A bout 20 years ago, researchers at Michi-
gan State University (MSU) discovered
that, in many plants, stem extension is
influenced by the way temperature is
delivered in each 24-hour period. In
particular, plants are often shorter when the day is
cooler than the night. A cooler day than night is com-
monly referred to as a negative DIF (DIF = difference).
The opposite is true with a positive DIF: Stem elonga-
tion increases when the day temperature is warmer
than the night.

But providing a warm night (negative DIF) can be
expensive because most of the energy consumed to
heat a greenhouse occurs at night (see www.tinyurl.
com/gpn-dif for more information on that topic). Fortu-
ately, dropping the temperature at the beginning
of the morning, which is referred to as a temperature
drop or dip, can provide at least a partial negative DIF
response. Using a temperature drop also has little
impact on heating costs.

Temperature drop is the practice of lowering the
temperature, typically by 5-15° F, before sunrise for a
two- to three-hour period. Generally, the greater the
magnitude of the temperature drop, the stronger its
effect on plant height. For the best and most consis-
tent results, the temperature drop must be achieved
before plants perceive the start of the day. Therefore,
a common goal is to attain the desired temperature-
drop setpoint 30 minutes before sunrise. Tempera-
ture drops are generally not effective when delivered
at other times of the day or night.

Some growers will let temperature naturally ramp
down near the end of the night by turning off heaters
for a short time. If the greenhouse does not cool rap-
idly enough, venting may be necessary to achieve
the desired low-temperature setpoint. Growers using
energy curtains at night may need to slowly open the
curtains before sunrise to allow the cool air above to
reach plants below.

With the addition of a morning temperature drop,
the average daily temperature decreases. Therefore,
the remaining hours of the day and night need to be
increased slightly so that the average daily temper-
ature remains the same as before (Figure 1). In this
example, the three-hour drop, from around 5:30 a.m.
(here, 30 minutes before sunrise) to 8:30 a.m., plunges
to 58° F. To achieve an average daily temperature of
68° F, the remaining period of the day and night is
increased to 69.5° F.

We don’t have a clear understanding of how DIF
and drop mediate stem extension of plants. Some sci-
cientific evidence indicates that temperature influences
the biosynthesis of gibberellic acid (GA). GA is a nat-
ural plant hormone that regulates stem extension. So,
in some way, a negative DIF and a temperature drop
inhibit the biosynthesis of GA. There is also likely
some interaction with phytochrome, the pigment in
plants that perceives whether light is present.