LOW-INTENSITY night lighting with incandescent lights will induce flower initiation in carnation shoots which have four to seven expanded leaf pairs (3, 9). These shoots flower earlier than non-lighted shoots, but they will have reduced lateral branching. This reduction in branching at the lower position of the plant is undesirable. For instance, if a lateral shoot is already two inches long at the time the flowering stem is harvested, that return shoot will flower 30 to 60 days sooner than a return shoot that must develop from a "blind cut" where there is no lateral bud activity (8).

Porkorny and Kamp in 1960 showed that carnation plants grown under short photoperiods developed many lateral shoots but flowering was delayed (10). The opposite response was observed under long photoperiods.

Light quality also influences plant development. In general, a light source high in far-red light will induce stem elongation, and at the same time far-red light will inhibit lateral shoot growth; red light will stimulate lateral branching while inhibiting stem elongation (5). Incandescent lamps, the common source of lights for flower control in carnations, are high in far-red light.

LIGHT QUALITY STUDY—An experiment was set up to determine if the light quality used to provide long days to a carnation shoot would influence lateral branching. Plants were lighted for four hours, from 10 pm to 2 am with a light source high in red light (cool white fluorescent), or with a light high in far-red light (incandescent, as well as a BCJ ruby-red incandescent lamp) or were grown under short days (eight hours of light) or under natural day lengths. While shoots flowering under the red light source had significantly more lateral shoots than the incandescent-lighted shoots, the date to flower was delayed (Table 1). Shoots flowering under normal photoperiods and short photoperiods had significantly more lateral shoots than any of the plants flowering under the light treatments.

Lights were maintained on the plants which were receiving long days, and the second flush was allowed to flower. Regardless of treatments, all shoots flowered in the same number of days from planting, and all had a consistently low number of lateral shoots. The interesting thing to note is that all shoots on the second flush flowered during the long days of spring.

PHOTOPERIOD STUDY—The light quality experiment suggested that photoperiod played a more important role in lateral shoot development than did light quality. Experiments were conducted for two more years to determine if photoperiod could be used to control lateral branching (4, 6). Plants were grown under normal days, short days or long days and then transferred to one of the other photoperiods during different stages of a shoot's development. The complete data are presented elsewhere (4, 6), so only the conclusions will be presented here.

Based on these studies, we will present the following summary and model for lateral shoot development and flowering in the carnation. A developing carnation shoot remains vegetative until at least 12 to 14 nodes are present. After this stage of development, floral initiation depends on photoperiod. Under short photoperiods, floral induction is delayed; under long photoperiods, it is enhanced. During the initial vegetative growth stage, very little lateral shoot activity or elongation is observed until after 12 to 14 nodes are present; this suggests strong apical dominance. Phillips (9) reported a similar inhibition of lateral shoot development until at least 16 nodes had formed. After the 12- to 14-node stage, lateral bud growth can be seen at many of the nodes that are subsequently formed, provided that the shoot remains vegetative. Once the lateral shoots start to elongate, they frequently continue elongation after floral initiation has occurred, and they are present as growing lateral shoots at the time flowers are harvested. If lateral shoot growth has not commenced before floral induction (as with shoots given long photoperiods at the 12- to 14-node stage with five to seven expanded leaves), subsequent lateral shoot growth does not occur. It appears that after 12 to 14 nodes have formed, apical dominance is reduced and lateral shoots can begin growth. Perhaps these lateral shoots then develop into a sink for metabolites which can be maintained even after floral initiation. It follows that, after floral initiation, flower buds may re-establish apical dominance and may become a dominant sink compared to non-actively growing subtending lateral buds. These lateral buds would be inhibited from further growth. This would explain why short photoperiods stimulate lateral shoot development before floral induction but not afterward.

It is interesting to follow production of carnations over a 2-year period. Production tends to follow the total solar radiation curve, decreasing in winter and increasing in spring and summer (1). Since it takes five to six-and-a-half months for a lateral shoot to flower under normal day (7) conditions, it is obvious that those flowers harvested in winter, when production is low, are the lateral shoots which were initiated during the long photoperiods. (Continued on page 61)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. flowers</th>
<th>No. vegetative</th>
<th>Days to flower</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cut/plant</td>
<td>2 cm shoots</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flush 1</td>
<td>Flush 2</td>
<td>Flush 1</td>
</tr>
<tr>
<td>SD</td>
<td>4.0</td>
<td>5.7</td>
<td>4.2</td>
</tr>
<tr>
<td>ND</td>
<td>4.0</td>
<td>4.0</td>
<td>4.2</td>
</tr>
<tr>
<td>FR</td>
<td>4.6</td>
<td>3.4</td>
<td>2.8 b</td>
</tr>
<tr>
<td>FL</td>
<td>4.5</td>
<td>3.4</td>
<td>1.4 a</td>
</tr>
<tr>
<td>IN</td>
<td>4.5</td>
<td>3.4</td>
<td>2.3 b</td>
</tr>
</tbody>
</table>

Table 1. Influence of photoperiod treatments on time to flower and on number of vegetative shoots greater than 2 cm long present at flowering.

(Continued on page 61)
periods of summer, and the high pro-
duction period in spring and summer are
the shoots which were initiated under the short photoperiods of
winter. This supports the model that long
photoperiods, which hasten flower
initiation, inhibit lateral shoot growth;
while short photoperiods, which delay
flower initiation, stimulate lateral shoot
growth. Thus, can we emulate these
seasonal changes?

In most cases, commercial green-
houses receive from the propagator
carnation plants which are frequently
already reproductive or will become
so shortly after planting. (This is a
personal observation.) This early flori-
al initiation will delay the develop-
ment of and will decrease the number of
potential vegetative lateral shoots
from which future vegetative shoots
and future flower production will
arise once the apical growing point,
which is reproductive, is removed.
Vegetative cutting from the propaga-
tor should ensure future plants with
adequate vegetative shoots present for
a large crop of flowers after planting.
Cuttings are no doubt vegetative when
they are removed from the stock
plants during the winter and spring
months and stored in coolers until
needed for rooting in May and June.
However, by May and June, the natu-
ral days are long (13½ to 15 hours),
and many of the cuttings most likely
initiate flowers while rooting under
long, normal photoperiods. The use
of short photoperiods while rooting
should ensure vegetative shoots be-
ing sold to the commercial grower.

Single cropping of carnations may
be economically feasible under certain
conditions—such as growing a crop
of carnations for a particular holiday.
The use of short photoperiods could
ensure vegetative plants with many
vigorous lateral vegetative shoots.
These plants could then be lighted
giving long days to induce rapid uni-
form flowering for a particular date.

Acres of chrysanthemums are given
short days/long days to control re-
ductive/vegetative cycles. Perhaps
it is wise to consider day length re-
duction not only in the propagation
area, but also for the stock block
areas used for cutting production any-
time natural photoperiods are greater
than 12 hours. While both the stock
block and propagation areas are rela-
tively restricted areas in size to cover
with "black shading cloth," the main
production sites should also be con-
sidered. Cloth could also be used as
a heat conservation factor in the win-
ter, and to control photoperiod in the
late spring and summer.

Trucking board reviews
proposed cost increases

TO COMBAT a proposal which could
have increased the cost of trucking
dried flowers and foliage as much as
65 percent, representatives from the
Society of American Florists testified
at a docket hearing before the National
Classification Board in Washington
DC recently.

National Classification Board (an
arm of the American Trucking Asso-
ciations Inc.) periodically reviews and
publishes tariffs subject to appeal when
they are forwarded to the Interstate
Commerce Commission.

SAF was represented on a panel with
representatives of the Wholesale Flor-
ists and Florists Suppliers of America
(WF&FSA) and six manufacturers
and producers.

Darryl D. McEwen, SAF's assistant
director, executive vice-president, said to the
chairperson and board members, "The
average density and value characteris-
tics of dried flower products, as re-
ported by our members, some of whom
will testify here today, clearly support
continuance of the present rating lev-
els, if not reductions."

SAF's statement emphasized the ab-
sence of reasonable justifications for
the proposed higher classification on
dried flowers, the certain and adverse
impact the proposal would have on
SAF members and the severe reper-
cussions such rate increases would have
on domestic producers and common
carriers.

McEwen cautioned the board that
the proposed reclassification would re-
sult in "severe loss of business to our
members and the elimination of top-
loaded traffic presently handled by the
carriers.

"The proposal is not only unjusti-
fied, it is inequitable," McEwen said.
"It penalizes our members without
creating any benefits to carriers. In-
deed, the effect of the proposal may
well be to encourage support of the
deregulation bills presently before
Congress."

Supporting statements for SAF's
opposition to the proposal were given by
Knut Nielson, Knut Nielson Inc.,
Evergreen AL; Marc Fredenberg,
Everlasting Products Inc., Plainfield
NJ; Richard Sluder, Sluder Floral Co.
Newland NC; Fred Vorm, American
Oak Preserving Co., North Judson IN;
Lewis Golin, Allyn Manufacturing
Co., Whiting NJ; Lamar Thompson,
Amco, Montgomery AL, and Archie
Clapp, executive vice-president of
WF&FSA.

After hearing testimony, the NCB
chairperson said, "With the input we
have just received, I can assure you
that the proposal will not appear in its
present form."

The NCB has 120 days to act on
the proposal.

Testifying at the National Classifica-
tion Board docket hearing were (top row,
left to right) Fred Vorm, Lewis Golin, Darryl D. McEwen, Lamar Thompson, Marc
Fredenberg, Steven Cundra, John Caldwell, (bottom row, left to right) Richard
Sluder, Knut Nielson, Archie Clapp and Michael Blevins.
Nevertheless, it appears that photoperiodic control of flower initiation is the factor which controls the upper limit for number of laterals on a carnation shoot. Many environmental factors subsequently determine if a lateral shoot will fulfill its potential to develop and flower (2).

Literature cited

EDITOR'S NOTE: R. D. Heins is assistant professor in the Horticulture Department at Michigan State University, East Lansing. H. F. Wilkins is professor in the Department of Horticultural Science and Landscape Architecture at the University of Minnesota, St. Paul. This article originally appeared in the May 1979 issue of the Colorado Flower Growers Association Bulletin.

Florafax receives
Good Housekeeping seal
FLORAFAX INTERNATIONAL INC., Tulsa OK, has received the Good Housekeeping Seal of Approval for the flowers and plants covered by its "Guaranteed Fresh" program.

The 9,400 florists participating in this program have signed an agreement certifying they will unconditionally guarantee customer satisfaction on all Florafax floral orders they fill. The program carries a 100 percent guarantee of freshness for all flowers and plants sold by participating florists.

alvi voigt:
marketing maneuvers
Alvi Voigt is an agricultural economist, extension section, 1 Weaver building, Pennsylvania State University, University Park PA 16802.

The 1979 national (28 states) statistical results will not be available until mid-April, but Florida, which accounts for the biggest share (41.5 percent) of US foliage sales, has reviewed its 1979 season. Growth in 1979 was experienced for all sizes of potted plants and rooted cuttings except for 5- and 12-inch pots, as follows.

<table>
<thead>
<tr>
<th>Florida foliage</th>
<th>1979 (x 1000)</th>
<th>Change from 1978</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rooted cuttings</td>
<td>36,900</td>
<td>+14%</td>
</tr>
<tr>
<td>2½&quot; and smaller pots</td>
<td>10,700</td>
<td>+3%</td>
</tr>
<tr>
<td>3&quot;</td>
<td>60,100</td>
<td>+4%</td>
</tr>
<tr>
<td>3½ to 4&quot;</td>
<td>12,800</td>
<td>+2%</td>
</tr>
<tr>
<td>4&quot;</td>
<td>2,600</td>
<td>-12%</td>
</tr>
<tr>
<td>5&quot;</td>
<td>12,300</td>
<td>+8%</td>
</tr>
<tr>
<td>6&quot;</td>
<td>2,100</td>
<td>+12%</td>
</tr>
<tr>
<td>8&quot;</td>
<td>4,900</td>
<td>-11%</td>
</tr>
<tr>
<td>10&quot;</td>
<td>199</td>
<td>-21%</td>
</tr>
<tr>
<td>12&quot;</td>
<td>439</td>
<td>+11%</td>
</tr>
<tr>
<td>14&quot; and larger</td>
<td>1950</td>
<td>+11%</td>
</tr>
</tbody>
</table>

The 1979 national season (28 states) statistical results will not be available until mid-April, but Florida, which accounts for the biggest share (41.5 percent) of US foliage sales, has reviewed its 1979 season. Growth in 1979 was experienced for all sizes of potted plants and rooted cuttings except for 5- and 12-inch pots, as follows.

<table>
<thead>
<tr>
<th>Florida foliage</th>
<th>1979 (x 1000)</th>
<th>Change from 1978</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rooted cuttings</td>
<td>36,900</td>
<td>+14%</td>
</tr>
<tr>
<td>2½&quot; and smaller pots</td>
<td>10,700</td>
<td>+3%</td>
</tr>
<tr>
<td>3&quot;</td>
<td>60,100</td>
<td>+4%</td>
</tr>
<tr>
<td>3½ to 4&quot;</td>
<td>12,800</td>
<td>+2%</td>
</tr>
<tr>
<td>4&quot;</td>
<td>2,600</td>
<td>-12%</td>
</tr>
<tr>
<td>5&quot;</td>
<td>12,300</td>
<td>+8%</td>
</tr>
<tr>
<td>6&quot;</td>
<td>2,100</td>
<td>+12%</td>
</tr>
<tr>
<td>8&quot;</td>
<td>4,900</td>
<td>-11%</td>
</tr>
<tr>
<td>10&quot;</td>
<td>199</td>
<td>-21%</td>
</tr>
<tr>
<td>12&quot;</td>
<td>439</td>
<td>+11%</td>
</tr>
</tbody>
</table>

Demand was reportedly brisk for the first seven months of 1979, tapering off somewhat in the last five months. Five-inch pots will likely drop further in 1980. Eight-inch pots may become more popular due to their desirable size for food chains and slightly lower transport cost per unit. Interestingly, two foliage buyers representing large firms (one having stores coast-to-coast) had unusually successful late Christmas period sales, a possible positive shift in merchandising.

The year's profits were variable for Florida foliage, as some firms reported expenses were not covered while some experienced higher profits. Production and marketing costs increased, but little if any price change was registered. Florida firms will be placing greater emphasis on marketing to increase sales. Competition is reportedly keen, resulting in better quality plant material and more rigid specification marketing. Florida and Texas were thought to be the only states on the mainland to have an appreciable volume increase (although California probably has, too). Smaller foliage profit margins are probably causing northern growers to switch to blooming plants.