


 research
bulletin

Published by the Colorado Greenhouse Growers' Assoc.,
Inc. in cooperation with Colorado State University

GERBERA II: LONG TERM RESPONSE TO ROOT ZONE HEATING IN SOIL AND GRAVEL SUBSTRATES

Kenneth L. Goldsberry, John Pohly and Regina (Lang) Hobika¹

The combined cut flower production of *Gerbera jamesonii* 'Amethyst', 'Friendship' and 'Mandrin' was significantly greater when grown in heated root zone media. Gravel proved to be superior over soil as a growing medium. The growing media had little influence on flower stem length and diameter. 'Mandrin' produced an average of 45.9 flowers per plant and 'Friendship' and 'Amethyst', 7 and 22 percent less, respectively.

Gerbera I, Colorado Greenhouse Growers Research Bulletin 451, January 1988, presented the early results of an experiment designed to evaluate the responses of three cultivars of gerbera planted in root-zone-heated (RZH) and non-heated (-RZH) plots of pea gravel and soil substrates. Cut flower production of 'Amethyst', 'Friendship' and 'Mandrin' was 90 percent greater in RZH media compared to production in nonheated substrates during the first 18 weeks of production. Longer stems and increased diameter of flowers was also noted. The greatest influence to plant responses was attributed to the gravel substrate.

Gerbera II summarizes the responses of the cultivars (planted on 17 October 1983) to gravel and soil growing media for a period of 52 weeks following the initial harvest of flowers on 1 January 1984. Flower yield of the soil grown cultivars was continued for an additional 20 weeks. Nutrient treated water was applied through a drip irrigation system. The gravel medium was watered 3 times daily for 3 or 4 minutes to insure that excess salts didn't accumulate. The soil benches were watered at tensiometer readings of 10-15 centibars from planting until week 23 of production, then they were watered when the soil started becoming dry to the touch. During winter months the house was heated to 54° at night and during daylight hours to 61°F, but cooled to 70° using a fan and pad system.

The average night air temperatures during the summer were approximately 60°, however, it was noted that some

¹Professor, graduate student and former student research assistant, respectively.

of the electric heating mats maintaining a minimum 66°F, 2 in. below the substrate surfaces, started malfunctioning in week 23 of the experiment. The -RZH plots approximated the night ambient air temperatures throughout the evaluation period. The greenhouse atmosphere was enriched to approximately 1000 ppm CO₂ during daylight hours and periods of no ventilation.

Results

Cultivar: The total flower production regardless of treatment varied with cultivar (**Fig. 1**), however, there were no significant differences in the yield of 'Mandrin' and 'Friendship' plants. 'Mandrin' produced an average of 45.9 flowers per plant, 'Friendship' 42.8 (7 percent less than 'Mandrin') and 'Amethyst' 35.7 (22 percent less than 'Mandrin'). 'Mandrin' produced the longest flower stems during the first 16 weeks of production. The average stem length of 'Friendship' flowers produced in all treatments was 62.2 cm for the 52 week period. 'Mandrin' was 5 percent shorter and 'Amethyst', 19 percent. There was no difference in the average flower diameter of all 'Friendship' and 'Mandrin' flowers produced in the first 16 week period, but 'Amethyst' was the smallest. A 30-day evaluation starting 1 November 1984 indicated that 'Friendship' flowers were 12.3 cm in diameter. 'Mandrin' and 'Amethyst' were 10% and 18% smaller respectively, than 'Friendship'.

Flower Production: There were highly significant RZH and medium effect on plant yield (**Fig. 2**) during the 52 week evaluation period. Plants in the RZH media produced 23 percent more flowers than those in the -RZH plots. The

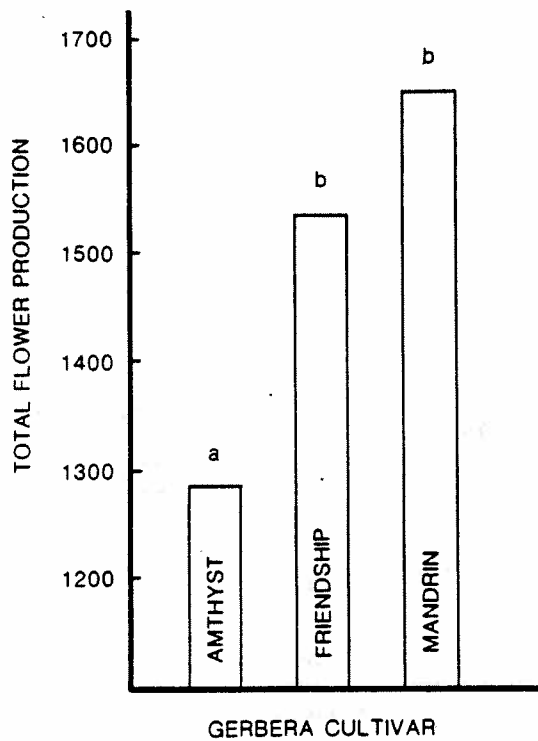


Fig. 1. Total flower production, regardless of treatments, of three different Gerbera cultivars (36 plants) planted in October and flowered for a 52-week period. Cultivars with the same letter were not significantly different.

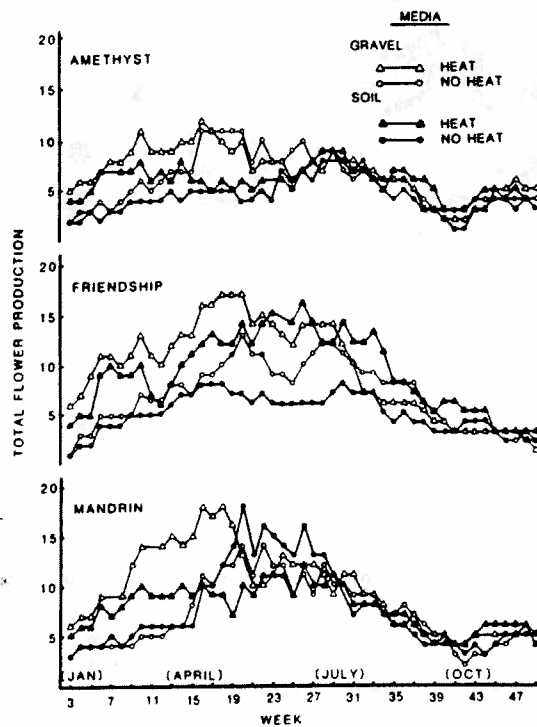


Fig. 3. Smoothed curves (five week moving means) of flower yield for 52 weeks from three Gerbera cultivars planted in October and grown in two media, with and without root zone heating.

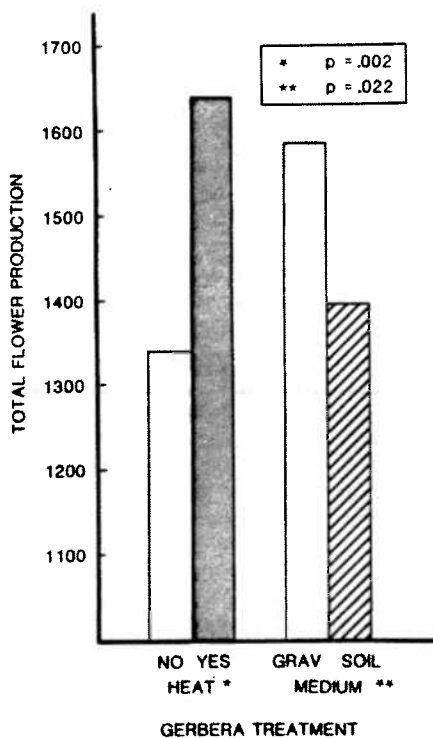


Fig. 2. The main effects of RZH and growing medium on the production of three Gerbera cultivars during the first 52 weeks of flower production.

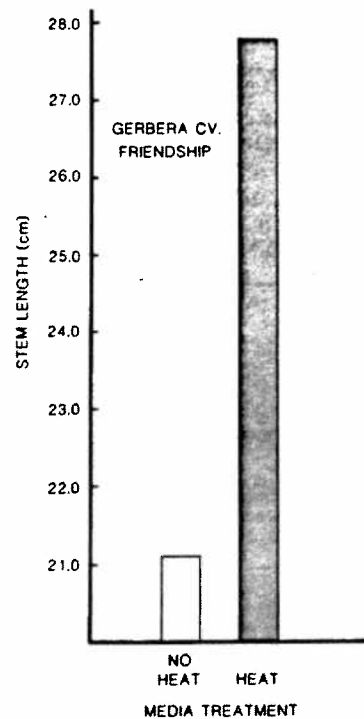


Fig. 4. 'Friendship', the only cultivar that had significantly longer ($P=.001$) flower stems due to root zone heating in both media.

gravel grown plants produced 13.4 percent more flowers than those grown in the soil medium. There was no evidence that the effect of RZH depended on medium, or vice versa. Weekly flower production of 'Amethyst', 'Friendship' and 'Mandrin' plants were graphed in order to visually observe the yield response due to medium and RZH (Fig. 3). 'Amethyst' production in both media and heat treatments was inferior to the yield of the other cultivars. There was a slight influence of RZH in both media for the first 23 weeks, then all responses were similar for the remaining 29 weeks. 'Friendship' was responsive to both RZH and gravel treatments for the majority of the year, although clear responses were not evident in the fall.

'Mandrin' flower yield was greatest in the RZH media treatments for the first 16 weeks of production and then the responses were reversed 15 weeks during the summer. Production was very similar for the last 15 weeks in all treatments.

Stem Length: The effect of RZH on stem length was only significant for 'Friendship' (Fig. 4). There was no medium effect, but the heat in both media caused stems to be significantly longer ($P=0.001$). There was no significant effect of heat or medium on the stem lengths of 'Amethyst'. The stem length of 'Mandrin' was not affected by heat. The lack of an effect was due to a cancellation of the positive heat response in gravel and a negative one in soil, however, neither of the two effects were statistically significant.

Flower Diameter: The 30-day evaluation of flower diameter in November was similar to the earlier data. There was little response of 'Amethyst' to RZH and medium. 'Friendship' produced the largest average diameter flowers, but there was no significant relationship due to RZH or media. 'Mandrin' responded similarly.

Long-Term Response: The gerbera cultivars grown in the soil treatment were retained for a total of 73 weeks in order to observe their production cycles (Fig. 5). Even though yield was not correlated with solar radiation in this experiment, it was evident that 'Amethyst' had little response to RZH or the irradiance levels during the evaluation period. Light quantity, high air temperatures or photoperiod were possibly the limiting factors for plant production of 'Friendship' and 'Mandrin' from late August to mid-January regardless of RZH. It should also be noted that the -RZH 'Mandrin' plants out-produced those in the RZH plots during late spring and early summer of their first year of production and a similar trend occurred again the following spring. It is possible that 'Mandrin' responded negatively to RZH or they were more easily water stressed by a combination of high irradiance levels and RZH.

Discussion

Leffring (2) proposed that low air temperature and short days enhanced flower bud initiation. Lin and French (3) ap-

pear to be in agreement with Leffring and claimed that *Gerbera* production was not increased by soil warming. Berninger (1) insists that soil warming accelerates flower development. The data in *Gerbera II* indicate that RZH definitely increases flower production, especially when the plants are not water stressed. The data also suggests that SD photoperiods may play a role in plant yield, but why did production remain relatively high throughout the summer months? The higher air and perhaps foliage (not measured) temperatures may have inhibited bud initiation and contributed to low late fall and early winter production. All three cultivars had similar cyclic production patterns, but were influenced differently by RZH and growing media. The results obtained from *Gerbera I* and *II* suggests that more basic research is needed to determine how a constant level of *Gerbera* production might be achieved year around.

Appreciation is expressed to Dr. Phillip Chapman, Experiment Station Statistician for his assistance in the preparation of this paper.

Literature Cited

- Berninger, E. 1979. Effects of air and soil temperatures on the growth of gerbera. *Scientia Hort.* 10:271-276.
- Leffring, L. 1975. Effects of day length and temperatures on shoot and flower production of gerbera. *Acta Hort.* 51:263-265.
- Lin, W.C. and C.J. French. 1985. Effect of supplementary lighting and soil warming on flowering of three *Gerbera* cultivars. *HortScience* 20:271-273.

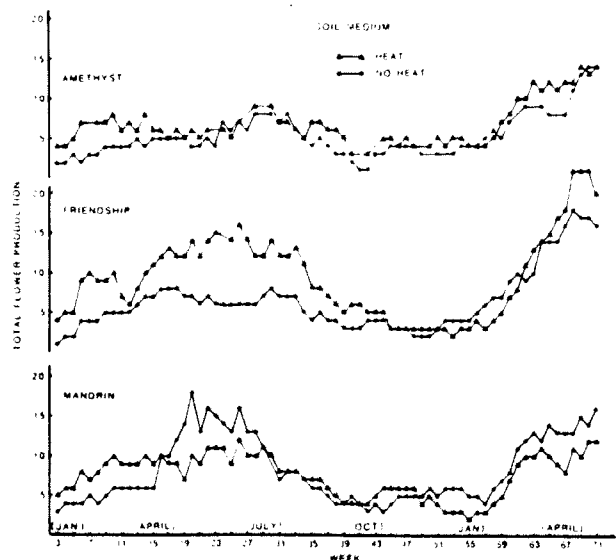


Fig. 5. Smoothed curves of flower production for 72 weeks from three *Gerbera* cultivars planted in October and grown in soil with and without root zone heating.