Colorado Flower Growers Association

IN COOPERATION WITH COLORADO STATE UNIVERSITY
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GROWTH OF CARNATION INCREASE BLOCKS WITH SUPPLEMENTARY CO_2

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Additions of CO_2 to plant atmospheres have produced increased yields and higher quality in roses, chrysanthemums, tomatoes, lettuce, and several other horticultural crops (1, 3, 4, 5, 6). Previous work using increased CO_2 levels for growing carnations showed greater yield, higher dry matter content, quicker return crops, and heavier flower heads (2, 4). From this work, it is evident that increased CO_2 atmospheres for carnation increase blocks should produce more cuttings of higher quality over a given period of time.

PLANT MATERIAL

On August 1, 1962, 540 cuttings of the variety Pikes Peak White from CSU foundation stock were stuck for rooting. Twenty-two days later, one-half of the cuttings were planted 8 X 8 inches in a 122.5 sq. ft. bench in one increase block house. The other half was planted at the same spacing in an identically positioned bench in an adjacent increase house. The plants were allowed to flower without a pinch for possible rogueing. Cuttings were available from both treatments the first week in November, 1962. They were taken every week thereafter, and records included fresh and dry weights, yield, and the performance of the cuttings.

PLANT ENVIRONMENT

Both houses were maintained at a night temperature of 55°F and heated to 65 or cooled at 70F during the day. Watering, feeding, and fumigating were similar in both treatments. Due to the orientation (positioning) of the range, both houses received comparable light, which was confirmed by the recorded ventilation time (Table 1).

Table 1. Environmental conditions of treated and non-treated plants

	Fan running time		Cu. ft. of CO_2 injected in treated hse.	Total solar energy in g cal/cm^2
	CO_2	No CO_2		
September	144.9	150.7	199.6	13,115
October	204.1	216.3	272.2	10,749
November	111.6	141.4	476.0	6,327
December	93.6	99.5	492.3	6,130
January	68.4	61.9	744.3	7,290
February	114.4	124.6	492.9	8,543
March	173.8	165.8	498.5	13,095
April			93.9	
Total	910.8	960.2	3269.4	

When the treated house was not being ventilated, CO_2 was injected (Table 1) from September 11, 1962 through April 8, 1963, at the rate of 3 cu. ft. per 1000 sq. ft. per hour. A Beckman infrared analyzer was used to monitor the CO_2 concentration at 30 minute intervals. Comparisons of the average concentration in the treated house, a producing carnation house and the outside atmosphere may be seen in Figure 1.

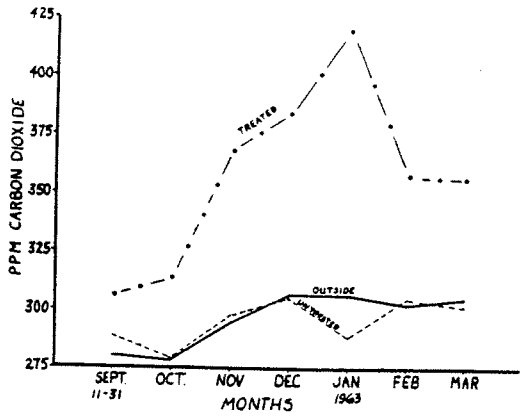

Fig. 1. Mean CO_2 concentration during daylight hours for treated and untreated houses compared to outside atmosphere.

RESULTS

The plants grown in the CO_2 enriched atmosphere continuously produced cuttings that were thicker and darker in color than the untreated plants. The yield of cuttings was the same from November to March. From March on, the CO_2 treated plants started outproducing the check plants. (Table 2). After 13 months of growth the treated plants had produced 152 cuttings per square foot compared to 134 for the controls. Table 2 shows these yields and the time when yield increases occurred.

Table 2. Summary of results from CO_2 treated carnation increase block and non-treated block accumulated yield of cuttings

		CO_2 treated	Non-treated
November		527	446
December		1,067	1,067
January		1,499	1,607
February		3,254	3,200
March		4,199	4,010
April		6,872	6,494
May		9,586	8,978
June		12,070	11,516
July		13,096	12,529
August		15,553	14,757
September		18,656	16,458
Cuttings/ sq. ft. from planting time	12 mon.	123	118
	13 mo.	152	134
Ave. percent of dry matter of weekly samplings		15.9	16.2
Ave. PPM CO_2 Sept. 10, 1962 - April 1, 1963		365	299

Fresh and dry weights of 27 cuttings per treatment were taken each week from December 17 to July 3. The difference in dry matter percentage was insignificant; the CO_2 treated cuttings contained an average of 15.9 percent while untreated had 16.1 (Table 2).

PERFORMANCE OF CUTTINGS

On March 27, 27 cuttings from each treatment were stuck in perlite. They were well rooted in 20 days and no differences in degree of rooting were observed. The cuttings were benched April 16 and pinched from May 2 to May 7. Counts were made on the number of laterals developing on each plant, the flowering time for the first crop, and the grade of flowers. No significant differences due to treatment were obtained. A larger population from each treatment will be studied during the second year of production from these plants.

DISCUSSION

It was apparent that additional CO_2 had helped to maintain a more desirable cutting throughout the experiment and especially during the summer months. It was also evident that the treated plants were beginning to make large gains in yield during the latter part of the 13 month period and that the value of CO_2 fertilization could not be fully assessed in a 1-year period.

The establishment of pruning methods, CO_2 fertilization, and possibly higher temperatures for increase block plants should allow the plants to be grown two or more years with equal or better yield, quality, and performance of the cuttings. In many instances, these plants are costly to renew, hence a longer productive period would be of considerable value to propagators and growers as well.

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