Progress Report

Development of protocols for optimization of branching and flower counts in cut-flower Gerbera production: investigation of photoperiod effect

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The objective of this part of the project was to differentiate effects of various photoperiods and light integral on the Gerbera cut flower production. Previous studies suggested that the flower production of Gerbera can be affected by photoperiod. A study by Leffring[1] (1973) on the influences of photoperiod and temperature on shoot and flower production indicated that Gerbera produce a greater number of lateral shoots (giving rise to additional flowers) in response to short day conditions. Leffring also used long days and increased temperatures as an explanation of summer depression. There are also other research studies with different results suggesting that perhaps there is a considerable influence related to the variety being used for experimentation. We set out to investigate whether or how photoperiod affects flower production counts, rates of development and inflorescence quality. We have been using two varieties that have been observed to have different production patterns.

Materials and Methods

Three lighting treatments used with our Gerbera crop consisting of two Terra Nigra varieties Maya and Passion (as described in our previous report). The plants were located on rolling benches, equipped with racks for mounting lamps and curtains. The following treatments were imposed for 6 weeks starting Dec 4, 2006.

- Short Day (SD)
  - 8 hrs light
  - Induced with black-out curtain
- Long Day (LD)
  - 16 hrs light

Figure 1 Greenhouse photoperiod study set-up

[1]Leffring, L. 1973. Flower Production in Gerbera. I. Correlation between shoot, leaf and flower formation in seedlings. Scientia Horti 1:221-229.

    - Induced with incandescent lights and black-out curtain (not shown)
- Control
    - Ambient light conditions

Data loggers equipped with Licor quantum sensors and shielded thermocouples (note white styrofoam shields in photo). Three separate light sensors were used to monitor light levels for each of the three treatment zones on a continuous basis.

Our determination of whether a flower had reached “Visible Bud” (VB) or “Harvest stage” (HV) was as shown in the figures below:

Figure 3 Flower bud at VB stage: First day on which bud could be distinguished as being a flower bud rather than leaf primordia

Figure 4 Inflorescence at HV stage: fully open and displaying first row of stamens

For each observed flower the following evaluations were made: each plant was inspected carefully three times a week and any new visible flower buds were noted; as harvest occurred, these were counted. Quality characteristics measured for each harvested inflorescence: scape length, capitulum diameter, fresh and dry weight.

Results and Discussion

The pattern of flower production on a weekly basis are shown in Fig 5. Clearly there is considerable variation in counts from week to week. This variability makes it difficult to assess whether treatment means at any particular date are significantly different.

Figure 2 Licor PAR sensor

Table 1: Effect of photoperiod treatment on weekly flower production and duration between VB and HV of the variety **‘Passion’** (Means separation tests were done using “Tukey” test)

Treatment	Number of new flower buds per plant	Number of harvested flowers per plant	Number days from VB to HV
Control	0.63 ± 0.06 b	0.59 ± 0.06 b	32.1 ± 0.49 a
Long Day	0.46 ± 0.04 a	0.40 ± 0.04 a	31.6 ± 0.44 a
Short Day	0.52 ± 0.04 ab	0.49 ± 0.04 ab	32.3 ± 0.45 a

Visible bud counts: The variety Passion showed and effect of photoperiod on the number of newly produced visible flower buds. Long days reduced the visible bud count by 27%. The short day treatment did not have a significant effect. For the variety Maya, there were no significant differences in the number of visible buds formed.

Number of Flowers harvested: The same pattern was manifested with the harvests: The long day treatment reduced the number of harvested flowers of ‘Passion’ by 32%. This difference was statistically significant. The short day treatment did not have a significant effect.

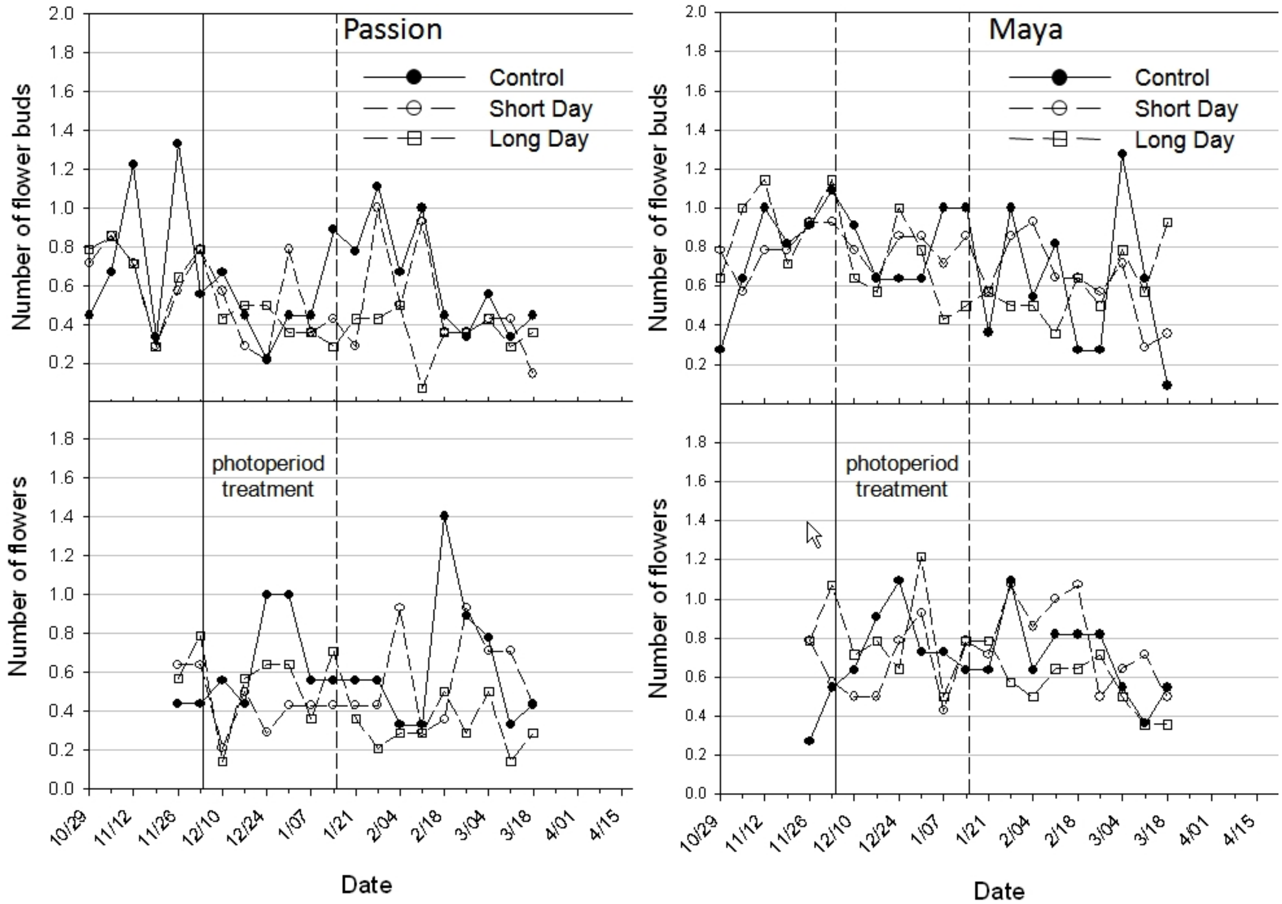

Figure 5 Number of flower buds and harvested flowers per week before, during, and after the photoperiod treatment

Table 2: Effect of photoperiod treatment on weekly flower production and duration between VB and HV of the variety **'Maya'** (Means separation tests were done using "Tukey" test)

Treatment	Number of new flower buds per plant	Number of harvested flowers per plant	Number days from VB to HV
Control	0.71 ± 0.06 a	0.79 ± 0.06 a	30.5 ± 0.41 b
Long Day	0.70 ± 0.04 a	0.73 ± 0.05 a	28.5 ± 0.25 a
Short Day	0.72 ± 0.04 a	0.73 ± 0.05 a	30.2 ± 0.33 b

It should be noted that the main difference between the short day treatment and the control is the amount of light the plants receive around dawn and dusk. But the treatments, while similar are not identical. This does explain the lack of a significant difference between these two treatments. It remains a puzzle as to why there is no significant difference between the Long Day and Short Day treatments.

The mean number of days from VB to HV for the variety Passion ranged from 31.6 to 32.3for the three treatments (Table 1); these means were not significantly different. For Maya, the mean for the Long Day treatment was 28.5, while the means for the Control and Short Day treatments were 30.5 and 30.2, respectively. The latter two were not significantly different from each other, but the Long

Day value is significantly shorter. This is important as it indicates that in Maya the flowers grow faster under long day photoperiods.

It should be noted that the observed effects were for the three week period just after the photoperiod treatment ended.

One might assume that the length of time from VB to HV is driven by the amount of photosynthetically active radiation available during that time. However the amounts of total PAR during the three treatments are generally pretty similar and completely equivalent after the photoperiod treatment. Note in particular that the patterns for this variable are very similar between the Control and Short Day treatment (Fig 6 symbols: • and □, respectively) but the pattern in the Long Day treatment (symbol △) is quite different, showing a marked reduction during the second half of the 6-week period where the photoperiod treatment occurred.

With regard to the measured quality characteristics, there were no significant differences due to the treatments.

Further research regarding the photoperiodic effect is on-going and will be reported on in the next progress report.

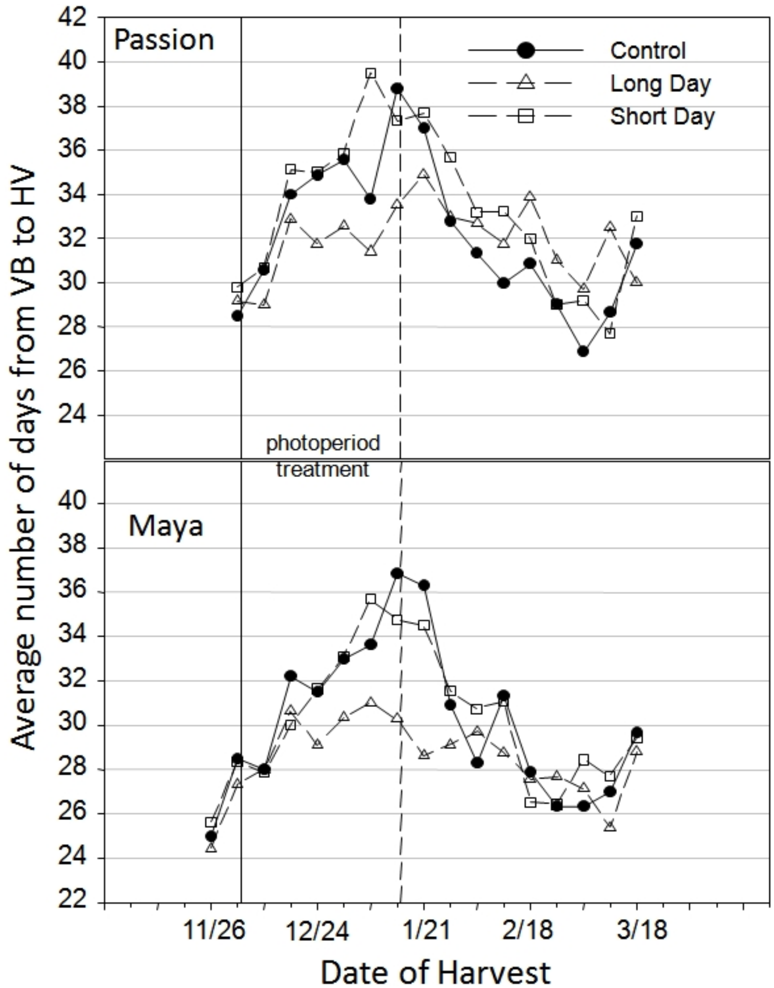

Figure 6 Average number of days from VB to HV calculated weekly for all flowers calculated during that week

Additional work has also been carried out on the nutrient starvation treatment that was discussed in the previous progress report. Preliminary analysis suggests that nutrient starvation is not a feasible treatment with the varieties that we have been using. Analysis of that work is not complete and will be included in the next report.

The earlier work with plant growth regulators for branching showed that the variety Maya seemed to be unaffected by the various treatments that were tried. Passion, on the other hand showed a slight effect. Further research is under way to explore this. The PGR work also includes a new material (Cyclanalide) from Bayer CropScience. Those results will also be available in the next progress report.