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LIGHTING OF GERANIUM AND MUM STOCK PLANTS FOR MORE CUTTINGS

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Growers in the Northeast have known for a long time that light limits plant growth during the winter more often than any other factor. It has been known for years that artificial light can be used to supplement low natural light intensity. The cost of such lighting has proved in most cases to be prohibitive, since very intense light must be used.

However, it has been found that a relatively cheap method of lighting is available. That is, using relatively low intensity light during the night when this weaker light is relatively strong by comparison with the complete darkness which would otherwise prevail. This method increases the light duration, a cheaper alternative than attempting to increase the light intensity during the day.

It is a familiar fact to plant physiologists that weak light is generally used more efficiently by the plant than strong light; that is, the law of diminishing returns sets in as the light intensity becomes greater. This fact partly explains the effectiveness of lighting at night with relatively low intensity light.

Since this relatively low intensity light must still be much stronger than that used for day-lengthening for chrysanthemums, etc., it is not an extremely cheap procedure and probably cannot be carried out economically in every situation.

A possible application of this type of lighting is the lighting of stock plants to increase cutting production.

This work has been carried out to determine how much extra cutting production can be expected from geranium and chrysanthemum stock plants with different amounts of lighting.

Geraniums: Materials and Methods

Four-hundred watt color-corrected mercury vapor lamps (G.E. lamp H400-J1) were chosen as a light source for this work because of the ease and simplicity of installing them and the relatively moderate original and operating cost per unit of light. Each lamp was ballasted with a moisture proof single transformer (G.E. 9T64Y3000). One of these lamps was suspended horizontally with a simple reflector over a 3 by 5 foot area of bench. This area was chosen for convenience; in commercial practice, an area wider than this could be used (4 by 6 feet or more). The lamp was at a height of 36 inches over the bench surface, or 30 inches over the tops of the plants when they are six inches tall. The intensity of light at the center of the plot was approximately 300 foot candles, as compared with a natural maximum of about 10,000 and a day-lengthening intensity of about 20, as used for chrysanthemums.

A second lamp was mounted in a similar way, but so that it could be moved on a track from one plot to another. In this way two plots could be lighted with one lamp and plants in each plot received light every other night. Both lamps were turned on all night.

A third area was prepared with no lighting for the normally treated plants.

On July 16, 1956, geranium plants, variety Ricard, which had been potted as rooted cuttings into 4 inch pots a month earlier, were placed in the treatment plots and grown on, re-potting when necessary until the plants were in 7 inch pots. Cuttings were taken at weekly intervals and the number and weight of cuttings taken were recorded. Records were taken from July 19, 1956 until April 24, 1957.

Geraniums: Results

Table 1 shows the numbers of cuttings per plant produced in the three treatment areas during two-month periods:

Table 1. The Effect of Lighting Treatments on Cutting Production From Geranium Stock Plants, Variety Ricard (Cuttings per Plant)

Months	No lighting	Lighting alternate nights	Lighting every night
July + August	5.8	5.9	6.1
Sept. + Oct.	13.5	15.2	18.1
Nov. + Dec.	9.3	11.4	14.6
Jan. + Feb.	7.4	8.3	11.6
Mar. + Apr.	14.2	17.3	21.0
Total	50.2	58.1	71.4

Greatest effect was found during November and December when lighting every night gave a 56% increase and lighting every other night gave a 22% increase. An interesting point is that the increase was nearly as great even in March and April, when the normal sunshine was 52% of possible as compared with 26% in November and December.

The small effect of lighting in July and August was expected, but may not have been as small had the plants been larger. The small size of the plants is the reason for low cutting production in all treatments during these two months.

The weight of a single cutting was found to vary considerably with the season, but there was no significant difference among treatments. Lighted cuttings appeared to be more compact, but weighed about the

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Lighting--Con't from page 1.

same.

Chrysanthemums: Materials and Methods

On July 27, 1956, rooted chrysanthemum cuttings, variety Gold Coast, were potted in 3 inch pots and placed under treatment in the same plots with the geraniums. They were grown on as stock plants and re-potted, when necessary, until they were in 5 inch pots. Cuttings were taken at the same time as those from the geranium stock plants and records of cutting production and size were kept from August 6, 1956 until January 23, 1957.

New cuttings of the same variety were potted on January 30, 1957 and were grown and treated in the same manner as the first group of plants, treatment beginning on February 17, 1957. Records were kept from February 24, 1957 until April 24, 1957.

Chrysanthemums: Results

The numbers of chrysanthemum cuttings produced per plant in the three treatment areas during two month periods is shown in Table 2:

Table 2. The Effect of Lighting Treatment on Cutting Production From Stock Plants of Chrysanthemum, Variety Gold Coast (Cuttings per Plant).

Months	No lighting	Treatment Lighting alternate nights	Lighting every night
August	8.8	9.1	9.4
Sept. + Oct.	16.5	17.2	18.8
Nov. + Dec.	18.9	23.3	25.4
Jan. + Feb.*	10.2	12.2	13.8
Mar. + Apr.	7.8	8.0	9.2
Total	62.2	69.8	76.6

* February and following production from new plants

Chrysanthemum cutting production can be substantially increased by lighting. The benefit of every-night lighting did not seem to be so great with chrysanthemums as with geraniums, but the increase with alternate-night lighting was about 20 percent at the maximum with both kinds of plants.

The increase did not seem to continue into the spring as much as it did with the geraniums. This may be due to the fact that new plants were started in February, thus eliminating any carry-over effect due to the difference in condition of the plants as a result of previous lighting and the fact that the plants were simply smaller.

Discussion

It is apparent from the figures presented here that production of cuttings can be increased by lighting with light of moderate intensity. By increasing the number of cuttings produced by a plant in a given length of time, a grower should be able to get along with proportionally fewer stock plants. This might be expected to be especially worthwhile where cuttings are being "cultured" to maintain disease-free stock.

It should be stressed that this work is exploratory in nature and far from technically perfect. Only one set of temperatures was used (60°F nights and 70°F days except when warmer outside). It is entirely possible that a higher temperature at night, such as 70°, would be more suitable for plants which are under conditions more similar to daytime than to night.

The plot size, as mentioned before, and height of the lamps were somewhat arbitrary and can undoubtedly be improved upon in time.

Color-corrected lamps were used in the expectation that their spectral distribution would be more suitable for overall plant growth. Recent work with lighting of snapdragon seedlings has indicated that the use of non-corrected clear mercury lamps may possibly lead to some injury during mid-winter. There have been no indications that any injury will result from the use of color-corrected lamps.

It is possible that incandescent lighting for this purpose (with similar wattage) might prove effective. The primary advantage would be the lower cost of installation. Fluorescent tubes should be as effective as mercury lamps but they require more elaborate wiring and fixtures and should be removed during the day as they must be placed lower and cast more shadow than an equal wattage mercury lamp.

The maximum cost of lighting an experimental 3 by 5 foot plot alternate nights over a one-year period, assuming four months of use during the year (600 hours per year), is approximately as follows:

Lamp depreciation (average life 6000 hours)	2.25
Transformer (indefinite life but this assumes 10-year life)*	3.30
Power (600 hours x 400 watts = 240 KWH) Assuming 2¢ per KWH	4.80
	10.35

*Less-expensive transformers than this can be obtained.

Assuming that lamps are used fully for these four months and that fair-sized geranium plants were available at the start of lighting, enough extra cuttings can be produced to more than pay for the cost of lighting as stated above.

The advantages of every-night versus alternate-night lighting were not clear from this work. A grower starting this type of lighting might choose the installation which would be most convenient in his own situation. It does not seem from these figures that one method would offer a great and consistent advantage over the other.

With adaptation to a commercial situation and inquiry into the possibility of using cheaper transformers under conditions where they could be kept dry and clean, as well as the use of wider benches than the 3 foot benches in use here, the cost of lighting can be considerably reduced below the maximum figures given here.

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