**Bulletin 451**
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# research bulletin

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## FIFTH ANNUAL COLORADO FLOWER CROP EXPO

**16 February 1988 Lory Student Center**
**Colorado State University · Fort Collins, CO**

**A.M. Session**

Colorado State University research reports on cut asters, freesia, growth regulators, Rockwool potting mixes.

Some minor crops for indoor and outdoor production that can make money. Allan Armitage, University of Georgia.

A complete cultural program for Colorado Majestic Mountain Carnation production — Ken Goldsberry.

Marketing strategies for Colorado Flower Crop producers. Panel of buyers — marketing expert George Kress, moderator.

**P.M. Session**

Organized tours of Colorado State University research and student teaching greenhouses.

Projects to be viewed: Easter lily nutrition, cut carnation timing, ideal rose climates, hybrid lily media, alstroemeria breeding for Colorado, bedding and pot plant varieties, Japanese cut flowers, dwarf carnation pot plant research, new Wadsworth computer control system, complete algae control.

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## GERBERA I: EARLY RESPONSE TO ROOT ZONE HEATING IN SOIL AND GRAVEL SUBSTRATES
## First of three gerbera articles.

**Kenneth L. Goldsberry and Regina C. Lang[1]**

**Cut flower production of gerbera, 'Amethyst', 'Friendship' and 'Mandrin', was 90 percent higher in root-zone-heated media compared to production in non-heated substrates during the first 18 weeks of production. Root-zone heating also caused an overall 15% increase in stem length, but only a 4%, nonsignificant, decrease in flower diameter. The greatest flower yield, longest stems and largest diameter flowers were produced by plants grown in the pea gravel substrate.**

A recommended growing medium for the commercial production of *Gerbera jamesonii* cut flowers has been a soil which provides good aeration, drainage and deep root growth. Gerbera soils have been modified with peat moss, perlite, Turface, sand or small percentages of composted bark or combinations of these. Soil-less media, including rockwool also have been recommended for gerbera flower production.

[1]*Professor and former Undergraduate research assistant, respectively.*

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Both root zone temperatures and air temperatures influence the growth and production of gerbera. Tesi reported a 33% increase in stems harvested from plants grown in a 68°F heated soil and mean air temperature of 60°F, compared to yield of plants in a non-heated root zone. Similar results were reported by Berninger and Lin. However, recent studies by Lin and French indicated gerbera production was not increased by soil warming; they apparently agree with Leffring's conjecture that low air temperature and short days enhance flower bud initiation and with Berninger's thesis that soil warming accelerates flower development. Cultivar differences in gerbera response to growing temperatures and photoperiods also have been reported.

**Materials and Methods**

Three plants of stage 3, tissue cultured cut gerbera, 'Amethyst', 'Mandrin' and 'Friendship', were planted in randomized experimental plots, (Fig.1) at a density of 1.75 $ft^2$ per plant, on 17 October 1983. Adjacent raised benches were used, each containing 3 root-zone-heated (RZH) and non-heated (-RZH) plots of pea gravel and soil substrates.

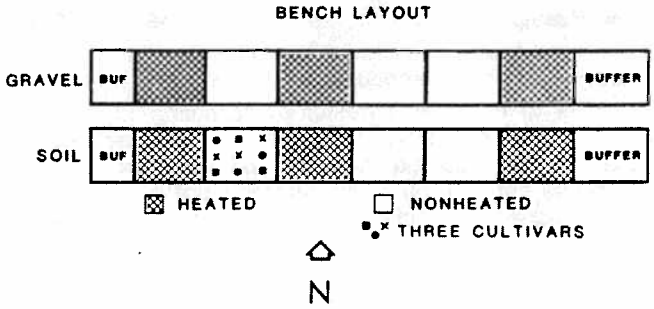


**Fig. 1:** Bench design used to evaluate the response of three gerbera cultivars to root zone heated and non-heated soil and pea gravel substrates.

The air within an east-west, fiberglass reinforced plastic (FRP) covered house was heated to 54°F at night, and during daylight hours to 61°F, but cooled to 70°F using a fan and pad cooling system. Three Flexwatt 'Agritape' (Ken-Bar Incorp., Reading, MA) electrical heating mats, 11 x 36 in. were installed according to manufacturers specifications in the bottom of each 7 in. deep heated plot, and thermostatically controlled to maintain the substrates at a minimum of 66°F, 2 in. below the surface. The -RZH plots approximated the night ambient air temperatures of the growing environment, 54°F. Air and media temperatures were monitored continuously. Soil plots were watered at tensiometer readings of 10-15 centibars, and the gravel medium automatically, 3 times daily, using a drip irrigation system within a continuous nutrition program designed for carnations. The greenhouse atmosphere was enriched to approximately 1000 ppm $CO_2$ during daylight hours.

Flowers were harvested (pulled) twice a week and data recorded for stem length, flower diameter and yield, starting with the initial harvest on 1 January and continuing through 3 May 1984. After the third month of flower production, the largest old leaves were removed by pulling them from the crown.

**Results**

Supplemental root zone heating positively influenced the growth and yield of all cultivars. The RZH plants in both substrates flowered first, with those in the heated inert medium plots flowering 20 days earlier than all other treatments.

**Flower production:** There was a highly significant RZH effect on flower yield (Fig. 2). Total flower production was 51 and 52 percent greater in the heated gravel and soil plots respectively, than production from the non-heated plants. Effects also occurred due to medium and cultivar; the yield of 'Amethyst' was significantly less than 'Friendship' and 'Mandrin', whose yields were not significantly different from each other.

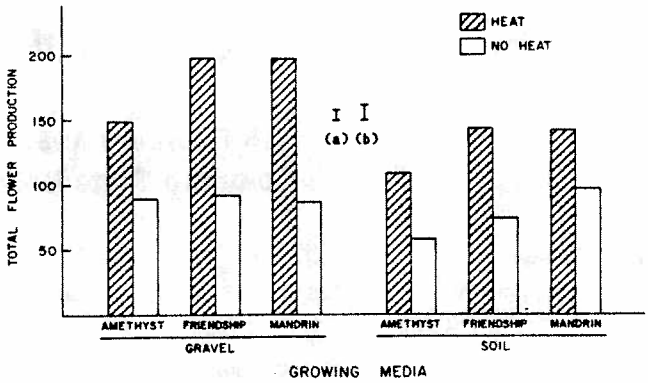


**Fig. 2:** Total flower production (9 plants) 1 Jan. through 3 May 1984, from gerbera cultivars grown in root zone heated and non-heated media. (a) numerical range, standard error (SE), of values belonging to the average that have the same medium and heat condition. (b) numerical range of values belonging to the average of values other than (a).

There was little difference in the weekly accumulated yield of 'Mandrin' in either -RZH or RZH treatments. The influence of the growing medium on plant production of the three cultivars was evident throughout the evaluation period (Fig. 3).

**Flower stem length:** 'Mandrin' had longer stems (21.6 in) than 'Amethyst' or 'Friendship' (20.4 in) (Fig. 4). Stem lengths of the latter were not significantly different from each other. Slightly longer flower stems of 20.9 in. vs. 18.5 in., were produced by gravel grown plants compared to those in soil. The effect of RZH on flower stem length did not depend on medium or cultivar.

**Flower diameter:** The flower diameters of the three cultivars were significantly different. The observed means (Fig. 5), indicated the flower size of 'Amethyst' was slightly increased in RZH media, but size of 'Friendship' and 'Mandrin' flowers was reduced. The effect of RZH on cultivar was not significantly different. Only when 'Friendship' was considered was the effect of RZH on flower diameter significantly greater. Flower diameter was larger, (1/2 in.) on gravel grown plants compared to those in soil.

**Discussion:** The gravel substrate had a positive influence on the growth of gerbera cultivars used in this experiment compared to growth in the soil medium. The better plant responses in gravel were attributed to increased aeration and uniform water availability in both RZH and -RZH conditions.

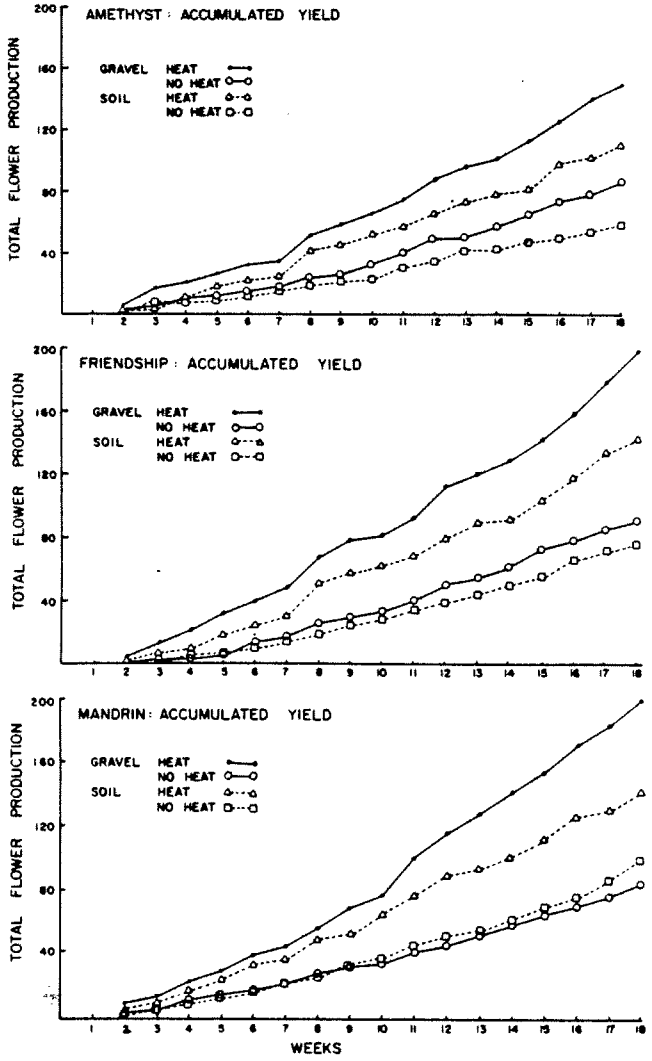


**Fig. 3:** Accumulated flower production (9 plants) of gerbera 'Amethyst', 'Friendship' and 'Mandrin' during 18 weeks starting 1 January 1984 when grown in root zone heated and non-heated media.

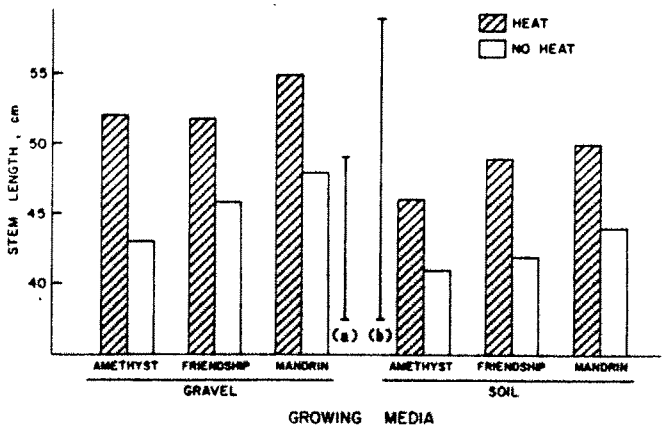


**Fig. 4:** Average stem length of flowers produced 1 Jan. through 3 May 1984, by three gerbera cultivars grown in root zone heated and non-heated media. (a) "standard error" or possible range of values for bars that have the same medium and heat condition. (b) Range, "standard error", for comparing two bars other than (a).

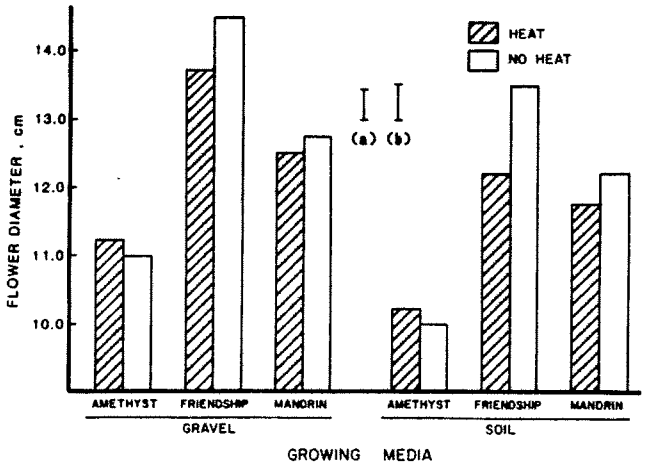


**Fig. 5:** Average diameter of flowers produced 1 Jan. through 3 May 1984, by three gerbera cultivars grown in root zone heated and non-heated media. (a) Range, "standard error", for values (bars) that have the same medium and heat condition. (b) Range, "standard error", for comparing two bars other than (a).

It is generally conceded that plant stress created by inadequate water supply will, for most floriculture crops, contribute to short stems, small flowers and reduced yield. In this 18 week evaluation, 'Amethyst', the lowest yielding cultivar in both RZH and -RZH media, showed increased production and stem length but, similar flower diameter. 'Friendship' and 'Mandrin' cultivars had similar flower yields in each RZH medium, but responded differently in stem length and flower diameter (Fig. 4 and 5).

RZH, when compared to -RZH, increased the number of flower stems harvested by 42, 55, and 56% in gravel-grown 'Amethyst', 'Friendship' and 'Mandrin' cultivars, and 46, 80 and 31% respectively, in the soil medium. The increase was far greater than the 33 percent due to RZH reported by Tesi. The abundance of winter solar radiation in the Fort Collins geographical area is the main factor for increased cultivar yields.

The different responses due to cultivar, growing media and root zone heating during the first 18 weeks of production were evident, and substantiated Leffring's observations that gerbera genotypes are influenced differently by their production environment. Gerbera II will summarize the production of the three cultivars over a 52 week period.

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