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A Healthy Ecosystem

Recent concerns with fuel reserves, production, price, and availability are reminiscent of the fuel crisis of the 1970's. How do increased prices and decreased availability of fuel influence the turf industry?

Energy Crisis? It's Déjà Vu All Over Again

A strong economy has lead to significant increases in disposable income in the US. In turn, the turf industry has benefited with new construction and enhanced budgets at existing facilities. However, recent concerns with fuel reserves, production, and the influence on price and availability are reminiscent of the fuel crisis and sluggish economy of the 1970's. How would increased prices and decreased availability of fuel influence the turf industry?

Turfgrass management requires a significant amount of fuel (nonrenewable energy) for the production of fertilizers and pesticides, equipment use, and irrigation. A 1980 National Academy of Science Committee Report suggests that world production of oil and gas was expected to peak by the end of the 20th century, followed by increased prices and strained reserves. It appears that based on the current situation, their prediction was correct.

Environmentally, there are additional costs associated with carbon emissions from gas powered equipment. Ten years ago scientists from around the world gathered at the Intergovernmental Panel on Climate Change and concluded that as a result of human activities the earth's temperature will increase a few degrees in the next decade. This point of view was initially considered controversial without significant scientific support. However, a host of recent measurements have supported the exact conclusion that the earth is warming.

Presidential candidate Al Gore has raised the public discussion of the issue of global warming in his book, *Earth in the Balance*. This book has been attacked in the turfgrass trade literature for being extremist. Consequently, many in our industry oppose a Gore Administration, fearing an increase in environmental regulation. Regardless of who becomes president, the turf industry should be aware of the economic and environmental aspects of nonrenewable energy consumption.

An Energy Sink

A chapter in the *1992 Turfgrass Monograph* from the American Society of Agronomy reviewed the issue of energy use and turfgrass maintenance. The authors suggest that the portrayal of the excesses of turfgrasses and its ultimate futility are only one side of the energy issue. They contend that there is a great need for the industry to always strive to reduce the use of nonrenewable energy, improve the public's understanding of the benefits of turf, and recognize that little information exists on the costs and benefits of turf.

Technological advances in the areas of mowing, fertilization, irrigation, and pest control have been emphasized, though without recognizing the energy associated with each practice. In the last several decades, mowing equipment has been used more extensively and more frequently, including mowing areas several times a week, sometimes twice or three

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Energy Crisis?

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In fact, on a per unit area basis, the maintenance of edges and borders is more energy intensive than mowing large areas. A 1983 study conducted in Utah demonstrated how almost 50% of the labor spent on mowing was for edging and trimming, in spite of the fact that it performed only half as much.

times per day. Petroleum-based synthetic pesticides and fertilizers as well as plastic irrigation equipment are commonplace and enable us to have higher quality turf.

A Florida study from 1974, published in the "Journal of Environmental Systems" found that compared to all other managed turfgrass areas (sports fields, home lawns, corporate parks, airports), golf courses have the highest costs per unit area from both an economic and energy perspective. This was confirmed in a California study published in the journal "Ecology" where energy costs were determined. In that study, the total energy use was similar to the Florida study, however, almost 70% of all the energy used for turf management was for irrigation.

Interestingly, in both studies, home lawns had the next highest energy and economic costs per unit area. Still, most scientists who study this area agree that completely eliminating turf is not likely to reduce overall energy consumption as result of the important benefits of a turf area.

Mowing Energy

The Florida energy study indicated that mowing accounts for 50% of the energy used in turfgrass management. Interestingly, only 2-14% of the energy is used for cutting the grass leaf. The remainder goes to throwing the leaf and to engine inefficiency. Nearly 25% of the energy cost of mowing is associated with the manufacture and purchase of the equipment, with the remaining 75% attributed to motor and drive train losses and moving air. Energy use is increased when the grass is mowed wet rather than dry.

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The old saying the "devil is in the details" is very true when considering energy costs for detailing (edging) turf areas. In fact, on a per unit area basis, the maintenance of edges and borders is more energy intensive than mowing large areas. A 1983 study conducted in Utah demonstrated how almost 50% of the labor spent on mowing was for edging and trimming, in spite of the fact that it performed only half as much.

I can remember being "attached" to a gas-powered line trimmer for weeks at a time, trimming around trees, ball washers, sand traps and difficult to mow areas such as hillsides. Given the energy inefficiency of this cutting, substantial savings could be realized if superintendents simply reduced the need for such edging. Planting ground cover and removing trees would help. So, too, would adopting a scruffier, more classical look.

Food, Water and Pests

During the mid-1970s, the price of ammonia used for fertilization more than doubled. As a result, fertilizer prices also increased. In fact, fertilizers have twice the energy per dollar value as the equipment used to manage turf. Even though much less is spent on fertilizers compared to a $25,000 mower, the energy needed to produce the fertilizer based on what you pay for it is considerable higher than the

Battery-operated mowers may offer substantial reductions in the pollution associated with mowing, especially if the power used to charge the mower does not come from coal burning facilities.

Pesticide application is an extremely energy intensive process, however, the activity of the chemicals at low rates does compensate for high energy production costs.

energy that the equipment consumes. Clearly, reducing the use of fertilizer has direct energy savings, but also indirect savings by reducing turf growth that would require additional mowing. Also, proper timing of application to promote color and turf health without stimulating top growth is an important energy saving measure that would also include the use of iron for improved turf color.

The California energy study found that 70% of all the energy used for turfgrass maintenance was used for irrigation—more than in Florida. This was related to the energy intensive nature of using municipal water. Even in Florida, energy for irrigation exceeded that expended for fertilization. There are a variety of other factors that influence energy consumption for irrigation including the use of variable frequency drive motor control and low pressure heads that have been shown to reduce energy requirements significantly. Application uniformity is often overlooked as an element of design. It might cost more up front to add irrigation heads, but the result might well be greater energy efficiency in the long term. The increased use of effluent water has not been evaluated from an energy perspective, but is likely to add some energy efficiency to our irrigation practices, provided it is not pumped great distances.

Pesticide manufacturing is the highest energy consuming practice on a weight basis of all agricultural inputs. In fact, the energy for production is 2 to 4 times greater than that for fertilizers. This includes the production of the active ingredient and the energy used for formulating the product, often with a petroleum based formulant. However, the high level of activity at low amounts of pesticides and selectivity provide other benefits that could reduce energy use, such as for weed control that would require enormous amounts of labor and energy.

Crucial in the pesticide and energy use discussion are intensive preventive strategies, especially for insecticide use. This argues strongly for a more Integrated Pest Management approach to soil insect control, one that emphasizes prevention rather than cure. This effort alone could save substantial energy on many courses with the increased use of preventive materials such as imidacloprid (Merit).

Energy Conservation

Very little research has been conducted on energy conserving turfgrass management. We are generally concerned with pest control and other measures which produce improved turfgrass quality and aesthetics. In the industry, how many turf managers take the time to review annual maintenance for energy use? Records like this might reveal how much energy use has increased over the years as use has increased. At this point in time, in real dollars the additional cost for energy may not be prohibitive. But at some point it might be.

Audubon International includes energy efficiency as a component of its Cooperative Sanctuary and Signature Programs. These programs not only look at the turfgrass area, but also at the entire facility management—an important clarification when viewing energy costs and evaluating efficiency. Nevertheless, we have significant challenges and opportunities ahead of us in the area of energy efficiency.

Frank S. Rossi

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