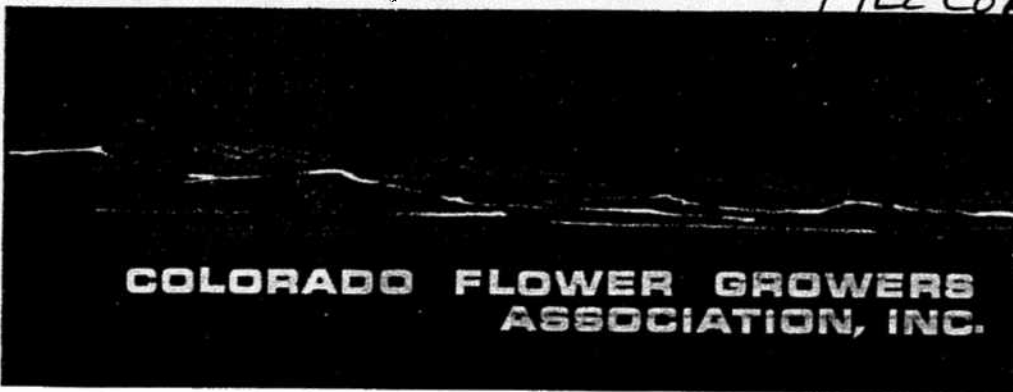


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Carnation Production in an Inert Substrate Compared to Soil

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Water utilization studies by Hanan and Jasper (1) indicated that yield and grade of carnations were directly related to the amount of water supplied to the plants. These workers concluded that maximum production would occur when soil moisture stress was minimized, provided other factors were favorable.

It is common knowledge among plant growers that soil can be kept too wet for good growth. The excess water prevents adequate soil air levels, leading to a chain of detrimental effects on plant growth. In order to minimize water stress a substrate other than soil must be used. This work was the start of numerous experiments with growing in inert substrates, the results of which have been published from Colorado State University during the past four years in CFGA Bulletins 205, 214, 215, 216, 227, 234, 250, and in some other publications.

A direct comparison of the growth of two varieties of carnation in soil and gravel was designed and started July 15, 1968. Four paired plots of two varieties were arranged in adjacent beds with buffer rows of Pink Sim in between the plots. Plot size was 70 plants or 10 rows planted at approximately 6 x 8-inch spacing. Yield and grade records were kept on 178 sq.ft. in each medium. Rooted cuttings were planted on July 15, 1968, the plants pinched once at 5 or 6 leaf pairs, and all flowers cut and graded until the experiment was terminated in May of 1971.

The soil used was Fort Collins Loam amended with treblesuperphosphate and organic matter. Previous experience with this soil had given excellent results. The inert substrate was Idealite, a manufactured lightweight aggregate screened to remove the particles less than 50 mesh and larger than 3/8" diameter. Both beds were watered with a gates peripheral system. The soil bench was watered on demand while the gravel was watered automatically from once per day in winter to a maximum of four times per day in summer.

Results and Discussion

Since this experiment extended over almost three years, progress reports have been presented orally at several intervals. Now that the 3-year production is completed, a much clearer comparison of the two substrates can be seen. A summary of the data with varieties grouped is presented in Table 1. The data are separated into periods for closer examination. Period 1 included the first crop and Period 2 the second crop, approximately 11 months from planting. Period 3 included month 12 to month 16 (June through mid-October). This is normally the major time of water stress on greenhouse crops in Colorado. Period 4 extended through fall, winter, and spring of the second year. Period 5 was the third summer and Period 6 the third winter and spring.

Yield

Since the major difference between carnations growing in the two substrates was yield, this will be

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highlighted first. Differences in yield were small (4-1/2%) during the first and second crops. Yield was up 25% for plants growing in gravel during Period 3 and about the same in Period 4. During

the last two periods (plants in their third year) yield differences were 13 and 15% in favor of the inert substrate.

Table 1. Yield and grade^a of flowers from two cultivars of carnations growing in two substrates for 35 months.

Period ^b	Soil					Gravel				
	Design	Green	Red	Blue	Total	Design	Green	Red	Blue	Total
1	4	46	50	0	2513	5	21	71	2	2398
2	10	3	30	57	4407	8	2	32	58	4832
3	8	9	52	31	4779	7	12	49	33	5966
4	3	8	54	35	4967	3	11	57	30	6142
5	4	16	62	18	6498	5	18	59	18	7371
6	7	15	50	27	4246	9	18	46	27	4882
Total	6	14	50	29	27410	6	13	52	29	31591

^aGrade expressed as percent of total yield.

^b1-First crop, October 14 to January 4, 1969.

2-Second crop, January 6 to May 24, 1969.

3-May 26 to October 11, 1969, summer.

4-October 13 to May 23, 1970, winter.

5-May 25 to October 10, 1970, summer.

6-October 12 to April 26, 1971, winter.

By this time plants in both media were too tall for their supports; those in the inert medium were the tallest. This factor, more than the substrate, caused an increase of flowers in design and green grades.

Looking at the totals for all six periods, the inert substrate produced 15% more flowers than soil did. Except during the first year, the increase in yield was distributed through the four grades about the same amount for both media.

Grade Differences

During the first crop there were 56% fewer flowers in the green or short grade produced from the inert medium. More available water caused 4 to 5 inches more stem length. Grade was also improved materially during Period 2 (second crop). While soil produced the usual high grade crop during the period, gravel produced 15% more red and 13% more blue grade flowers with somewhat fewer design and green grades. Although there were 25% more flowers produced by gravel during Period 3, the grade distribution was essentially the same for gravel and soil. During Period 4 the sizable increase in yield for gravel was almost entirely in the red (821 flowers) and green grades (253 flowers). The average grade during Period 5 was the same for both media. During the final period, mean grade was down slightly for flowers produced in gravel.

Varietal Differences

The basic differences between the cultivars White Pikes Peak and CSU Red other than color were: CSU Red was more productive than Pikes Peak by around 5%; and it produced more flowers in the green grade and about twice as many designs. Grade distribution for White Pikes Peak was the same in both media (Table 2). Gravel and more water increased yield for this cultivar by 15.5% over the 3-year period. The inert substrate and more water changed 2% of the total production of CSU Red from green (short) to red (standard) grade. There was no change in percentages of design or blue grade flowers. The yield increase in gravel for CSU Red was 15%.

Table 2. Yield and grade of flowers produced by two cultivars of carnation in two substrates for three years. There were 89 square feet of bed area per cultivar in each substrate.

Cultivar	Total	Grade as percent of total				Cultivar	Total	Grade as percent of total			
		Design	Green	Red	Blue			Design	Green	Red	Blue
White Pikes Peak						CSU Red					
Soil	13322	4	11	53	31	Soil	14088	8	16	48	27
Gravel	15390	4	12	53	31	Gravel	16201	8	14	50	27
Total	28712	4	12	53	31	Total	30289	8	15	49	27

Summary

Two cultivars of carnation were grown in soil and a lightweight aggregate for 35 months. A significant increase in grade of flowers was obtained from the inert substrate during the first and second crops (11 months). The greatest increase in yield produced by the inert medium occurred during the second year of growth. An increase in yield of 15% was obtained over the three years by use of the

gravel substrate. Results with cultivars White Pikes Peak and CSU Red were similar.

Literature cited

Hanan, Joe J. and F. D. Jasper. 1969. Consumptive water use and response of carnations to three irrigation regimes. *Jour. Am. Soc. Hort. Sci.* 94:1, 70-73.