



Using +DIF To Lower Fuel Costs

As energy costs continue to be a concern, consider growing crops at a warm day temperature and a cool night temperature to help reduce fuel costs.

By Erik Runkle

The cost of energy has been identified as the most important issue facing the floriculture industry by several recent greenhouse grower surveys. Although energy prices have subsided somewhat, fuel costs are still high, especially for growers in cold climates. There are several different production strategies and infrastructure investments that can lower fuel consumption to heat greenhouses. One strategy is to grow crops at a warm day temperature and a cool night temperature.

Testing The Theory

Plants develop in response to the 24-hour average daily temperature. For example, crop timing is similar if plants are grown at a constant temperature of 65° F or a day/night of 70/60° F if the day and night segments are each 12 hours long. If growers lower the night temperature without increasing the day temperature by the same amount, crops will be delayed. Since approximately 75 percent of the energy consumed in greenhouses occurs at night, it stands to reason that a lower night temperature will consume less energy.

To test this theory, I used Virtual Grower to simulate monthly energy costs at different temperature setpoints for two hypothetical greenhouses in Grand Rapids, Mich., and Charlotte, N.C. Virtual Grower is a free computer software program developed by the USDA-ARS, Toledo, Ohio, that predicts energy consumption using a variety of user inputs, including location, greenhouse characteristics, time of year and temperature setpoints.

The Results

As Figure 1, below, indicates, the predicted fuel cost to heat 1 acre of double-poly greenhouse was always less expensive with a positive DIF (+10° F DIF means that the day is 10° F warmer than the night) compared with a 0° F DIF (day equals night temperature) or a negative DIF (-10° F DIF means that the day is 10° F cooler than the night).

However, the estimated fuel cost savings depended on the month, location and average daily temperature. For example, a grower in Grand Rapids delivering an average temperature of 65° F could lower his or her March fuel bill by 18 percent by switching from a -10° F DIF (60/70° F day/night) to a +10° F DIF (70/60° F day/night). A producer in Charlotte growing crops at an average temperature of 72° F could lower an April fuel bill by 27 percent by switching from a 0° F DIF (72/72° F day/night) to a +10° F DIF (77/67° F day/night).

Interestingly, the potential reduction in fuel consumption by using a positive DIF was greatest during mid spring (April and May in Michigan and March and April in North Carolina). During these months, growers could theoretically save more than \$2,000 per acre by switching from a -10° F DIF to a +10° F DIF and about \$1,000 per acre by using a +10° F DIF instead of a 0° F DIF. Clearly, the way temperature is delivered during the day and night can be manipulated to minimize fuel consumption while still delivering the same average daily temperature.

Something To Consider

One consequence to using a positive DIF temperature regimen is it promotes stem elongation of most bedding plants, herbaceous perennials and potted plants. In other words, plants will become progressively taller as the day temperature increases relative to the night temperature. If finished plant height specifications remain unchanged, it is likely higher rates of plant growth retardants will have to be used. Therefore, growers will have to weigh the potential savings in fuel costs relative to the potential increased cost of plant growth retardants. GPN

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Estimated Monthly Costs						
Month	65° F Average Temperature			72° F Average Temperature		
	+10° F DIF	0° F DIF	-10° F DIF	+10° F DIF	0° F DIF	-10° F DIF
Grand Rapids, Mich.						
February	\$13,357	\$13,989	\$14,662	\$15,929	\$16,505	\$17,124
March	\$ 9,201	\$10,200	\$11,246	\$11,638	\$12,560	\$13,546
April	\$ 5,226	\$ 6,391	\$ 7,603	\$ 7,274	\$ 8,392	\$ 9,551
May	\$ 2,342	\$ 3,355	\$ 4,532	\$ 3,860	\$ 5,046	\$ 6,300
Charlotte, N.C.						
February	\$ 6,621	\$ 7,476	\$ 8,393	\$ 8,812	\$ 9,644	\$10,496
March	\$ 3,886	\$ 4,993	\$ 6,185	\$ 6,016	\$ 7,110	\$ 8,249
April	\$ 1,935	\$ 2,882	\$ 4,045	\$ 3,449	\$ 4,615	\$ 5,839
May	\$ 289	\$ 777	\$ 1,631	\$ 1,087	\$ 2,056	\$ 3,244

Figure 1. Estimated monthly cost to heat 1 acre of greenhouse (14 spans 125x25 ft.) located in Grand Rapids, Mich., or Charlotte, N.C. Assumptions include heating with natural gas at \$1.20 per therm, 70-percent efficient boiler, double-poly greenhouse without an energy curtain and a 12-hour day and night.

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