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CULTURAL PRACTICES INFLUENCE YIELD AND INCIDENCE OF NON-FLOWERING *GYPSOPHILA*

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Abstract. **Non-flowering *Gypsophila paniculata* L. plants typically average 5-10% of the population in commercial operations, and, in some instances, portions of a field or an entire field fail to flower. Several experiments were designed to examine the influence of cultural practices on the yield and incidence of non-flowering *Gypsophila*. A 2x3 factorial experiment was established to determine effects from management practices involving use of mulch (plastic much versus no much) and fertilization rates (200, 400 or 800 lb N/acre). Use of mulch had no effect on flowering. High fertilization rates delayed flowering but did not induce a non-flowering plant habit. In another experiment, mechanical damage three and six weeks after planting to simulate root injury by hoeing or insects resulted in about 50% less yield than undamaged plants, and 13% of the damaged plants were non-flowering while all control plants flowered. In a third study, the flowering status of plants in two commercial fields was related to soil moisture levels. In wet (14 to 21% moisture) and dry areas (3 to 4% moisture), 43 to 62% of the plants were non-flowering compared to only 14 to 16% non-flowering plants in areas with good soil moisture levels.**

Field grown *Gypsophila paniculata* had an estimated cut flower value of about 6.3 million dollars in 1986 (3) making it the third most valuable cut flower in Florida. Rooted stem-tip cuttings are planted in the field from August through February and should have visible signs of flowering 50 to 60 days from planting. One problem that has plagued growers over the years has been that some plants fail to flower. A survey of commercial producers revealed that the percentage of non-flowering plants in any one field varied from a typical 5 to 10% to almost 100%. Selection of clones within 'Bristol Fairy' revealed that some of the non-flowering plants were the result of genetic changes (2). This led to the isolation of clones which would not flower in normal production months in Florida and the selection of day neutral 'Floriana Mist' and 'Floriana Cascade', which flower uniformly in Florida (4). However, it was apparent cultural practices also affected flowering in *Gypsophila*. The experiments presented in this paper were designed to test the hypothesis that cultural practices involving irrigation, fertilization and weed control influence the incidence of non-flowering gypsophila.

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Materials and Methods

Experiment 1. A field of EauGallie fine sandy soil was amended with 1000 lbs dolomite/acre and 500 lbs superphosphate/acre. Beds were formed 6 to 8 inches high and 30 inches wide. Seep irrigation was supplied with a constant water table held 15 to 18 inches below the bed surface. Fumigation was with methyl bromide 98%/chloropicrin 2% at 600 lbs/acre two weeks before planting. 'Bristol Fairy' plants were planted 18 inches apart down the center of the beds on 27 December.

A 2x3 factorial experiment was conducted to determine the effects of mulching practice and fertilization rates on the incidence of non-flowering plants. Raised beds were either mulched with white/black 1.25 mil polyethylene plastic or not mulched. Fertilizer levels were 200, 400 or 800 lbs N/row acre from 6N-2.6P-4.9K. A single application of fertilizer was applied on the bed surface in two bands 12 inches from the plant row for treatments with mulch. In treatments without mulch, the fertilizer was broadcast on the beds in four equal applications at three week intervals initiated at planting.

A randomized block design was used with five replications of three plant experimental units. Data on total weight of cut inflorescences were recorded on 25 March, 6 and 22 April for each plant. Plants with stem elongation, the first visible sign of inflorescence initiation (1), were recorded as flowering while those plants without signs of stem elongation and rosette growth habit were recorded as non-flowering on 18 February, 8 and 25 March, and 22 April.

Experiment 2. This experiment was to determine the effects of mechanical damage to *Gypsophila* roots. Field preparation was as in Experiment 1 with plants grown on beds without mulch. All treatments received 200 lbs N/row acre from 6N-2.6P-4.9K applied in four equal applications initiated at planting, 27 December. The treatments were: 1. no mechanical damage; 2. pre-plant damage; 3. post-plant damage. Approximately 50% of the roots were broken off at planting in the pre-plant treatment, simulating rough handling which may occur in shipping or during the planting process. Post-plant damage was three and six weeks after planting. A hoe penetrating the top 2 to 4 inches of soil was used to remove shallow rooted weeds around the Gypsophila plants. Weeds with deeper root systems were pulled by hand. In addition to this post-plant damage to roots from weeding, a soil sampler was pushed into the soil to a depth of 6 inches in four locations close to the crown of the plant to simulate root damage by subterranean insects.

Treatments were arranged in a randomized block design with five replications of three plant experimental units. The number of plants with inflorescence initiation was recorded on 8 and 20 February and weight of harvested inflorescences recorded on 25 March and 6 and 22 April.

Experiment 3. This study was to determine the relationship of percent soil moisture and flowering status of *Gypsophila*. Two fields of 'Bristol Fairy' at Rainbow Farms, Ruskin, Florida were used for this study. Field I was planted on 21 December from plants propagated in California and Field II was planted 21 February with plants propagated in Ohio. Both crops were planted on 16 inch centers in 3 foot wide raised beds covered wtih plastic mulch. Seep irrigation was used and nutrition supplied with 200 lbs N/row acre from a balanced fertilizer.

One hundred randomly chosen plants were evaluated for flowering status on 18 May in Field I and fifty in Field II. Plants were classified non-flowering if they exhibited a compact growth habit with no visible inflorescences. Soil samples to a six inch depth were taken from the middle of the bed on each side of plants evaluated for flowering. Total soluble salts from a saturated paste extract were determined. Percent soil moisture was determined on a dry weight basis. An analysis of variance using the method of fitting constants was run on percent soil moisture and total soluble salts. A Chi-square test for independence was used to compare the relationship of percent moisture and flowering status of sampled plants.

Results and Discussion

Experiment 1. Main effect means only are presented in Table 1 because of no interactive effects of mulching practice and fertilization on yield or percent flowering plants for any harvest date. Plants treated with 200 and 400 lbs N had similar yields at all harvests and total yields were 36.4 and 38.8 oz per plant respectively. Plants with 800 lbs N produced the lowest yields on 25 March, 6 April and for total harvest (24.8 oz). Mulching practice had no effect on yield.

On 18 February, all plants receiving 200 lbs N/acre were flowering compared to 80 and 66% of the plants which received 400 or 800 lbs N/acre. On 8 and 25 March, plants provided 400 lbs N/acre had 97 and 100% flowering, while percentage of flowering plants with 800 lbs N/acre was 70 or 80% for these dates. Plants in all treatments were flowering by 22 April. Mulching practice did not influence percent flowering plants for any harvest date.

Experiment 2. Yields of *Gypsophila* receiving post-plant root injury were less in all harvests compared to plants with no root injury or pre-plant root injury (Table 2). Total yields were 21.0 oz/plant with no root injury, 15.5 oz/plant with pre-plant root injury or 10.0 oz/plant with post-plant root injury. The percentage of flowering plants was similar for the no-injury and pre-plant root injury treatments for all dates, and all plants in both treatments were flowering by 25 March. Plants receiving post-plant root injury had fewer plants flowering at all harvests and 13% were non-flowering at experiment termination.

Table 2. The effect of pre-plant and post-plant root injury[z] on the percentage flowering plants and weight of inflorescences (yield) of *Gypsophilia paniculata* 'Bristol Fairy'.

Root injury	Flowering plants[y] (%) 18 Feb	8 Mar	25 Mar	22 Apr	Yield (oz/plant) 25 Mar	8 Apr	22 Apr	Total
Control	60 a[x]	89 a	100 a	100	2.3 a	13.9 a	4.8 b	21.0 a
Pre-plant	60 a	95 a	100 a	100	3.0 a	10.7 a	1.8 a	15.5 a
Post-plant	32 b	60 b	72 b	87 ns	0.5 b	4.9 b	4.6 b	10.0 b

[z]Pre-plant root injury was to simulate rough handling during transplanting and about 50% of the roots were removed at transplanting. Post-plant root injury was produced by hoeing, weeding and simulated subterranean insect root damage.
[y]Plants with any visible sign of flowering, such as one stem with internodal elongation, were counted as flowering.
[x]Mean separation by Tukey's HSD, .05 level.

Experiment 3. No differences were recorded in total soluble salts between Field I and Field II or between non-flowering and flowering plants (Table 3). Mean soil moisture levels between fields did vary, with Field I having a mean moisture level of 9.9% compared to 12.4% in Field II. The difference in average moisture values was due to the presence of dry areas (3-4% moisture) in Field I which were lacking in Field II. The non-flowering or flowering status of plants was dependent on soil moisture in both fields. In relatively high moisture areas (range of 14 to 21%) in Field I or II and dry areas in Field I, the percentage non-flowering plants ranged from 43% to 62% (Table 4). Non-flowering plants represented only 14-16% of the plants from areas of the field with intermediate soil moisture levels. The intermediate moisture levels were within a range considered ideal for seep irrigation.

Results of these tests indicated that cultural practices influenced the yield and incidence of non-flowering *Gypsophila.* While fertilization rates did not induce non-flowering plants, high rates delayed flowering. A delay in flower-

Table 1. Main effects of three fertilizer rates and mulching practice on the percentage flowering plants and weight of harvested inflorescences (yield) of *Gypsophila paniculata* 'Bristol Fairy'.

Main effects	Plants flowering[z] (%) 18 Feb	8 Mar	25 Mar	22 Apr	Yield (oz/plant) 25 Mar	6 Apr	22 Apr	Total
Fertilizer rate (lbs N/acre)								
200	100 a[y]	100 a	100 a	100 a	8.9 a	21.5 a	6.0	36.4 a
400	80 b	97 a	100 a	100 a	9.2 a	24.4 a	5.2	38.8 a
800	66 b	70 b	80 a	100 a	4.6 b	10.2 b	10.0 ns	24.8 b
Mulching practice								
Mulch	80	85	91	100 ns	9.4	20.9	7.3	37.7
No Mulch	84 ns	91 ns	95 ns	100 ns	5.7 ns	21.1 ns	6.7 ns	33.6 ns

[z]Plants with any visible sign of flowering, such as with one stem with internodal elongation, were counted as flowering.
[y]Mean separation by Tukey's HSD, .05 level.

Table 3. Total soluble salts (TSS) and percent moisture of the soil around flowering and non-flowering *Gypsophila paniculata* 'Bristol Fairy' in two commercial fields.

Flowering status	TSS	% Moisture	TSS	% Moisture
	Field I		Field II	
Flowering	6891	9.9	6178	12.4
Non-Flowering	6268	12.1	5789	15.0

	Significant Effects	
	TSS	% Moisture
Flowering vs Non-flowering	ns	0.01
Field I vs *Field II*	ns	0.01
Flowering vs Field	ns	ns

ing is not as devastating to the producer as production of vegetative plants, but a delay in flowering can result in a significant loss in revenue due to changing prices in the market during the season. The incidence of non-flowering plants was not affected directly by mulching practice in these tests, but an indirect effect on flowering may result since unmulched beds may have to be weeded by hoeing. Our findings indicated that post-plant root injury from hoeing and simulated insect damage resulted in 13% non-flowering plants and 50% less yield than plants which did not have root injury. The importance of field preparation relative to leveling and moisture control was illustrated by the relationship between flowering status and percent soil moisture in a commercial field. Since the water table is held at a constant level with seep irrigation, any low areas in the bed become waterlogged and high areas become too dry. Our examination of a commercial field revealed that wet and dry areas of the field had 43 to 62% non-flowering plants. The overall effects of improperly preparing a field

Table 4. Number of flowering and non-flowering *Gypsophila paniculata* 'Bristol Fairy' observed in different soil moisture levels in two commercial fields.[z]

Flowering status	Number of plants from soil moistures of: 3 to 5 %	5 to 14 %	14 to 21 %
		Field I	
Flowering	8	51	5
Non-flowering	6	10	7
		Field II	
Flowering	0	32	5
Non-flowering	0	5	8

[z]The Chi-square test for independence used to compare the relationship of percent soil moisture and flowering status was significant at the 0.01 level for both fields.

on total yield would, of course, depend on the proportion of the total production area that was not leveled or prepared properly to prevent wet or dry areas.

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GROWTH OF DIEFFENBACHIA AND GARDENIA IN VARIOUS POTTING INGREDIENTS

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Abstract. **AlIflor and BioEarth, two commercially available products, were tested in various combinations with Florida sedge peat, pine bark and builders' sand as potting components for *Dieffenbachia* 'Compacta' and *Gardenia jasminoides* 'Veitchii' in six-inch pots. The first of two experiments tested 10 potting mix combinations with either 2 or 4 irrigations per week and the second experiment using 8 combinations received three irrigations/week. Plants were grown in a glasshouse with a maximum light intensity of 1500 ft-candles and were fertilized with 5 grams Osmocote 19-6-12 per three months in Experiment 1 and per two months in Experiment 2. Results varied, but indicate that both AlIflor and BioEarth can be used successfully as potting ingredients and further evaluation is encouraged.**

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Several reports have compared various potting ingredients for best growth of foliage plants (2, 4, 5, 6). There is also information available on physical and chemical properties of artificial media used in containers (1, 3, 8, 9, 10). Suggested standards for physical requirements of media has already been published (7).

Large volumes of potting ingredients are utilized by the foliage industry for plant production. Of the many ingredients used, peat is used in largest quantities. New materials are constantly being introduced that may have the potential for being less expensive or have better physical or chemical characteristics than peat.

ALIflor (ALIflor Corp., Miami, FL) and BioEarth (Fabcon, Inc., San Francisco, CA) were tested at the research