Flashing Light Affects the Flowering of Snapdragons

E. A. Maginnes* and R. W. Langhans
Department of Floriculture
Cornell University

Experiments reported by the authors (N.Y.S.F.G. Bulletin 171) and other workers have shown the flowering of snapdragons to respond to photoperiod. However, because incandescent lights were used to create long photoperiods the question has arisen as to whether the response was solely a response to photoperiod or whether it was influenced, to some degree, by heat received from the artificial light source. To gain some insight into this problem, an experiment was set up incorporating flashing light. Because the experiments reported in bulletin 171 showed the number of leaves formed before flowering to be a photoperiodic response, it was decided to use this feature to evaluate the results of the treatments. This experiment also served as an evaluation of flashing light as a means of lighting by comparing daylength extension, breaking of the dark period with a continuous light break and breaking the dark period with flashing light.

---

*Present address: Department of Horticulture, University of Saskatchewan, Saskatoon, Saskatchewan

(continued on page 2)

Snapdragons

(continued from page 1)

MATERIALS AND METHODS

Seeds of the variety Jackpot were sown on February 10, 1961 and placed at a minimum night temperature of 70°F until germinated (March 1/61). After germination, the seedlings were subjected to a minimum night temperature of 60° and 9 hours of natural light daily (8 am to 5 pm) until the start of light treatments on March 10, 1961. From this date onward the seedlings were divided into the following light treatments:

1. Nine hours of natural light plus *flashing light 5 seconds per minute*, 10 pm to 2 am daily (13-hour photoperiod).
2. Nine hours of natural light plus *flashing light 10 seconds per minute*, 10 pm to 2 am daily (13-hour photoperiod).
3. Nine hours of natural light plus *flashing light 15 seconds per minute*, 10 pm to 2 am daily (13-hour photoperiod).
4. Nine hours of natural light plus *flashing light 30 seconds per minute*, 10 pm to 2 am daily (13-hour photoperiod).
5. Nine hours of natural light plus a *continuous light break*, 10 pm to 2 am daily (13-hour photoperiod).
6. Nine hours of natural light plus *daylength extension*, 5 pm to 9 pm daily (13-hour photoperiod).
7. Nine hours of natural light plus *daylength extension*, 5 pm to 2 am daily (18-hour photoperiod).
8. Check—Nine hours of natural light daily (9-hour photoperiod).

The artificial supplementary illumination was obtained from 60 watt incandescent lamps placed 3 feet apart and 4 feet above the pots. This produced a light intensity of 10 to 25 fc at pot level (Weston Illumination Meter, Model 603). When the seedlings in the above treatments attained 2 to 3 pairs of leaves (March 24/61) they were potted (24 plants per treatment).

During the course of this experiment observations were made on the following:

A. Days to maturity—The number of days from germination and the tip of the flower spike began to elongate.
B. Days to first floret—The number of days from germination until the first floret on the flower spike was fully open.
C. Stem length—The length of the stem from butt to tip of flower spike, after it was severed between the cotyledons and the first pair of true leaves, measured in centimeters (1 inch=approx 2.5 cms).
D. Spike length—The distance from the base of the lower most floret to the tip of the flower spike, in centimeters (1 inch=approx. 2.5 cms).
E. Number of florets fully open.
F. Number of florets showing color.
G. Number of leaves—The numbers of leaves on the stem below the flower spike, including the cotyledons, but not the bracts under the first florets.
H. Total weight—Weight of the stem, in grams, with no lateral growth or leaves removed (1 oz=28.35 gms).
I. Weight less ⅓ leaves—Weight of the stem in grams with the lower ⅓ of leaves removed (1 oz=28.35 gms).
J. S.A.F. grade—Snapdragon grades recognized by the Society of American Florists.

RESULTS

Results of the treatments on 10 observations are presented in Table 1. In order to compare the values between treatments for a given observation the data for 8 of the 10 observations was analyzed statistically and compared using Tukey's honestly significant difference values (hsd) at the 5 per cent level. If the difference between two means, for a given observation, exceeds the hsd value, the means are significantly different.

DISCUSSION

Light Source, Heat and Flowering Consideration of the

(continued on page 3)

Table 1—A comparison of daylength extension, breaking of the dark period with a continuous light break, and breaking the dark period with flashing light on the growth and development of the snapdragon variety Jackpot.

	TREATMENTS[a]							
	(13-HOUR PHOTOPERIOD)						(18-HOUR)	(9-HOUR)
Observations	30 sec. per min.[b]	15 sec. per min.[b]	10 sec. per min.[b]	5 sec. per min.[b]	4-HOUR BREAK	4-HOUR EXT.	9-HOUR EXT.	9-HOUR DAY
Days to Maturity	86	88	90	93	89	89	80	101
Days to First Floret[c]	83.0	84.7	84.8	88.0	84.0	86.3	77.0	96.9
Stem Length (cm)[d]	92.8	95.5	93.9	99.3	94.2	98.5	76.9	102.7
Spike Length (cm) [e]	33.0	33.8	32.0	31.3	34.3	38.7	19.1	30.5
No. of Florets fully open[f]	24.9	24.8	26.7	25.7	27.1	28.7	13.6	35.7
No. of Florets showing color[g]	28.4	30.5	31.8	30.8	31.5	34.6	19.0	43.1
No. of Leaves[h]	23.8	24.6	25.3	29.3	25.2	28.3	20.0	43.0
Total weight (gms)[i]	40.7	44.2	44.2	47.9	42.7	47.4	26.4	65.6
Weight—⅓ Leaves (gms)[j]	33.7	36.0	35.6	37.5	34.7	37.9	22.6	50.2
S.A.F. Grade	EXTRA	EXTRA	EXTRA	EXTRA	EXTRA	EXTRA	FIRST	FANCY

a—All plants received 9 hours of natural light before the various treatments.
b—Flashing light treatments were employed over a 4-hour period from 10 pm to 2 am daily.
Honestly significant differences (Tukey) for comparison of the various values

c—hsd .05 equals 2.1
d—hsd .05 equals 6.3
e—hsd .05 equals 4.3
f—hsd .05 equals 4.6
g—hsd .05 equals 5.4
h—hsd .05 equals 2.0
i—hsd .05 equals 8.1
j—hsd .05 equals 5.8

(continued from page 2)

number of leaves formed by the 4-hour extension (13-hour photoperiod), the 9-hour extension (18-hour photoperiod) and the 9-hour photoperiod treatments (Table 1) would tend to suggest that temperature may have an influence on the results. However, when the results of the 4-hour break and the 30, 15, 10 and 5 seconds of flashing light per minute are considered it may be seen that light flashes as few as 10 seconds per minute for a 4-hour break are as effective as a continuous 4-hour break. The 10 seconds per minute treatment, which had the artificial light on 1/6th as long as the 4-hour continuous break, thus would receive considerably less heat from the light source. Since these treatments were all grown at the same time, in the same location and under similar conditions (except photoperiod), then the heat from the light source can be considered to have extremely little or no influence on the flowering response of snapdragons.

Ten Characteristics Observed A perusal of the results in Table 1 shows the values for the 13-hour treatments fall between those for the 9- and 18-hour treatments. Six of the eight analyzed observations show statistical significance in this respect. Stem length and spike length did not show statistical significance. The non-analyzed observations, days to maturity and flower grade, followed the general trend.

The 13-hour treatments can be sorted into two populations on the basis of leaf number; one composed of the 4-hour extension and the 5 second flashing light treatment and the other of the 4-hour break and the 30, 15 and 10 second flashing light treatments. Several of the other observed characteristics show this same trend, but there is no statistical significance.

A comparison of the days to first floret and number of leaves for the 4-hour break and the 4-hour extension shows the 4-hour break to flower significantly sooner and after fewer leaves than the 4-hour extension. In other words the 4-hour break is more efficient at shortening the time to flowering and hastening the change from leaf bud to flower bud production. The results for the 30, 15 and 10 second flashing light treatment were not significantly different from those of the 4-hour break.

The results for the 10 observations indicate some interesting trends and possible commercial implications that would appear to merit further investigation.