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YIELD AND QUALITY OF 'SAMANTHA' ROSES IN THREE INERT MEDIA

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Mini-rose plants were benched July 2, 1985, with production records taken for 35 weeks during the 1985-86 winter. Plants in loose rockwool outproduced roses in gravel or cubed rockwool by more than 55 percent, with a greater number of cut flowers in the 21, 24, and 27 inch stem lengths.

There has been considerable interest in utilization of rockwool as a growing medium. Several systems have been touted, especially in the European trade literature. Under certain circumstances, with strict attention to detail, very significant yield increases may be achieved with some of these hydroponic systems.

Methods and materials

Mini plants of the rose variety 'Samantha,' grafted on *R. odorata,* were benched July 2, 1985, in:

1) Eight inches of loose, washed gravel,
2) Three-inch deep, plastic covered, cubed rockwool, each cube having a dimension of about 6 × 39 inches, and
3) Eight inches of loose rockwool.

These materials were placed in "V" bottomed, concrete benches, with 1½ inch PVC pipe laid in the "V" for drainage. A preplant addition of lime and treble superphosphate was made to gravel and loose rockwool and mixed in.

Six benches in House 2 were utilized (Fig. 1) with each treatment repeated in two benches, each bench divided into three plots of 21 plants, each at a one plant per sq. ft. density. 'Privie' was utilized as buffers between plots and at the ends of the benches.

Two lines of Twin IV, trickle irrigation tubing, emitters spaced at 1½ inches, per plant row, were laid in the gravel and loose rockwool treatments. A single line was installed initially for the cubed rockwool medium, but blockage of the emitters by hair roots later required replacement, and a second line per row was added. Care was required to insure that the emitters faced upward to avoid future blockage. Water pressure on the leader tubes to each trickle line was controlled at 9 to 10 psi by automatic regulating valves. The plants were irrigated automatically by a timer, starting at four times daily for 6 minutes each irrigation in July, reduced to twice daily on Dec. 5, and then increasing to four times daily in Feb., 1986. The standard Colorado State carnation solution was injected at each watering, using a raw water supply with less than 100 micromhos/cm electrical conductivity. A high pressure mist system controlled humidity at about 60 to 70 percent, with CO_2 injected to maintain about 500 to 1000 ppm. The greenhouse was covered with FRP, with night temperatures set at 62°F, heating to 72°F during the day with ventilation beginning at 86°F from November through March.

Soft pinching for plant buildup was begun on July 15, and a timing soft pinch given on Sept. 26. Records were kept on a weekly, per plot basis, from Sept. 9, when production began, through April 27, 1986, when the plants were hair-cut to 12 inches for the start of a new experiment.

[1]*Professor.* *The study carried out with a grant from Rockwool Industries and the Colo. Agric. Expt. Sta. Appreciation is expressed to Jackson & Perkins and Conard-Pyle for plant materials, and to Rockwool Industries, Grodania A/S, Denmark, and Chapin Watermatics for materials.*

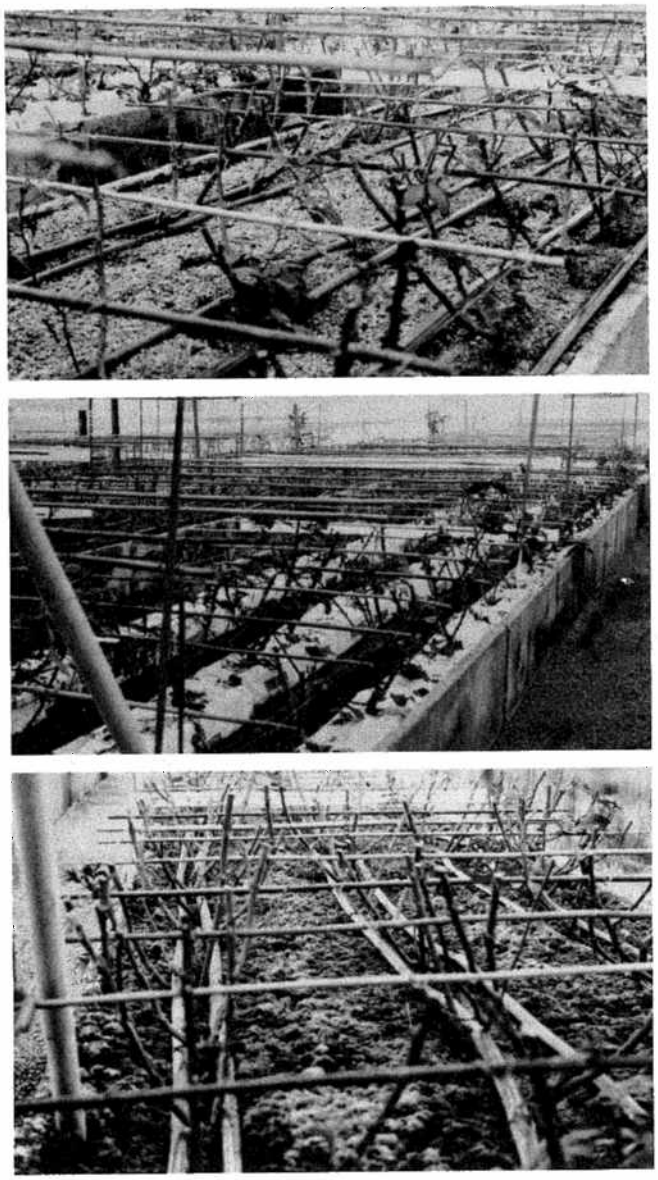

Figure 1: Mini-roses, 'Samantha' on *R. odorata* shortly after planting in gravel (upper), cubed rockwool (middle), and loose rockwool (lower).

Table 1: Yield of 'Samantha' roses for a 35 week period (Sept. 9, 1985, to April 27, 1986) grown in gravel, cubed rockwool, and loose rockwool. All treatments watered at the same frequency and amount, with the same nutrient solution.

	Gravel	Cubed rockwool	Loose rockwool
Average total flowers per plot each week (21 plants)	11.4	10.9	17.3
Total cut flowers per plant (35 weeks)	19.0	18.2	28.8

Table 2: Percent stem length distribution of 'Samantha' roses over a 35 week period (Sept. 9, 1985, to April 27, 1986) grown in gravel, cubed rockwool, and loose rockwool. All treatments watered at the same frequency and amount, with the same nutrient solution.

	Stem length (inches)						
	9	12	15	18	21	24	27
Gravel	3	7	17	28	24	12	9
Cubed rockwool	3	8	20	24	19	14	13
Loose rockwool	2	3	10	18	22	22	23

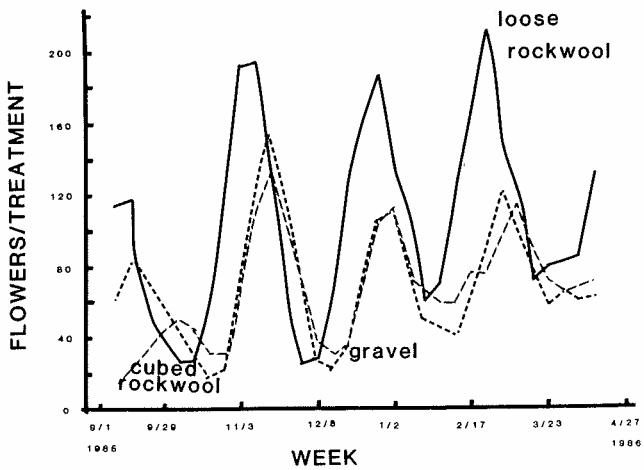

Figure 2: Smoothed weekly yield per plot of 'Samantha' rose grown in gravel, cubed rockwool, and loose rockwool. Soft pinched for timing on Sept. 26, 1985, benched July 2, 1985. All treatments watered at the same frequency, the same amount each watering, and fertilized with the same nutrient solution.

Results

Plants in the loose rockwool treatment produced nearly 60 percent more flowers than the cubed rockwool or gravel treatments (Table 1). Yield of plants in gravel was slightly higher than those in cubed rockwool. Cut roses from the loose rockwool treatment were characterized by much longer stems, with 67 percent of the total cut in the 21, 24, and 27 inch lengths, whereas gravel and cubed rockwool produced less than 50 percent of their flowers in the top three grades (Table 2). In general, return to peak flowering by roses in loose rockwool was two to three weeks quicker, with plants in gravel and cubed rockwool performing comparably (Fig. 2). Note that the first flowering peak for cubed rockwool was low and delayed compared to either gravel or loose rockwool, probably resulting from severe stress when the trickle tube emitters were blocked by rose roots. During the initial stages of growth, guttation was prevalent in all treatments (Fig. 3), evidence of a positive root pressure, and a sufficiency of water, at least during the early morning hours.

Discussion

It was evident to us that the different treatments should have been watered differently. The restricted volume of cubed rockwool, combined with a material to reduce water-holding capacity, meant that roses in this type of substrate would be, and were, subjected to drought at vari-

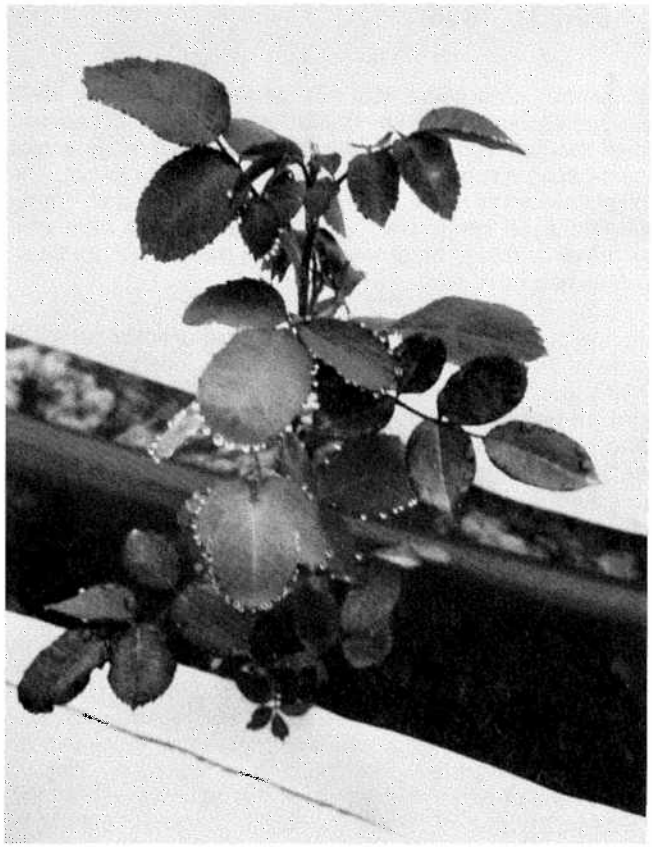

Figure 3: Guttation of small rose plants in an inert medium during early morning hours. This is evidence of a positive root pressure.

ous times. On the other hand, loose rockwool retained a high amount of water, with one able to squeeze water, with little effort, from particles of the upper surface. Gravel, based upon experience, would be intermediate, with a greater likelihood of drainage of the upper layers by capillarity as contrasted to rockwool, which apparently exhibited little or no continuous capillarity throughout the entire medium volume. The yield of roses in loose rockwool was spectacular.

The irrigation timer was limited to a maximum frequency of four times daily, and the frequency and timing of each watering had to be reprogrammed manually as the season progressed. In May, 1986, after the roses had been cut back, the watering system was placed on the computer for control. We have set up the system to irrigate cubed rockwool when 1000 kilojoules per square meter total radiation has been accumulated, with each watering for three minutes, whereas gravel requires 2000 KJ/sq.m. for 6 minutes each, and loose rockwool is irrigated when the system accumulates 3000 KJ/sq.m., with 8 minute lengths. Observations of watering frequency through July indicate the cubed rockwool being irrigated on bright, clear days in excess of 15 times daily, whereas the loose rockwool is being irrigated five to seven times daily. All treatments are irrigated simultaneously when the system switches to day regimes.

We would like to emphasize that particular attention must be given to the details in systems of this type. Soils are less dangerous, given their buffering capacity. However, common soils usually limit maximum production potential in roses, whereas we think that inert media have a distinct advantage in terms of yield and quality — if the grower is persnickety.

FORT COLLINS GREENHOUSE CLIMATOLOGICAL SUMMARY FOR FOUR WEEKS BEGINNING JUNE 1, 1986 (See Bulletin 426 for details.)

	Week beginning							
	June 29		July 6		July 13		July 20	
	Day	Night	Day	Night	Day	Night	Day	Night
Average outside temperature (°F)	80	69	75	62	78	65	74	63
Maximum outside temperature (°F)	97	85	89	74	96	78	88	75
Minimum outside temperature (°F)	64	55	59	55	64	56	57	52
Degree-days of heating	—	—	—	11	—	—	—	7
Average hours in the period	14	10	14	13	13	10	13	11
Accumulated total solar radiation (MJ/sq.m.)	153	—	143	1	131	1	140	1
Average relative humidity (%)	38	42	43	66	40	65	47	72
Maximum relative humidity (%)	75	61	90	96	76	92	97	99
Minimum relative humidity (%)	14	25	19	36	15	39	20	32
Average absolute vapor pressure (mb)	13	12	13	13	13	14	14	14
Average wind speed (mph)	2	2	2	2	2	1	2	1
Maximum wind speed (mph)	26	14	21	18	25	16	20	9
Average CO_2 concentration (Pascal)	17	—	17	—	17	—	17	—
Maximum CO_2 concentration (Pascal)	26	—	36	—	22	—	24	—
Accumulated gas consumption (cu.ft./sq.ft.)	1	—	1	2	1	1	2	1