

How Vegetable Growers Can Cut Energy Costs

By R. E. Gomez and D. J. Cotter

Producers are supplying consumers year-round with an abundance of fresh and processed nutritious vegetables. The commercial vegetable enterprise is very large, occupying about 3.3 million acres in 1980. While this is an increase of only about 75,000 acres since 1970, the total value has increased from \$1.65 billion in 1970 to \$3.08 billion in 1980.

About three-fourths of commercial vegetable production goes to fresh market outlets while one-fourth is processed. Both types of production are energy-intensive.

During the 1970's a study in California showed that fresh vegetable production required, on the average, 1.5 calories of fuel and electrical energy for each food calorie produced. Canned vegetables consumed 4.4 calories and frozen vegetables 5.2 calories, excluding energy in the containers.

Conservation is fast becoming an economic necessity because vegetable production does require large quantities of energy. It must be remembered, however, that nonedible calories are transformed into edible ones and that some processed foods require fewer energy inputs when prepared in the home.

Vegetable producers should plan carefully on matters affecting energy and income. For example, is it better to specialize in one crop and benefit from production efficiencies, or produce several and spread the risk of crop loss and market failure?

Many factors need to be considered, such as crop rotation and succession, type of crops, varieties, equipment and energy needs, labor requirements, water and nutrient availability and cost, and pest management programs. By carefully examining each farm enterprise and the crops, producers can make farming less chancy and more energy-effective.

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New Ways to Measure Yields

Since the fresh vegetable producer does not have a price guarantee, the best means a producer has to assure profits is to strive for high yields at the right time. For many years vegetable production efficiency has been measured by yield per acre. In the future we will also measure production efficiency in terms of yield per quantity of water (mainly in the West) and yield per unit of energy input.

Energy conservation begins with records. They must be kept so that decisions can be made. Some of the important records are: a) location of each crop planted; b) date and yield; c) pesticide application (type, amount, results); d) fertilizer application (amount, date, results); e) soil analyses (prior to and after crop harvest); f) machinery time per operation; and g) fuel costs. The more complete the records, the better the decision you can make.

Crop succession and rotation influence energy input by affecting weeds, diseases, and insects as well as nutrient requirements of the future crops. Consulting experts in horticulture, weed control, plant pathology, and entomology as to the possible rotational effects on pests and soils will enable the producer to draw up a final schedule for crops.

Similar crops are often hosts to the same insects and diseases. Even some nonrelated crops act as hosts to the same pests. In some cases, a pest organism may always be present and its effect on crop plants must be minimized by variety selection and/or cultural practices.

More Data Needed on Irrigation

Irrigation (where necessary) increases yields and quality, but also contributes to production costs and energy expenditure. Use of water by many vegetable crops has not yet been tallied up. Only when data are available can a producer reasonably predict the amount of water needed for his crop. Careful water monitoring with tensiometers or other types of measuring devices can give a producer a better picture of irrigation needs.

Trickle, drip, or subsurface irrigation systems have not been used extensively on most vegetable crops. More experimental testing by commercial operators is warranted. Even though the initial cost seems high, these techniques can help decrease the amount of water, nutrients, and pesticides needed, and can also be used for salinity management in areas with salt problems.

In the arid areas of the West or where irrigation is needed for germination and early plant development, accurate soil leveling would be a way to save energy, water, and labor costs. Technology changes

such as laser land leveling should be considered by both large and small producers. When a field is properly leveled it is less prone to flooding and to certain diseases. Efficient use of fertilizers, particularly nitrogen, is enhanced by applying the right amount of water coupled with the correct distribution of that water.

Adding Organic Matter

During soil preparation, adding organic matter such as crop residues or manures can benefit soil structure and water and nutrient holding capacities. Organic matter added to soil is particularly important to promote better growth and development. Proper growth makes for more efficient use of water and nutrients.

Soil analyses can be used to predict nutrient needs, organic matter requirements, and to estimate water requirements and frequency of waterings. These analyses are run by many Land-Grant Universities and a host of private laboratories throughout the United States.

Planting pregerminated seed can also improve stands and yield even though it is costlier than dry-seeding methods. Pregerminated seed, along with precise planting techniques, can reduce the amount of labor at thinning, the amount of water required, and the time between planting and emergence. Similarly, using high quality viable seed enables a grower to select a lower seeding rate to reduce cost.

Mulching for weed control, moisture retention, and earliness can also reduce unit energy input by increasing yields. Plastic mulches, however, are oil based and require energy in their manufacture and in field application.

A grower must choose among the trade offs — to mulch or not, to use plastic or not, or whether to use organic mulches. The latter approach is ideal in summer but delays soil warming and crop growth when applied early in spring.

Capping

Pre-irrigation and planting seed in moist soils followed by covering seed with two to four inches of soil on the seed beds (capping) should also be considered. These techniques have been used extensively in some field crops and have been tried successfully in some vegetable production areas. However, small seeded crops cannot be planted in this manner.

High density planted, single harvest, short-season varieties will also play an important role in the near future.

Mechanical harvesting promises to change fresh

vegetable production drastically. A major benefit to the grower is that peak labor requirements are reduced. Producers can, therefore, predict schedules and better use available labor on a continual rather than sporadic basis.

While the shortrun effect on labor may be viewed as detrimental, in the longrun farm labor is more highly paid and work productivity remains high.

Plant geneticists and breeders often foresee some of the changes before they take place. Their foresight results in a timely array of varieties adapted to the new constraints and opportunities of the times and are often more palatable to the consumer.

Vegetables For Small Families

One recent societal trend is towards smaller families and consuming groups, single-parent families, couples, and retirees. Development of vegetables small enough to be used by single people or couples should also be of prime importance to plant breeders.

The vegetable producer must start to think in terms of a yet more intensive type of crop culture — multiple or sequence cropping. Properly researched techniques that enable more to be planted in a given area can lead to lower costs of production and lower consumption of energy.

Early application of pesticides may be warranted to preserve a desired plant population, especially when crops are precision planted. Encapsulating seed with nutrients, particularly phosphorus or micronutrients or pesticides, coupled with precision planting, has a great future for tomorrow's vegetable producer.

Integrated pest management holds a legitimate and important place in the vegetable farmer's operation. By using established levels in managing pests efficiently, the producer can sometimes cut down on use of pesticides. This will have a marked effect on the production costs, and also reduce overall energy expenditures of the Nation. The other beneficiary is the environment. Pesticides are necessary to assure plentiful food, but a clean healthful environment benefits us also.

Low volume or ultra low volume spraying for pest control should be considered for use on a wider scale, and in conjunction with pest monitoring and biological control. Cost levels need to be followed closely.

The right pesticide must be used and the correct amount at the right time to attain desired results and cause least possible impact on the environment.

Instructions on labels as well as State and Federal usage regulations must be followed.

Minimum Till Culture

No-till or minimum till culture can take place if plant canopies can be developed quickly and densely enough to shade out weeds. Therefore, high density plantings can contribute to energy and production cost savings.

Fertilizer efficiency needs to be investigated further, especially of those nutrients readily moved by water. Soluble fertilizer materials in irrigation water can save costs for growers who apply small amounts at the appropriate plant development stage.

Not much is known about when and how much should be applied at what growth stage. New techniques will allow growers to improve the timing. Again, the producers, researchers, and Extension personnel, working as a team solving plant nutrient problems, can bring about a more enlightened attitude towards energy and resource conservation.

Too much fertilizer not only is a waste of material, but could result in reduced yields and hurt other plant growth and development processes. Further excesses can become hazards to the environment.

Minimizing Transport Expenses

Another way to save energy costs on a nationwide scale is to minimize transportation requirements and costs. One method is to produce a large assortment of vegetables regionally to meet most needs. This is contrary to today's criteria of growing crops in regions where they are best adapted. But if energy and transportation costs become high enough, long distance transport may become prohibitive.

Direct marketing offers another avenue for energy savings, especially for local producers. The internal quality of much locally grown produce is excellent. Many consumers are willing to accept vegetables of lower external quality if they know the internal quality is as good or better than in produce available through traditional outlets. Direct marketing could effect an attitude change in this paradox between internal and external quality requirements.

The Land-Grant Universities, through research and Extension, have a responsibility to present information to make the public aware of nutritional aspects of the various vegetables and the possibility of substituting one vegetable for another. Educational programs will have to be increased and made available for more people.

To sum up, energy is used either directly by the producer in fuel for vehicles and other equipment, pumps, and graders, or indirectly in the form of fertilizers, organic matter, pesticides, irrigation equipment, and plastic mulches. Labor also contributes to energy costs. Therefore, there are many direct and many more indirect energy costs which could be reduced with proper planning and execution. With energy savings, we could still produce vegetables efficiently and remain competitive with other areas of the world.

Tips on Energy Saving For the Home Gardener

By Ricardo E. Gomez

Since the early 1970's there has been an increasing trend towards more gardening activities around the home. A total of 77 percent of households are engaged in the care of some type of plants.

Even though each individual area is small, the aggregate areas of plants around the home is large. For example, the average home vegetable garden is around 600 square feet, yet the total area devoted to home grown vegetables is comparable to that used in California for the commercial vegetable industry.

Energy savings in such individually small areas seem negligible. But when taken as a whole they can't be disregarded. So all homeowners share the responsibility of using energy efficiently.

Energy is used as fuel for lawnmowers and other equipment, to maintain water pressure, and to produce chemicals and other materials for gardening. Therefore, whenever any activity or practice is minimized, an energy savings is bound to occur.

Of course, a reduction in the size of the maintained area will cut down on energy related expenditures around the home. For example, in some areas of the West two gallons of water are used on

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