gas, etc.), the indirect energy used to make those eight energy sources available and the indirect energy used to provide thirteen major agricultural inputs (nitrogen fertilizer, pesticides, etc.) to determine the energy required to produce agricultural commodities in Florida.

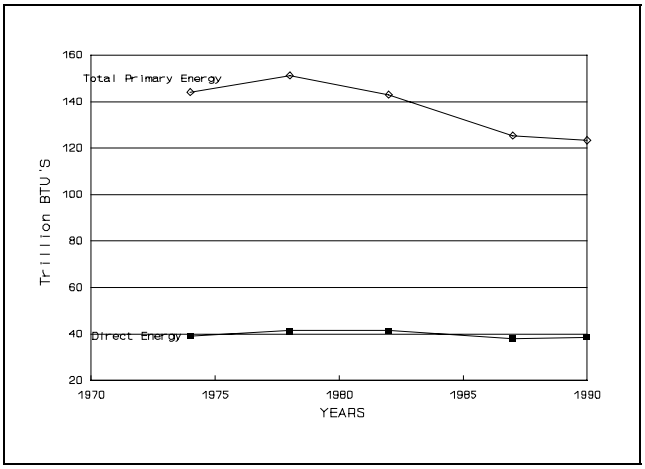

Figure 1. Florida agriculture production energy.

In total, FAECM predicts all the energy required to provide all inputs necessary, up to the farm gate, for all of Florida's agricultural producition using current management practices. FAECM does not address energy requirements for any transportation, packing, processing, distribution or other function provided for agricultural commodities after they leave the farm gate.

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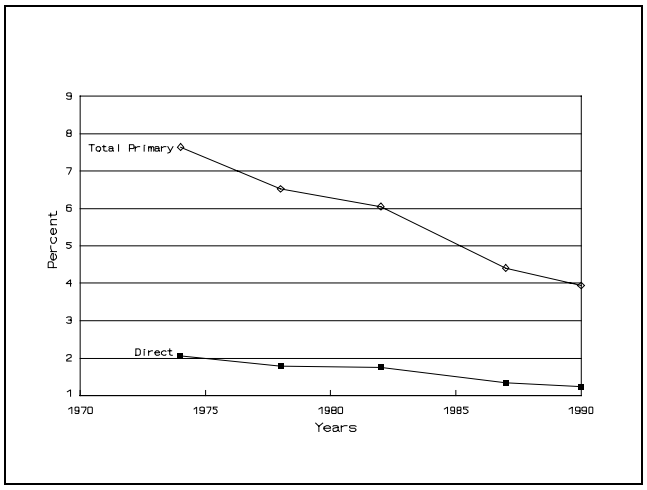

Figure 2. Direct and Total Primary Energy for Agricultural Production

ENERGY INVESTMENTS

The direct energy used by Florida agricultural production has remained relatively constant since 1974 (Figure 1). The total amount of direct energy used in agricultural production in Florida in 1990 was 38.70 trillion Btu, 7.7 percent of the energy consumed in Florida's industrial sector. Direct energy used in agricultural production increased from 39.09 trillion Btu in 1974 to 41.55 trillion Btu in 1982 before decreasing to 1990 levels. Variations in direct energy consump tion have been caused mainly by changes in production levels and a changing mix of commodities produced.

The difference between the direct energy used and the primary energy used is the indirect energy requirement which was 2.31 times the direct energy used for Florida agricultural production in 1990. The natural inclination, when thinking of energy, is to focus on direct energy inputs, but the unseen indirect energy is just as essential as and much larger than the more visible direct energy requirement.

The primary energy used in agricultural production in Florida was 128.25 trillion Btu in 1990, equal to 25 percent of the energy consumed in Florida's industrial sector (Figure 1). The reduction in total primary energy use was due primarily to the increased energy efficiency of the industrial production of agricultural production inputs.

Florida consumed 66 percent more energy in 1990 than in 1974, due in large measure to its increasing population. Florida agricultural production energy, expressed as a percentage of the rapidly increasing total energy consumption, has decreased (Figure 2). In 1974 the primary energy used in agricultural production in Florida up to the farm gate was almost 8 percent of all the energy consumed in Florida for all purposes including industrial, commercial, residential and transportation. The primary energy used in agricultural production was 3.9 percent of all the energy consumed in Florida for all purposes in 1990.

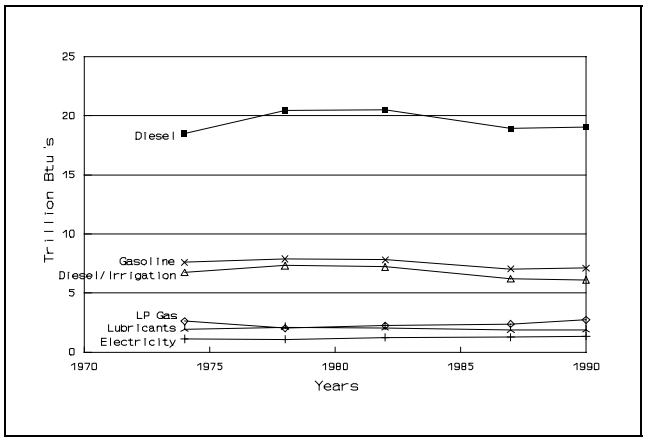

Figure 3. Direct energy requirements for Florida agricultural production.

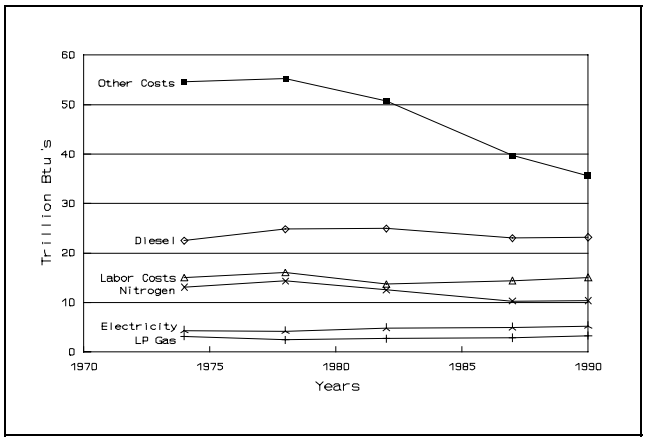

Figure 4. Total primary energy requirements for Florida agricultural production.

Florida agriculture runs on liquid fuels; diesel fuel and gasoline account for 81.5 percent of the direct energy requirements for production agriculture (Figure 3). Direct energy requirements for irrigation account for 16.8 percent of all direct energy inputs.

Other Costs (capital improvements, machinery, repairs, purchased feed, containers, etc.) make up 28.9 percent of the total primary energy in Florida agricultural production (Figure 4). Other Costs, diesel fuel, labor, nitrogen, gasoline and electricity not used

for irrigation account for 84.8 percent of the total

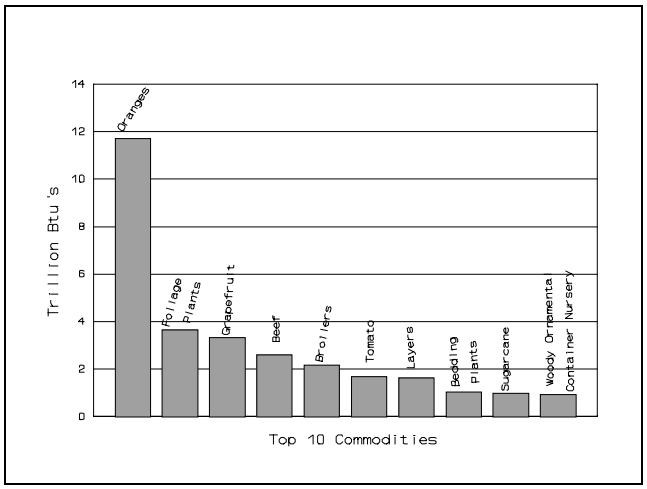

Figure 5. Direct energy requirements, 1990.

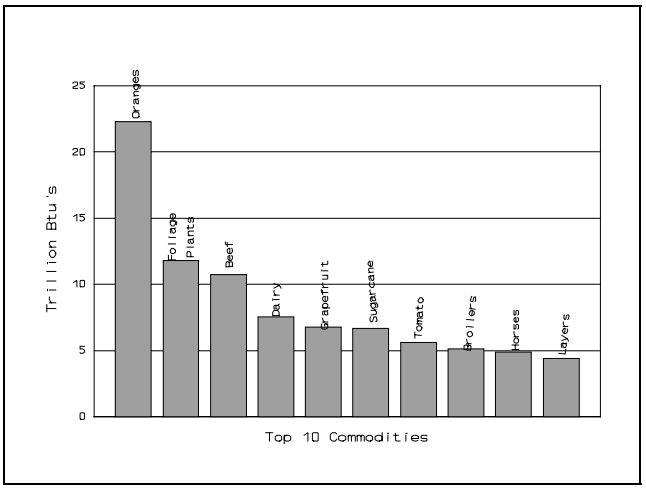

Figure 6. Total primary energy requirements, 1990.

Table 1. Direct Energy Production Requirements

	Direct Energy (trillion Btu)	Percent (%)
Oranges	11.7	30.3
Foliage	3.65	9.4
Grapefruit	3.34	8.6
Beef	2.60	6.7
Broilers	2.17	5.6
Tomatoes	1.67	4.3
Layers	1.65	4.3
Bedding plants	1.03	2.7
Sugarcane	0.98	2.5
Container nursery	0.93	2.4

Table 2. Primary Energy Production Requirements

	Primary Energy (trillion Btu)	Percent (%)
Oranges	22.3	18.1
Foliage	11.8	9.6
Beef	10.7	8.7
Dairy	7.54	6.1
Grapefruit	6.75	5.5
Sugarcane	6.68	5.4
Tomatoes	5.61	4.6
Broilers	5.12	4.2
Horses	4.86	3.9
Layers	4.39	3.6

primary energy required for Florida agricultural production. Labor is the third largest energy input, revealing the heavy reliance of Florida agriculture on labor. Nitrogen, the fertilizer element requiring the most energy, makes the production of high-value crops on sandy soils possible.

ENERGY INVESTED STATE WIDE

The energy invested in a commodity state wide depends on the energy used to produce an acre or other unit of the commodity and the number of acres invested or units produced in the state. On a state wide basis, oranges used 30.3 percent of the direct energy consumed in production agriculture. Foliage production in the state ranked second in direct energy use (Table 1, Figures 5 and 6).

On a state-wide basis, orange production used 18.1 percent of the total primary energy used in production agriculture in Florida. Beef production ranked third in total primary energy use (Table 2).

ENERGY INVESTED PER UNIT PRODUCED

An acre of the average crop produced in Florida in 1990 required 13.3 million Btu of direct energy and 38.0 million Btu of total primary energy. Production of bedding plants, Central Florida foliage and greenhouse vegetables required about 1.25 billion Btu of

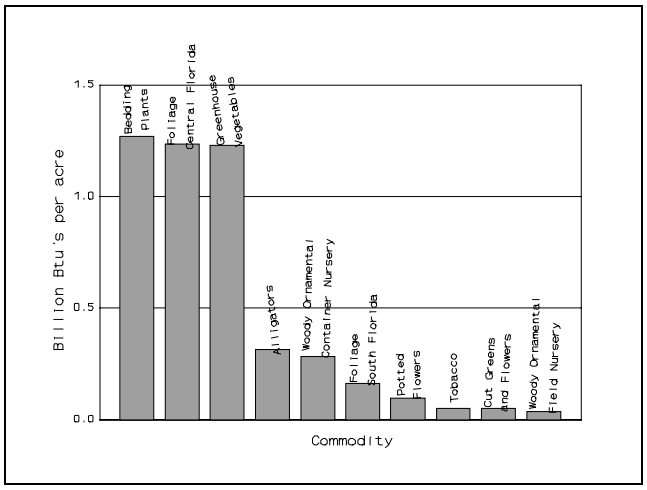

Figure 7. Top 10 commodities, direct energy per acre.

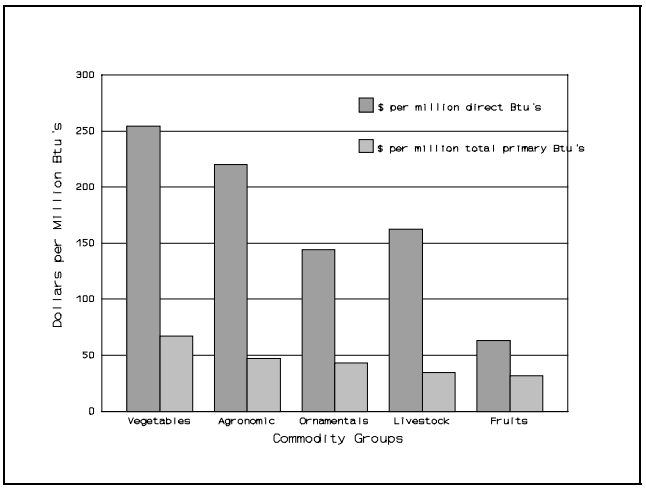

Figure 9. Economic return by commodity type.

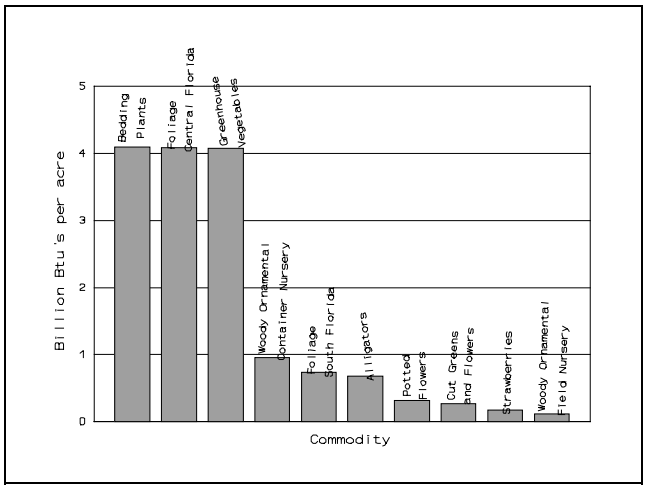

Figure 8. Top 10 commodities, primary energy per acre.

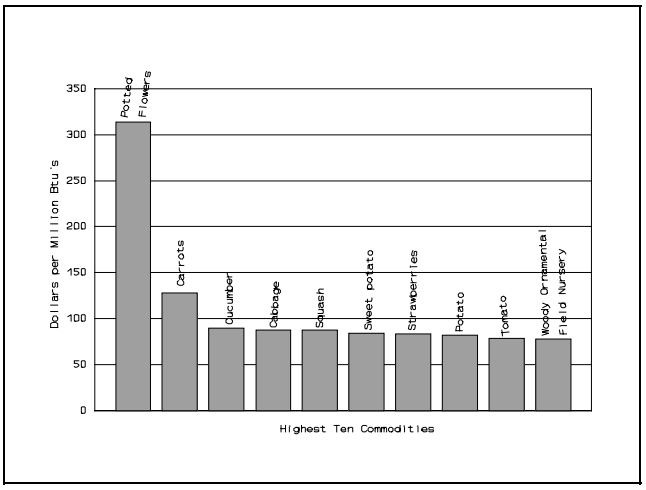

Figure 10. Dollar value per primary energy investment, top 10 commodities.

direct energy inputs per acre (Figure 7). Bedding plants, Central Florida foliage and greenhouse vegetables were also the most primary energy intensive crops produced in Florida; production of all three used over 4 billion Btu of primary energy per acre. Foliage grown in Central Florida used five times the amount of primary energy used by foliage grown in South Florida. Woody ornamentals grown in a container nursery use seven times the primary energy used by woody ornamentals grown in a field nursery (Figure 8).

ENERGY EFFICIENCY

One possible approach to evaluate the energy efficiency of agricultural production systems may be to compare the dollar value of the commodity to the energy required to produce it. The average agricultural commodity grown in Florida had a value of $136 per million Btu of direct energy used to produce it in 1990. The economic return to the primary energy investment was $44 per million Btu.

As a group, vegetables produced the highest economic return for both direct and primary energy investments (Figure 9). On an individual basis, the dollar value of dairy products per direct energy investment was the highest, and, for total primary energy, potted flowers gave the highest return (Figure 10).