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Response of Carnations to Liquid Feeding

by

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The response of carnations to subnormal and normal rates of liquid feeding were published in CFGA Bul. 104. The two highest rates used in this former experiment gave the highest yields and average grades, with the differences between the two rates not significant.

To check the reliability of this information and to test one higher rate of liquid feeding 12 5-row plots were planted with rooted cuttings of Crowley's Pink Sim on June 26, 1958. One buffer row of Red Gayety was planted between each pair of plots and dividers were used to prevent intermixing of soil solutions.

Beginning with the first irrigation following planting and continuing throughout the experiment, four plots arranged at random, were watered with each of three different nutrient solutions. These solutions were applied by means of a PR Fertoject machine from separate tanks of stock solution. The irrigation water for the three treatment rates contained the following chemicals and amounts per 1000 gallons:

	Soln. 1	Soln. 2	Soln. 3
Ammonium nitrate	3 lbs.	3.75 lbs.	4.50 lbs.
Muriate of potash	1.75 lbs.	2.19 lbs.	2.63 lbs.
Magnesium sulfate	0.5 lbs.	0.63 lbs.	0.75 lbs.
Sodium nitrate	0.25 lbs.	0.31 lbs.	0.38 lbs.
Borax	0.50 oz.	0.63 oz.	0.75 oz.

Adequate treblesuperphosphate was incorporated in the soil prior to planting. Solution 1 is the basic rate of treatment of irrigation water used at Colorado State University for the past eight years.

Flowers were cut from these plants from October 12, 1958, to May 31, 1959, and graded by weight, length, and appearance. The rates of feeding caused no significant differences in either yield or average grade of flowers. The mean grade

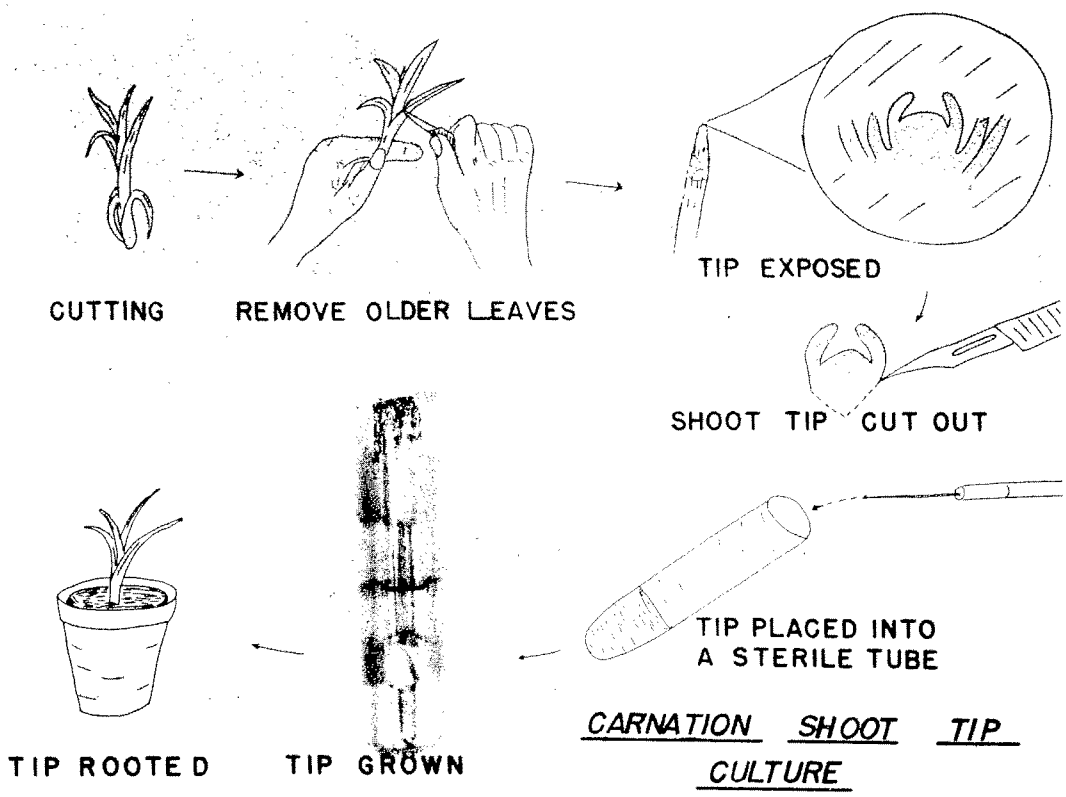

Figure 1. The procedure followed in Carnation Shoot Tip culture.

gibberellin added to the medium was effective and would give normal appearing growth of the tips.

The 1 mm tips, however, did not live long in the gibberellin medium. An examination of the medium showed it to be somewhat acid (pH 5). When the media was adjusted to neutrality (pH 7) the 1 mm tips grew well during the 2 weeks of the experiment.

Two problems of carnation shoot tip culture are now being investigated:
(1) long term culture of the tips, and
(2) factors influencing root initiation.
The cultures maintained without transfer for a period of over 2 weeks show signs of a decline. This is evidenced by a browning at the point of contact with the media. Several compounds are being investigated in an attempt to counteract this response.

Root initiation has not been observed in the sterile cultures. Attempts to root 2-3 week old shoot tips (15-20 mm) were not successful.

Sucrose, all known essential elements, amino acids and some supplementary vitamins are incorporated into a medium which is to supply the nutritional needs of the small tip. Agar or a paper wick is introduced into the media to provide support for the tip. Aseptic conditions are maintained while the outer leaves of a cutting are cut off. A scalpel is used to remove the shoot tip. The tips, 1 to 4 mm long, are placed into sterile prepared tubes. The tip size is recorded at this time and compared with its size at the termination of the experiment.

In our experiments growth of 4 mm tips was very slow and the resulting tissue was abnormal when the basic medium, as outlined above, was used alone. The very small tips (1 mm) were viable for only a short time. Gibberellin has been used to promote the normal growth of shoot tips of other plants (1). Gibberellin was used first at a concentration of 50 and 25 ppm. The gibberellin medium (50 ppm) produced plants approximately 3 times the size of plants grown in the basic medium during a 2 week period (see table 1). However, this growth was chlorotic and twisted. In subsequent experiments it was found that a concentration of 5 ppm

for all treatments was down slightly from the previous year (Bul. 104) because a bench of taller plants shaded one of the benches in this experiment until December. Yield and grade of all the flowers cut follow:

Solution	Split & design	Short	Standard	Fancy	Total	Mean grade
1	125	278	707	426	1536	3.93
2	122	343	729	372	1566	3.86
3	111	278	787	373	1549	3.92

Samples of the flowers and stems taken May 30, 1959, had a dry matter percentage range of 18.6 to 20.4 for individual plots. Variation in mean dry matter percentage due to feeding rate, however, was not significantly different.

Recommendations

No appreciable increase in yield or grade has resulted from using higher than normal concentrations of nutrients in the irrigation water on a continuous schedule.

The following amounts of chemicals or their equivalent per 1000 gallons of irrigation water are adequate for carnation growth in Colorado:

Ammonium nitrate, 3 lbs. OR calcium nitrate, 6 lbs.
Muriate of potash, 1.75 lbs. OR potassium sulfate[a], 2.1 lbs.
Magnesium sulfate, 0.5 lbs.[b]
Sodium nitrate, 0.25 lbs.
Borax[c] 0.5 ounces.

a Use potassium sulfate if water contains appreciable chlorides.
b Not needed in most water from deep or shallow wells. Experiments are now under way to determine the amount needed in water from mountain streams.
c The borax requirements vary with the amount of light received by the plants (See Bul. 113). This amount should be doubled from June to September.

No mention has been made of phosphate requirements. It is assumed that treble superphosphate is added to the soil prior to planting to maintain a soil test of 2 - 10 ppm. Agricultural phosphoric acid 52% can be added to the irrigation water to supply all or part of the requirements. Two pounds per 1000 gallons should supply the complete requirements in artificial media. One-half to one pound is usually adequate for soils that contain some phosphate.

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