A COST ANALYSIS OF TWO ENERGY CONSERVATION METHODS, PART I*

James P. Stefanis, L.D. Albright, G.B. White, and R.W. Langhans

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As energy costs rise, growers and researchers continue to study methods of minimizing fuel bills. Common ways to reduce energy costs are to lower thermostats and/or to cover glass greenhouses with a single or double layer of polyethylene. While they cut fuel costs, the problem is more complex than these solutions indicate. Both of these practices may extend the production period, increasing production costs per unit, affecting crop scheduling, and reducing the number of crops grown per year, reducing total sales. Even though the net annual fuel bill is reduced, the total fuel used per plant may increase and net profits may decrease. Finally, sales may be lost or income reduced as a result of lower plant quality, a factor that is difficult to determine and is often ignored.

Fuel consumption varies because of many factors. For this example, we will assume an average yearly fuel cost of \$1.00/sq ft of bench area (2). Overhead, which includes all costs except fuel and direct costs (pots, media, cuttings, direct labor, etc.), also varies. We are assuming weekly overhead costs are \$.08/sq ft of bench area. While fuel costs are expected to increase, overhead costs are also expected to increase, which emphasizes the need for each grower to continually evaluate all production costs when making energy conserving decisions.

Using data collected at Cornell University, heating fuel requirements per month were estimated using a base of 65 °F. To simplify cost calculations, the annual data, by season, are summarized in Table 1. During the winter season 65% of the heating fuel is used. The cost of fuel is 3.78 cents/sq ft/week during this period. Approximately 30% of the fuel is used during the fall/spring and the cost is 1.75 cents/sq ft/week. During the remaining four months, 5% of the fuel is used and the cost is .28 cents/sq ft/week.

Table 1. Summary by season of the average temperature and fuel cost per week for Ithaca, N.Y. based on 65° heating degree days.[z]

Season	Ave. temp. (°F)	% of heating requirement	Cost of fuel[y]	Number of days	Fuel cost/ sq ft/ week
Winter (Dec.-Mar.)	27°	65	65¢	121	3.8¢
Fall/Spring (Oct., Nov. and Apr., May)	48°	30	30¢	122	1.8¢
Spring/-Summer (June-Sept.)	65°	5	5¢	122	0.3¢

[z]The numbers have been rounded for simplicity; they will vary among locations.

[y]Based on \$1.00/sq ft of bench area/year.

From the above assumptions we can calculate the fuel and dollar savings when the growing temperature is lowered 5 °F. Our research has shown that in Ithaca, NY about 30 percent of the heating takes place during the day and 70 percent at night (1). A chrysanthemum grower might grow at 62 °F nights (4 pm-8 am) and 72 °F days (8 am-4 pm). Therefore, using a weighted average, the average greenhouse temperature for the 24-hour period would be 65 °F { (.33 x 72°) + (.67 x 62°) }. If both day and night temperatures are lowered 5°, the average inside temperature would be 60°. If the average outside winter temperature is 27° there would be a 13 percent fuel savings (5°/65°-27° x 100). During the fall/spring period there would be a 29 percent fuel savings (5°/65°-48° x 100).

Tables 2 and 3 illustrate the cost per plant of 5½" potted chrysanthemums grown with three cuttings per pot and spaced one pot per square foot throughout the production period. Direct costs are estimated to be \$.50 per pot. Winter production would probably encompass parts of both heating categories, either beginning in the fall or ending in the spring; however, the seasonal costs were calculated separately to illustrate the relative fuel costs and savings for each heating period.

Table 2 indicates some savings (\$.06/pot) can be realized if production periods during the winter are the same (i.e. 12 weeks). However, if the crop is delayed one week because of the lowered temperature, fuel savings are offset by an increase in overhead costs and the total cost per pot increases by 6¢; for a two week delay 17¢; for three weeks, 28¢. The information in Table 3 for the fall/spring period is similar to the winter period; production costs per plant increase despite the fuel savings. This emphasizes that overhead costs are so important that maintaining or reducing normal production schedules should be the major objective. A production delay of just one week can result in an increase in overall production costs.

Extending the production period two weeks in the winter resulted in greater fuel consumption per plant and therefore higher fuel costs per plant than for a plant grown at 65°. One should be cautious about growing at

Table 2. Winter production costs for 5½" potted chrysanthemums when growing temperature is lowered 5 degrees and the production period is increased.

Average inside temperature	Production period (weeks)	Fuel cost/ sq ft/wk[z]	Net fuel cost	% fuel savings (per plant)	Net overhead[y]	Direct costs	Total cost[x]	Cost change
65°	12	\$.0378 3.8¢	\$.45	—	\$ .96	\$.50	\$1.91	\$—
60°	12	.0329 3.3	.39	13⁷	.96	.50	1.85	−.06
60°	13	.0329 3.3	.43	4	1.04	.50	1.97	+.06
60°	14	.0329 3.3	.46	−2	1.12	.50	2.08	+.17
60°	15	.0329 3.3	.49	−9	1.20	.50	2.19	+.20

[z]The assumption is lowering the temperature 5° saves 13 percent.

[y]Overhead costs = \$.08/sq ft/week.

[x]Total costs = net fuel cost + net overhead + direct costs.

Table 3. Fall/spring production costs for 5½" potted chrysanthemums when growing temperature is lowered 5 degrees and the production period is increased.

Average inside temperature	Production period (weeks)	Fuel cost/ sq ft/wk[z]	Net fuel cost	% fuel savings (per plant)	Net over-head[y]	Direct costs	Total cost[x]	Cost change
65°	12	$.0175	$.21	—	$ .96	$.50	$1.67	$—
60°	12	.0124	.15	29	.96	.50	1.61	−.06
60°	13	.0124	.16	24	1.04	.50	1.70	+.03
60°	14	.0124	.17	19	1.12	.50	1.79	+.12
60°	15	.0124	.19	10	1.20	.50	1.89	+.22

[z]The assumption is lowering the temperature 5° saves 29 percent.

[y]Overhead costs = $.08/sq ft/week.

[x]Total costs = net fuel cost + net overhead + direct costs.

cooler temperatures even though the plant may respond well at lower temperatures. For example, extending the production period of a cyclamen crop two or three months because of lower growing temperatures probably will result in higher total production costs despite a lower fuel bill.

If only the night temperature is lowered 5°, the fuel savings would be less than the 13 percent described above because 30 percent of the fuel is used during the day. In addition, night temperature appears to be more critical with many crops. Here again production delays could result in even higher total production costs because overhead per plant is increased and fuel savings per plant are reduced.

Fuel is a large expense and a valuable resource; it should not be wasted. The grower who lowers the thermostat to 40° saves a lot of fuel but is also out of business. An investment in greenhouses and equipment is substantial. Overhead costs per square foot are more than twice the fuel costs during the winter, more than five times the cost of fuel during the fall and spring. Both greenhouse space and energy are used more efficiently when we think in terms of the number of potted plants or cut flowers produced per gallon of oil rather than the total number of gallons used per year.

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Colorado Greenhouse Growers Association, Inc.
Dick Kingman, Executive Vice President
2785 N. Speer Blvd., Suite 230
Denver, Colorado 80211

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Direct inquiries to:
Office of the Editor
Horticulture Department
Colorado State University
Fort Collins, Colorado 80523