RESEARCH RESULTS FOR FLOWER GROWERS

Utilization of Processed Garbage in the Production of Florist Crops 1967 - 70

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INTRODUCTION

This research had as a broad objective the determination of means of conservation and utilization of the resources contained in garbage compost.

The compost was produced from garbage after most of the metals, rags, and large items of refuse were removed by hand or mechanical means. The remaining material was ground in a hammer mill and composted in windrows

Two products of Municipal Compost Plant of the City of Mobile, Alabama, except as noted, were used. The first was a coarse ground compost containing a large quantity of plastic and will be referred to as the original compost (oc). The second compost was marketed under the trade name of Mobile Aid (MA) and, while chemically similar to the original compost, contained less visible plastic and was finer ground.

Growth and Foliar Analysis of Chrysanthemums Grown in Garbage Compost Amended Media.

Most garbage compost materials contain considerable amounts of metals such as: calcium, magnesium, manganese, zinc, copper, iron, aluminum, sodium, boron, chromium, vanadium, arsenic, and molybedenum. Many of the heavy metals found in garbage compost are toxic to plants in minute quantities. Toxicity symptoms observed on plants may be the result of concentration of one or more of these elements in plant tissues. To investigate this possibility, foliar analysis experiments were conducted on chrysanthemums grown in garbage compost-amended soils.

Experiments compared original compost with Mobile Aid and other materials as a soil amendment for chrysanthemums. The two compost materials used had the following analyses:

Compost	Soluble salts (mhos)	pH	Elements (p.p.m. Spurway)			
			N	P	K	Ca
Original	30 - 86	8.4	0-5	0-1	20-40	100-150
Mobile Aid	70 -195	8.5	0-2	0-1	20-40	100-300

Ten potting mixtures were formulated from the two garbage composts, Table 1. The pH of the mixtures was adjusted to 6.0 using dolomitic limestone or fine sulfur. Gypsum was added to mixtures where the pH was adjusted with sulfur. Superphosphate was added to all mixtures at the rate of 1.6 kg per 1 m^3 of rooting media. Plants were fertilized every 2 weeks by watering with a solution containing 3 g of 25-10-10 fertilizer per liter of water.

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Rooted cuttings of two cultivars of chrysanthemums (Chrysanthemum morifolium Ramat.), 'Giant No. 4 Indianapolis White' and 'Giant No. 4 Indianapolis Yellow', were planted into two greenhouse benches containing 12 randomized plots each. Planting was done on June 5. The plants were pinched on June 19 and short day treatment was started on July 12.

Growth data consisted of the weight and length of the flowering stems cut at the pinch. Twenty flowering stems were selected at random for these determinations and measurement of flower diameters. Leaf samples were collected for chemical analysis approximately 4 weeks prior to flowering. Leaf samples were composed of the uppermost mature leaves (usually 7th or 8th leaf below the stem tips.) A composite sample, representing each treatment, was prepared from the two cultivars. Spectrographic analyses for phosphorus, potassium, calcium, magnesium, sodium, zinc, manganese, iron, copper, boron, and aluminum; and micro-Kjeldahl analysis for nitrogen were performed.

Most plants were in flower by September 11. Plants grown in media amended with either compost exhibited a marginal burn on their older leaves. Plants grown in peat-amended soils did not show any injury. Table 1 presents the growth data of the plants grown in the various media. The length of the flowering stem ranged from 83 cm (soil, perlite, and peat) to 65 cm (soil and Mobile Aid.) Plants grown in peat-amended media (81 cm) averaged longer flowering stems than plants grown in original compost (78 cm) and Mobile Aid compost (73 cm) amended media.

Table 1. Growth Comparison of Cut Chrysanthemums Grown in Several Media

Media	Stem length	Stem weight	Flower diameter
	cm	g	cm
Soil and peat 1:1	81.0	90.4	13.0
Soil and original compost 1:1	71.1	70.5	12.2
Soil and Mobile Aid 1:1	65.0	62.0	11.9
Soil, peat and original compost 2:1:1	79.8	75.0	11.9
Soil, peat and Mobile Aid 2:1:1	78.0	72.5	12.4
Soil, perlite and peat 1:1:1	82.6	83.2	11.9
Soil, perlite and original compost 1:1:1 . .	81.0	77.0	11.9
Soil, perlite and Mobile Aid 1:1:1	70.1	67.0	12.2
Soil, perlite, peat and original compost 2:2:1:1 . .	80.0	80.8	12.2
Soil, perlite, peat and Mobile Aid 2:2:1:1 . .	78.5	76.9	12.7

The mean weight of flowering stems of plants grown in peat-amended media (81.5 g) exceeded the mean stem weight of plants grown in media amended with original compost (75.8 g) and Mobile Aid compost (69.6 g). Plants grown in soil and Mobile Aid (62.0 g) had the smallest stem weight, and plants grown in soil and peat (90.4 g) had the largest stem weight.

Large differences in flower diameter were not apparent in plants grown peat (12.2 cm), original compost (12.2 cm), and Mobile Aid (12.4 cm) amended media. Soil and peat (13.0 cm) produced the largest flowers. Most of the media yielded flower diameters approximately equal to the experiment mean (12.2 cm).

The foliar analysis of the plants is presented in Table 2. Plants grown in soil and original compost had the highest nitrogen level (5.20%). Kofranek 1/ has stated that the critical nitrogen level for chrysanthemums is 4.5%. With the exception of plants grown in soil and original compost, all the plants had nitrogen levels below Kofranek's critical value. Phosphorus levels exceeded the optimum range in all plants. Plant potassium and calcium levels equaled or exceeded the optimum range in all media. Plants grown in soil and original compost (.22%), soil and Mobile Aid (.21%), peat, soil, and Mobile Aid (.31%), soil, perlite, and Mobile Aid (.23%) and soil, perlite, peat, and Mobile Aid (.31%) had magnesium levels below the optimum but above the critical range. Soil and peat (.68%) and soil, perlite, and peat (.43%) exceeded the optimum range for magnesium. Sodium levels ranged from 770 p.p.m. (soil, peat, and original compost) to 446 p.p.m. (soil, peat, and Mobile Aid). Optimum and critical ranges were not available for sodium. Zinc levels were approximately 6 to 12 times the optimum range. It was not known if these zinc levels approached toxicity levels. Manganese reached a high of 1,116 p.p.m. in soil, perlite, and compost. Toxicity from manganese has been observed in California at 800 p.p.m. on the cultivars 'Good News' and 'Detroit News' and at 1,700 p.p.m. on the cultivar 'Albatross'. The levels of iron were below the optimum range in all the plants; however, all the plants except those grown in soil and peat, had iron levels above the critical range. Copper levels were below the optimum and critical ranges in plants grown in soil and peat; soil, peat, and original compost; soil, perlite, and peat; soil,perlite, peat, and original compost; and soil, perlite, peat, and Mobile Aid. Boron levels in the plants exceeded the optimum and critical ranges in all media. Indianapolis cultivars of chrysanthemum have been reported to be quite sensitive to boron toxicity (personal communication William J. Skou, Yoder Brothers, Barberton, Ohio). The aluminum content of the plants ranged from 220 p.p.m (soil, perlite, peat and Mobile Aid) to 344 p.p.m (soil, perlite, and peat). The status of aluminum in chrysanthemum nutrition has not been determined.

The above results showed the foliar analysis of 'Indianapolis' cultivars of chrysanthemums grown in media amended with composted garbage. High levels of boron, calcium, potassium, zinc, and manganese were observed in plants grown in soil amended with these composts. Although 'Indianapolis' cultivars are probably the most widely grown cut chrysanthemums, optimum and critical nutrient levels for chrysanthemums have been based in the main on two cultivars, 'Albatross' and 'Good News'. In addition, these cultivars differ in their optimum and critical levels for certain elements. To better assess the nutrient status of cut chrysanthemums grown in media amended with compost, an experiment was conducted using the cultivars 'Albatross' and 'CF No. 2 Good News'.

1/ Optimum and critical range supplied through courtesy of Dr. J. W. Boodley and are based on research conducted by Dr. J. W. Boodley of Cornell University and Dr. Anton Kofranek of the University of California at Davis.

Table 2. Foliar Analysis of Cut Chrysanthemum Grown in Peat-, Original Compost- and Mobile Aid Compost-Amended Media

Media	Per cent by weight					Concentration in p.p.m.						
	N	P	K	Ca	Mg	Na	Zn	Mn	Fe	Cu	B	Al
Soil & peat 1:1 . .	4.02	.88	5.43	1.94	.68	660	320	708	114	12	87	332
Soil & original compost 1:1 . .	5.20	.62	6.60	2.02	.22	550	494	900	226	36	179	338
Soil & Mobile Aid 1:1	4.04	.53	7.00	1.94	.21	510	402	826	194	28	236	290
Soil, peat & original compost 2:1:1 . .	4.12	.69	6.20	2.36	.46	770	452	576	186	24	114	302
Soil, peat & Mobile Aid 2:1:1	4.04	.56	7.28	2.02	.31	446	384	396	146	29	157	236
Soil, perlite & peat 1:1:1 . . .	3.94	.84	6.60	1.80	.43	580	350	570	290	24	135	344
Soil, perlite & original compost 1:1:1 . .	3.58	.75	6.00	2.29	.38	610	558	773	202	34	129	308
Soil, perlite & Mobile Aid 1:1:1 . . .	4.08	.71	6.60	1.83	.23	610	597	1,116	210	34	230	320
Soil, perlite, peat, & original compost 2:2:1:1 . .	3.94	.75	5.70	2.13	.40	490	294	564	170	22	113	228
Soil, perlite, peat & Mobile Aid 2:2:1:1	4.02	.65	6.94	1.98	.31	490	303	702	162	24	152	220
Optimum range1/ . .	5.0-6.0	.27-.40	4.5-6.5	1.0-2.0	.35-.65	?	20-50	250-500	500-1,000	25-75	50-100	?
Critical range	4.5	.20	3.5	0.5	.14	?		200	125	25	25	?

1/ Optimum and critical range supplied through courtesy of Dr. J. W. Boodley and are based on research conducted by Dr. J. W. Boodley of Cornell University and Dr. Anton Kofranek of the University of California at Davis.

Rooted cuttings of the two cultivars were planted in two greenhouse benches on July 29. The benches were divided into four replications consisting of six treatments per replication. The treatment plots were subdivided for cultivars. Treatments are given in Table 3. The pH of each media was adjusted to 6.0 using either dolomitic limestone or sulfur. Gypsum was added to the sulfur adjusted media at the rate of 0.8 kg per 1 m^3. Superphosphate was added to all the media at the rate of 1.6 kg per 1 m^3. Fertilization consisted of watering with a solution containing 200 p.p.m. each of N, P, and K. The plants were pinched on August 12 and short day treatment was started on September 2.

Table 3. Foliar Analysis of Chrysanthemum cv. 'Albatross', Grown in Peat- and Mobile Aid Compost-Amended Media

Media	Per cent by weight					Concentration in p.p.m.						
	N	P	K	Ca	Mg	Na	Z	Mn	Fe	Cu	B	Al
Soil & peat 1:1 . .	5.52	.68	5.28	.78	.32	346	76	252	102	42	114	156
Soil & compost 1:1	4.96	.50	7.42	1.07	.17	1,403	147	271	110	52	202	272
Soil, peat & compost 2:1:1 . . .	4.87	.51	7.89	1.12	.16	572	109	264	100	48	171	197
Soil, perlite & peat 1:1:1 . . .	5.29	.70	6.24	1.00	.32	415	66	282	106	37	161	218
Soil, perlite & compost 1:1:1 .	4.79	.51	7.49	1.13	.17	606	118	327	98	46	194	218
Soil, perlite, peat & compost 2:2:1:1	4.70	.53	7.95	1.13	.17	436	98	297	102	44	159	199
Mean	5.02	.57	7.05	1.04	.22	629	102	279	103	45	167	210
Optimum range 1/ . .	5.0-6.0	.21-.40	4.5-6.5	1.0-2.0	.35-.65	?	20-50	250-500	500-1,000	25-75	50-100	?
Critical range	4.5	.20	3.5	0.5	.14	?	?	200	125	25	25	?

1/ Optimum and critical ranges supplied through the courtesy of Dr. J. W. Boodley of Cornell University and are based on research conducted by Dr. J. W. Boodley of Cornell University and Dr. Anton Kofranek of the University of California at Davis.

Leaf samples were collected from the two cultivars on September 9. The uppermost mature leaves (usually the 7th or 8th leaf, below the stem tip) were collected. The leaves were rinsed twice in distilled water and stored in bags in a refrigerator until drying in an oven at 80° C. The dried samples were ground with a Wiley mill using a 2-mesh screen and analyzed for nitrogen, phosphorus, potassium, calcium, magnesium, sodium, zinc, manganese, iron, copper, boron, and aluminum.

Plants grown in compost-amended media generally contained more potassium, calcium, sodium, zinc, and boron than plants grown in peat-amended media, Tables 3 and 4. The levels of nitrogen, phosphorus, and magnesium were higher in plants grown in media containing peat than in compost amended media. The nitrogen content of both cultivars exceeded the critical range; however, some plants did not have a nitrogen content in the optimum range. The highest nitrogen content was observed with 'Albatross' grown in soil and peat. The lowest nitrogen content was found where 'CF No. 2 Good News' was grown in soil, peat, and compost mixture. 'Albatross' averaged slightly higher nitrogen levels than "CF No. 2 Good News'.

Phosphorus was above the optimum levels for both cultivars in all treatments. Plants of 'CF No. 2 Good News' grown in soil, perlite, and peat had the highest phosphorus content; whereas, 'Albatross' grown in soil and compost had the lowest phosphorus content. 'CF No. 2 Good News' averaged slightly higher phosphorus levels than 'Albatross'.

Table 4. Foliar Analysis of Chrysanthemum, cv. 'CF 2 Good News', Grown in Peat- and Mobile Aid Compost-Amended Media

Media	Per cent by weight					Concentration in p.p.m.						
	N	P	K	Ca	Mg	Na	Zn	Mn	Fe	Cu	B	Al
Soil and peat 1:1 .	5.37	.75	6.15	1.21	.53	306	58	341	100	37	105	181
Soil and compost 1:1	4.65	.54	8.49	1.56	.29	282	100	365	86	55	179	209
Soil, peat & compost 2:1:1 .	4.53	.61	8.11	1.65	.32	272	87	315	94	43	155	222
Soil, perlite & peat 1:1:1 . . .	5.28	.78	6.27	1.38	.51	294	57	362	103	33	109	200
Soil, perlite & compost 1:1:1 .	4.80	.58	8.15	1.53	.30	276	96	356	81	41	157	193
Soil, perlite, peat & compost 2:2:1:1 .	4.66	.63	8.25	1.58	.31	292	97	380	90	39	153	234
Mean	4.88	.65	7.57	1.49	.38	287	83	353	92	41	143	206
Optimum range 1/. .	5.0-6.0	.27-.40	4.5-6.5	1.0-2.0	.35-.65	?	20-50	250-500	500-1,000	25-75	50-100	?
Critical range . .	4.5	.20	3.5	0.5	.14	?	?	200	125	25	25	?

1/ Optimum and critical ranges supplied through the courtesy of Dr. J. W. Boodley of Cornell University and are based on research conducted by Dr. J. W. Boodley of Cornell University and Dr. Anton Kofranek of the University of California at Davis.

Potassium levels were optimum in all treatment combinations. Some treatment combinations had potassium levels greater than twice the critical level. The highest potassium content was observed with 'CF 2 Good News' grown in soil and compost, and the lowest potassium content was observed with 'Albatross' grown in soil and peat. Generally, 'CF 2 Good News' plants contained more potassium than 'Albatross' plants.

All treatments had magnesium levels below the optimum range but above the critical level. With the exception of plants grown in soil and peat; and soil, perlite and peat; all treatments for 'CF 2 Good News' had magnesium levels below the optimum range but exceeding the critical level. The highest magnesium levels occurred when 'CF 2 Good News' was grown in soil and peat. The lowest magnesium content was observed with 'Albatross' grown in soil, peat, and compost.

No optimum or critical levels for sodium are available for chrysanthemums. 'Albatross', grown in soil and compost had the highest sodium levels. Lowest sodium content occurred with 'CF No 2 Good News' grown in soil, peat, and compost. The average sodium content of 'Albatross' was more than twice that of 'CF 2 Good News'.

In all treatments, the two cultivars exceeded the optimum levels for zinc. 'Albatross', grown in soil and compost, had the highest zinc content of any treatment; whereas, 'CF 2 Good News', grown in soil, perlite, and peat had the lowest zinc content of any media.

All plants had iron levels below the critical level. The highest iron level occurred with 'Albatross' grown in soil, perlite, and peat; whereas, the lowest concentration occurred with 'CF 2 Good News' grown in soil, perlite, and compost.

Levels for copper were optimum for both cultivars in all treatments. 'CF 2 Good News' grown in soil and garbage had the highest copper concentration of the experiment. The lowest copper content occurred with 'CF 2 Good News' grown in soil, perlite and peat. The two cultivars differed in copper content with 'Albatross' containing more copper than 'CF 2 Good News'.

Plants in all treatments had boron levels exceeding the optimum range. The concentration of boron in 'Albatross' grown in soil and compost was more than twice the optimum amount - the highest in the experiment. The lowest boron level in the experiment occurred with 'CF 2 Good News' grown in soil and peat.

Optimum and critical levels for aluminum in chrysanthemum are unknown. 'Albatross' grown in soil and compost had the highest aluminum concentration. The lowest aluminum concentration occurred with 'Albatross' grown in soil and peat.

Effect of Various Media Combinations of Peat and Original Compost on the Growth of Potted Chrysanthemums, cv. 'Golden Yellow Princess Anne'

Most growers of potted chrysanthemums have a particular media which they use in the production of their plants. Such media are usually combinations of soil, organic, and inorganic amendments. Peat moss is the most commonly used organic amendment and often constitutes 25 to 50 per cent of the media by volume. Inorganic amendments are numerous but sand, perlite, vermiculite, calcined clay, and slag are frequently used. Compost might be used as a substitute for peat moss; however, the best inorganic amendments to use with garbage compost might be quite different from the best inorganic amendment often combined with peat moss. Furthermore, if garbage compost does contain some toxic substance, certain inorganic amendments might absorb these substances. The leaf injury observed on some plants might be eliminated by this absorption.

Experiments were designated to determine the effects of various media combinations of peat, slag, calcined clay, and original compost on the growth of potted chrysanthemums. Treatments are given in Table 5.

The pH of each media was adjusted as previously shown. Fertilization consisted of 4.7 kg of 12-6-6 per 1 m^3 of media incorporated prior to planting and watering with a solution containing 200 p.p.m. N, 80 p.p.m. P, and 80 K. There were five rooted cuttings of cv. 'Golden Yellow Princess Anne' chrysanthemums (Chrysanthemum morifolium Ramat.) in each pot and five pots in each treatment. Three weeks after the start of short days, the plants were sprayed with a hormone to reduce excessive elongation. Plants were grown in a greenhouse at a night temperature of 17° C. The first planting was made on November 15 followed by the other three plantings at 2-week intervals. The last planting flowered on March 19.

Table 5. Effect of Various Media Combinations of Peat and Original Compost on the Height and Number of Flowers per Plant of Potted Chrysanthemums, cv. 'Golden Yellow Princess Anne'

Media Combinations	Height	Flower per plant
	cm	No.
Soil and peat 1:1	28	2.9
Soil and compost 1:1	30	3.8
Soil, peat and compost 2:1:1	30	3.6
Soil, perlite and peat 1:1:1	32	3.1
Soil, perlite and compost 1:1:1	35	3.8
Soil, perlite, peat and compost 2:2:1:1	31	3.4
Soil, calcined clay and peat 1:1:1	32	3.2
Soil, calcined clay and compost 1:1:1	31	3.9
Soil, calcined clay, peat and compost 2:2:1:1 . .	29	3.6
Soil, foundry slag and peat 1:1:1	30	3.6
Soil, foundry slag and compost 1:1:1	31	3.7
Soil, foundry slag, peat and compost 2:2:1:1 . .	29	3.8

The mean height of plants and the average number of flowers per plant were similar for all treatments, Table 5.

Influence of Peat- and Mobile Aid Compost-Amended Media on the Growth of Potted Chrysanthemum, cv. 'Yellow Mandalay'

Mobile Aid compost was compared to imported German peat moss an an organic soil amendment in production of potted chrysanthemums, (Chrysanthemum morifolium Ramat.), cv. 'Yellow Mandalay'. Five rooted cuttings were transplanted per 15-cm pot using potting mixtures shown in Table 6. The pH of each soil mixture was adjusted to 6.0 using limestone or sulfur as needed. Gypsum, as a source of calcium was added at the rate of 1.2 kg per 1 m^3 and 12-6-6 fertilizer at the rate of 4.7 kg per 1 m^3 of media. After potting, all plants were fertilized at each watering with a solution containing 200 p.p.m. nitrogen, 80 p.p.m. phosphorus, and 80 p.p.m. potassium.

Records on the height and number of flowers per plant were taken at flowering on 40 plants per treatment.

A mixture of soil, perlite, and peat produced the tallest plants (28.4 cm), Table 6. The shortest plants were produced in soil, perlite, and Mobile Aid (19.3 cm). Mixtures amended with peat moss produced a greater mean height (25.1 cm) than mixtures amended with processed garbage (20.0 cm).

The greatest mean number of flowers per plant was produced by plants grown in soil and Mobile Aid (4.2). Plants grown in soil, perlite and peat, and soil and peat had the fewest flowers per plant (3.3 and 3.4, respectively.) Plants grown in Mobile Aid amended soil (4.0) produced more flowers per plant than those grown in peat amended soil (3.4).

The overall appearance of all plants was satisfactory. Plants grown in Mobile Aid-amended media did not exhibit the pronounced lower leaf injury often observed in experiments with original compost.

Table 6. Influence of Peat- and Mobile Aid Compost-Amended Media on the Growth of Potted Chrysanthemums, cv. 'Yellow Mandalay'

Media	Height above pot rim	Flowers per plant
	cm	No.
Soil and peat 1:1	21.8	3.4
Soil and Mobile Aid 1:1	20.6	4.2
Soil, peat and Mobile Aid 2:1:1	23.6	3.9
Soil, perlite and peat 1:1:1	28.4	3.3
Soil, perlite and Mobile Aid 1:1:1	19.3	3.8
Soil, perlite, peat and Mobile Aid 2:1:1:2 . .	25.4	3.7

Influence of Soil Mixtures Amended with Recomposted Mobile-Aid Compost on the Growth of Chrysanthemums, cv. 'Yellow Mandalay'

Mobile Aid compost that had been recomposted was used as a soil amendment in the production of three crops of potted chrysanthemums, cv. 'Yellow Mandalay'. Table 7 presents the 18 mixtures. Five cuttings were placed in a 15 cm pot for each treatment.

A constant fertility program by watering with a solution of 200 p.p.m. nitrogen, 80 p.p.m. phosphorus, and 80 p.p.m. potassium was used. An appropriate photoperiod control program was developed for each experiment to produce a flowering plant. Plants were grown in a lightly shaded greenhouse and at a night temperature of 15^{o} C. The first crop was planted on July 24, the second on August 7 and the third on August 21.

Growth of all plants was normal. The foliar burn previously observed on the leaf margin of plants grown in compost amended media was not evident in these experiments. The soluble salts level was considerably lower in recomposted than in unrecomposted Mobile Aid and this might explain the absence of the injury.

The greatest differences between treatments occurred in the number of flowers per plant, Table 7. Soil and peat moss plus additives had the least number of flowers per plant (5.2). Plants grown in a mixture of recomposted Mobile Aid and soil with $CaSO_4$, 8-8-8 fertilizer and sulfur added at potting produced the most flowers per plant (6.1). Several other treatments produced as many as 6.0 flowers per plant. The addition of 8-8-8 fertilizer at composting averaged 5.5 flowers per plant when mixed with soil and used as a growth medium. Plants grown in 1:1 mixture of soil and Mobile Aid which had been recomposted with NH_4SO_4, $Ca(H_2PO_4)_2$, KCl, $MgSO_4$ and NaCl averaged 5.8 flowers per plant. This recomposted compost combination had a higher nitrate level than those receiving 8-8-8. The addition of either $AlSO_4$, $FeSO_4$ or $CaMg(CO_3)_2$ to the former increased the number of flowers per plant to 6.0

Table 7. Height and Number of Flowers Produced by Chrysanthemum, cv. 'Yellow Mandalay', Grown in 1:1 Mixtures of Soil and Mobile Aid Compost or Peat

1:1 Soil-Compost mixture 1/

Mobile Aid recomposted with 1.6 kg 8-8-8 fertilizer per 1 m^3 plus -

	Height	Flower per plant
	cm	No.
0.4 kg Sulfur	31.2	5.5
2.4 kg $AlSO_4$	31.5	5.6
2.4 kg $FeSO_4$	31.2	5.3
2.4 kg $MgSO_4$	31.2	5.4
2.4 kg NH_4SO_4	30.7	5.8
0.8 kg Lime-Sulfur	31.8	5.7
0.8 kg $CaSO_4$	30.0	5.5
Mobile Aid recomposted with 1.6 kg NH_34SO_4, 0.8 kg $Ca(H_2PO_4)$, 0.4 kg KCl, 0.1 kg $MgSO_4$ and 0.1 kg NaCl per 1 m^3 plus -		
0.8 kg $CaMg(CO_3)_2$	31.0	6.0
0.4 kg Sulfur	31.0	5.4
2.4 kg $AlSO_4$	30.5	6.0
2.4 kg $FeSO_4$	30.2	6.0
2.4 kg $MgSO_4$	30.0	6.0
2.4 kg NH_4SO_4	31.0	5.6
0.8 kg Lime-Sulfur	30.5	5.5
0.8 kg $CaSO_4$	29.5	5.9
Mobile Aid recomposted with no additions at composting		
Check	31.0	5.8
Check plus 0.8 kg $CaSO_4$, 1.6 kg 8-8-8 and 0.4 kg Sulfur per 1 m^3	29.7	6.1
Soil and Peat plus		
1.6 kg 8-8-8, 4.7 kg $CaMg(CO_3)_2$, and 1.9 kg $Ca(HPO_4)_2$ per 1 m^3	28.7	5.2

1/ Mobile Aid was recomposted by moistening and mixing every 2 weeks for 12 weeks.

Comparison of Three Compost Products as Soil Amendments on the Growth of Potted Chrysanthemums, cv. 'Yellow Mandalay'

Three commercial compost products, Mobile Aid, Cura, and Cofuna, were evaluated as soil amendments in experiments on the growth of chrysanthemum, cv. 'Yellow Mandalay'. Cura is a fortified municipal compost supplied by the International Disposal Corporation, St. Petersburg, Florida. According to the listed analysis, Cura contains 10,000 p.p.m. nitrogen, 20,000 p.p.m. phosphorus, and 10,000 p.p.m. potassium. Because of the extremely high readings, a reliable Spurway analysis could not be obtained. The material has a pH of 5.6 and a soluble salt reading of 1,000 mhos. Cofuna is the trademark of the French Natural humus Company, Paris France for a humic and biological fertilizer. Cofuna is a vegetable waste by-product. Spurway analysis of Cofuna revealed 600-700 p.p.m. nitrates, 50-75 p.p.m. phosphorus, 200-250 p.p.m. potassium and 200-400 p.p.m. calcium. The pH was 5.4 and soluble salts read 250 mhos.

Six media were made from these amendments. The various media and the results of Spurway analysis prior to adjustment are presented in Table 8. All media received 1.6 kg superphosphate per 1 m^3. The pH except for mixtures containing Mobile Aid was adjusted to 6.5 with dolomitic limestone. Mobile Aid media received no pH adjustment. Gypsum was added to all media except Mobile Aid media at the rate of 1.4 kg per 1 m^3. Mobile Aid media received 2.8 kg gypsum per 1 m^3. All plants were fertilized at each watering throughout their growth with a solution containing 200 p.p.m. nitrogen, 80 p.p.m. phosphorus, and 80 p.p.m. potassium.

Five cuttings of chrysanthemums cv. 'Yellow Mandalay', were potted in 15 cm pots with 5 pots being used per media. A single spray of a growth retardant was applied to the plant 2 weeks after pinching in each crop. Data in Table 9 are averages of 3 plantings. Soluble salt injury was noted early in the growth of plants grown in Cura media. Root damage was evident and the top of the plant was chlorotic. The plants recovered from this injury in a few weeks following repeated watering.

The height of the plants ranged from 52.1 cm (soil and Mobile Aid) to [redacted] cm ([redacted]). The addition of Cofuna increased the height of the plants in all media except Mobile Aid and soil.

Soil and Mobile Aid (5.7) and soil, Mobile Aid, and Cofuna (5.6) produced the most number of flowers per plant, Table 9. Soil and peat had the least number of flowers per plant (4.7). The addition of Cofuna increased the number of flowers produced by plants grown in soil and peat, decreased the flower number of plants grown in soil and Mobile Aid and had no effect on the flower number of plants grown in soil and Cura.

Table 8. Spurway Analysis, pH and Soluble Salts Reading (1:5) of Media Amended with Various Composts

Media	Spurway analysis (p.p.m.) NO_3	P	K	Ca	pH	Soluble salts (mhos)
Soil and peat 1:1	2	5	10-20	20	4.0	48
Soil, peat & Cofuna 5:4:1 . .	25-50	5-10	20	50	4.3	55
Soil and Mobile Aid 1:1 . .	25-50	2-5	20	200	6.9	48
Soil, Mobile Aid & Cofuna 5:4:1 .	25-50	5	20	150	6.6	65
Soil and Cura 1:1	150 +	5	60-80	200	5.7	1,000
Soil,Cura & Cofuna 5:4:1 .	150 +	5-10	60-80	200	5.7	800

Table 9. Comparison of Three Compost Products as Soil Amendments on the Growth of Potted Chrysanthemum, cv. 'Yellow Mandalay'

Media	Height	Flowers per plant
	cm	No.
Soil and peat 1:1	45.7	4.7
Soil, peat and Confuna 5:4:1	49.5	5.1
Soil and Mobile Aid 1:1	52.1	5.7
Soil, Mobile Aid and Cofuna 5:4:1	50.3	5.6
Soil and Cura 1:1	44.5	5.1

Effect of Media Containing Original Compost on the Growth of Chrysanthemum, cv. 'Sunstar'

Potted chrysanthemums grown in media amended with original compost often showed an injury on lower leaves while producing more flowers per plant than plants grown without compost. The amount of compost used in the media of these experiments ranged from 33 to 50 per cent. The injury might be reduced or eliminated by using smaller amounts of compost in the media; however, a similar reduction in flower number might also be obtained. It was hoped that the trend of increased flower number would be unaffected by a reduction in the amount of compost in the media. Three experiments were conducted to determine the influence of media containing various amounts of original compost on the growth of chrysanthemum (Chrysanthemum morifolium Ramat.), cv. 'Sunstar'.

The six media treatments are given in Table 10. The pH of each media was adjusted to 6.5 according to lime requirement test. Dolomitic limestone or sulfur was used for adjustment. Media not adjusted with limestone received 0.8 kg of gypsum per 1 m^3. All media received 1.6 kg of superphosphate per 1 m^3. Ten 15 cm pots of each media were used in each experiment. 5 g of 14-14-14 fertilizer was added to each 15 cm pot just prior to planting. Five rooted cuttings were planted per pot. Plants were also fertilized at each watering with a solution containing 200 p.p.m. each of nitrogen, phosphorus and potassium. The experiments were conducted in a greenhouse with an appropriate photoperiod, pinching, and disbudding schedules.

Data on the height of the plant above the pot rim and the number of flowers per plant were recorded at flowering. Leaf samples were collected within 2 weeks of the start of short days in each experiment. The 7th or 8th leaf from the stem tip was sampled. A composite sample was prepared from the leaves of the three experiments for foliar analysis.

The mean height of plants grown in equal amounts of soil and compost was more than 3 cm less than the mean height of plants grown in soil and peat, Table 10. Media amended with 10 to 40 per cent compost produced some of the tallest plants in the experiment. The addition of 20 per cent or more compost to the media increased the number of flowers per plant. The most flowers per plant were produced in 5:2:3 soil, peat, and compost media. Media containing more than 30 per cent compost resulted in a slight reduction in flower number.

Table 10. Height and Number of Flowers Per Plant of Chrysanthemum, cv. 'Sunstar' Grown in Media Containing Various Amounts of Original Compost

Media	Height	Flowers per plant
	cm	No.
Soil and peat 1:1	35.8	4.0
Soil, peat and compost 5:4:1	36.6	4.0
Soil, peat and compost 5:3:2	37.1	4.1
Soil, peat and compost 5:2:3	37.1	4.5
Soil, peat and compost 5:1:4	36.6	4.3
Soil and compost 1:1	33.0	4.2

Table 11 presents the foliar analysis of the composite samples. Most of the media produced plants with elements in the optimum range unless otherwise indicated. Nitrogen was below the critical range in plants grown in all compost amended media except soil, peat, and compost 5:3:2. The highest nitrogen content occurred in plants grown in soil and peat 1:1 and soil, peat, and compost 5:3:2. Plants grown in soil and peat 1:1 and soil and compost 1:1 contained the most and least amount of phosphorus, respectively. The potassium content of the plants was highest in soil, peat, and compost 5:4:1 and lowest in soil and peat 1:1. Media containing more than 10 per cent compost produced plants with levels below the optimum magnesium levels. Plants grown in soil and peat 1:1 contained the most magnesium. Sodium was 50 to 100 p.p.m. higher in plants grown in compost amended media than in soil and peat 1:1. Plants grown in media containing 10 to 50 per cent compost had two to five times as much zinc as plants grown in soil and peat 1:1. None of the media yielded plants with iron in the optimum range. The copper content of the plants from all media was below the critical range. Plants grown in soil and peat 1:1, and soil and compost 1:1 had the lowest and highest copper content, respectively.

Influence of Peat- and Original Compost-Amended Media on the Growth of Easter Lilies

Easter Lilies (*Lilium longiflorium* Thumb.), a crop which is usually grown at a high pH, were grown in various soil mixtures amended with compost. Precooled bulbs of Easter lilies, cv. 'Nellie White' and cv. 'Ace' were potted on January 2 in the 12 soil mixtures shown in Table 12. The pH of each mixture was adjusted to 6.5 as shown above for chrysanthemums. Mixtures adjusted with sulfur (soil and compost; soil, perlite, and compost; soil, compost, and foundry slag; and soil, compost, peat, and foundry slag) were amended with gypsum at the rate of 0.8 kg per 1 m^3. Fertilization consisted of 4.7 kg of 12-6-6 fertilizer per 1 m^3 of media plus watering with a solution containing 200 p.p.m. nitrogen, 80 p.p.m. phosphorus and 80 p.p.m. potassium. A Spurway analysis of the mixtures was taken one month after potting and revealed that nitrates were 5-25 p.p.m. for all mixtures except soil, perlite, and peat (2 p.p.m.). In all mixtures the phosphorus levels were 5 p.p.m. and potassium ranged from 5 to 10 p.p.m. Calcium was 100 p.p.m. or above except in soil and peat, and soil, perlite and peat. Two months after potting, nitrates were low (0-10 p.p.m.) in all mixtures except soil and peat, and soil, peat, compost, and foundry slag. Phosphorus had dropped to 2 p.p.m. in soil, perlite and compost; and soil, compost, and foundry slag. Potassium was adequate (25 p.p.m.) in soil and compost; soil, perlite, and peat; and soil, compost, and foundry slag. Calcium was adequate (100-150 p.p.m.) in soil and compost; soil, perlite,

Table 11. Foliar Analysis of Chrysanthemum, cv. 'Sunstar' Grown in Media Containing Various Amounts of Original Compost

	Elements											
	Per Cent by Weight					Concentration in p.p.m.						
Media	N	P	K	Ca	Mg	Na	Zn	Mn	Fe	Cu	B	Al
Soil and peat 1:1	4.60	1.25	4.97	2.02	.77	1,140	67	216	130	17	57	278
Soil, peat and compost 5:4:1	4.32	1.10	5.80	2.16	.60	1,200	122	288	130	19	53	344
Soil, peat and compost 5:3:2	4.60	.98	5.18	2.29	.34	1,090	197	390	122	18	67	220
Soil, peat and compost 5:2:3	4.02	.91	5.22	2.50	.35	1,170	208	366	146	18	63	382
Soil, peat and compost 5:1:4	4.00	.90	5.20	2.74	.33	1,240	254	486	130	20	76	208
Soil and compost 1:1 . . .	4.15	.72	5.60	3.15	.35	1,200	320	390	146	23	76	450
Mean	4.28	.98	5.33	2.48	.46	1,173	195	356	134	19	65	314
Optimum range 1/	5.0-6.0	.27-.40	4.5-6.5	1.0-2.0	.35-.65	?	20-50	250-500	500-1,000	25-15	50-100	?
Critical range	4.5	.20	3.5	0.5	.14	?	?	200	125	25	25	?

1/ Optimum and critical ranges are supplied through the courtesy of Dr. J. W. Boodley of Cornell University and are based on research conducted by Dr. J. W. Boodley of Cornell University and Dr. Aton Kofranek of the University of California at Davis.

and compost; and soil, compost, and foundry slag. Following each soil test the fertility was adjusted to a range considered adequate.

Fifteen pots of each of the cultivars were used in the 12 media treatments. The heights and numbers of flowers per plant were determined on the first 10 plants to flower.

Soil media was found to influence plant height, Table 12. The greatest mean height (41.9 cm) was produced when the lilies were grown in soil and compost. The shortest mean heights were produced by plants grown in soil, calcined clay, peat, and compost (33.9 cm), and soil, calcined clay, and compost (34.0 cm). 'Ace' produced the tallest plants when grown in soil and compost (50.5 cm) and the shortest plants when grown in soil, calcined clay, peat, and compost (35.3 cm). The tallest and shortest plants for 'Nellie White' were grown in soil and peat (34.8 cm) and soil, calcined clay, and compost (30.0 cm), respectively. Considering the various media combinations, soil and either or both of the organic materials (38.8 cm) and soil, perlite and peat, compost or both (38.9 cm) produced the tallest plants. The combination of soil, calcined clay, and organic amendment produced the shortest plants (35.4 cm); however, soil, foundry slag, and organic amendment averaged approximately the same height (36.0 cm). Media containing peat produced lilies with a mean height of 33.5 cm and media containing compost produced lilies with a mean height of 30.0 cm.

Table 12. Influence of Peat- and Original Compost-Amended Media on the Mean Height of 'Ace' and 'Nellie White' Easter Lilies

Media	'Ace'	'Nelliw White'	Mean
	cm	cm	cm
Soil and peat 1:1	43.0	34.8	38.9
Soil and compost 1:1	50.5	33.3	41.9
Soil, peat, and compost 2:1:1	39.5	31.5	35.5
Soil, perlite, and peat 1:1:1	45.0	31.8	38.4
Soil, perlite, and compost 1:1:1	48.3	31.3	39.8
Soil, perlite, peat, and compost 2:2:1:1 . . .	44.0	32.8	38.4
Soil, calcined clay, and peat 1:1:1	43.8	33.0	38.4
Soil, calcined clay, and compost 1:1:1	38.0	30.0	34.0
Soil, calcined clay, peat and compost 2:2:1:1	35.3	32.5	33.9
Soil, foundry slag, and peat 1:1:1	41.3	33.3	37.3
Soil, foundry slag, and compost 1:1:1	37.8	33.3	35.6
Soil, foundry slag, peat, and compost 2:2:1:1	37.6	32.5	35.1

The mean number of flowers per plant ranged from 6.2 ('Ace' grown in soil, clay, and compost) to 3.3 ('Nellie White' grown in soil, foundry slag, and peat; and soil, calcined clay, and compost), Table 13. 'Ace' lilies produced the most flowers when grown in soil, calcined clay and peat (6.2) and the fewest flowers when grown in soil, foundry slag, and compost (3.5). Flower number was greatest for 'Nellie White' in soil and peat (4.3), and soil, calcined clay, and peat (4.3). 'Ace' (5.1) averaged more flowers per plant than 'Nellie White' (3.9). Considering media, the highest mean number of flowers occurred where plants were grown in soil, calcined clay, and peat (5.3). Soil, foundry slag, and compost yielded the fewest flowers per plant (3.5).

Table 13. Influence of Peat- and Original Compost-Amended Media on the Mean Number of Flowers per Plant of 'Ace' and 'Nellie White' Easter Lilies

Media	'Ace'	'Nellie White'	Mean
Soil and peat 1:1	5.1	4.3	4.7
Soil and compost 1:1	5.8	4.1	5.0
Soil, peat and compost 2:1:1	4.9	4.0	4.5
Soil, perlite and peat 1:1:1	4.6	4.0	4.3
Soil, perlite and compost 1:1:1	6.0	4.1	5.1
Soil, perlite, peat and compost 2:2:1:1 . . .	5.7	4.0	4.9
Soil, calcined clay and peat 1:1:1	6.2	4.3	5.3
Soil, calcined clay and compost 1:1:1	5.3	3.3	4.3
Soil, calcined clay, peat and compost 2:3:1:1 . . .	4.4	4.1	4.3
Soil, foundry slag and peat 1:1:1	5.5	3.3	4.4
Soil, foundry slag and compost 1:1:1	3.5	3.4	3.5
Soil, foundry slag, peat and compost 2:2:1:1 . .	4.2	3.4	3.8

<u>Influence of Peat and Original Compost-Amended Media and Constant Fertilization with and without a Single Application of Iron Chelate on the Growth of Geranium</u>

Rooted, cultured cuttings of the geranium (<u>Pelargonium</u> <u>hortorum</u> Bailey) cultivars 'Blaze', 'Dark Red Irene', 'Eleanor', and 'Summer Cloud' were potted on April 24 with mixtures as shown in Table 14: (1) soil and peat 1:1; (2) soil and compost 1:1; (3) soil, peat, and compost 2:1:1; (4) soil, perlite, and peat 1:1:1; (5) soil, perlite, and compost 1:1:1; (6) soil, perlite, peat, and compost 2:2:1:1. The pH of the mixtures was adjusted to 6.0 and fertilizer applied as shown previously for Easter lilies. Iron chelate at the rate of 1.5 mg per liter of solution was added once to the water applied to one-half the pots in each treatment. Plants were grown one plant per 15 cm pot and each treatment contained four pots. The greenhouse was lightly shaded and cooled to 21° C during the day. On July 10 the dry weight was determined on two of the plants in each treatment.

Plant dry weight was greatest when the plants were grown in either soil, perlite, and peat or soil, perlite, peat, and compost, Table 14. Plants grown in soil and compost yielded the least dry weight (15.7 g). Considering the organic amendments, plants grown in peat-amended soils (20.9 g) produced more dry weight than plants grown in compost-amended soil (16.6 g). 'Eleanor' had the greatest plant dry weight (23.5 g) and 'Dark Red Irene' had the least (13.5 g). The single application of iron chelate increased the plant dry weight of geraniums in all media. Plants which received iron chelate averaged 19.6 g whereas plants which did not receive chelate had a mean of 18.2 g. It was not determined whether the effect of the chelate was a result of the application of iron, a reduction in pH, or both. Symptoms of iron chlorosis had been observed in preliminary tests on other plants.

Table 14. Influence of Peat- and Original Compost-Amended Media of the Mean Dry Weight of Four Geranium Cultivars.

Media	Cultivars				
	'Blaze'	'Dark Red Irene'	'Eleanor'	'White Cloud'	Mean
	g	g	g	g	g
Soil and peat 1:1	19.0	14.8	26.5	21.2	20.4
Soil and compost 1:1	14.5	11.2	20.9	16.3	15.7
Soil, peat and compost 2:1:1	17.3	14.5	19.8	18.1	17.4
Soil, perlite and peat 1:1:1	21.5	16.4	26.0	21.1	21.3
Soil, perlite and compost 1:1:1	17.3	11.2	22.1	19.4	17.5
Soil, perlite, peat and compost 2:2:1:1	20.8	12.9	27.5	23.9	21.3

Influence of Peat- and Original Compost-Amended Media on the Growth of Gloxinia

Seedlings of Gloxinias (Sinningia speciosa Benth. and Hook.) cv. 'Panzer Scarlet' and cv. 'Missle Series' were transplanted into 13 cm pots on March 1. Two soil mixtures were used in transplanting: soil and peat 1:1, and soil and original compost 1:1. Each treatment was composed of 25 pots of each cultivar. The pH of the mixtures was adjusted to 6.0 using dolomitic limestone on the' peat-amended media and sulfur on the compost-amended media. Gypsum was added to the compost-amended media at the rate of 1.4 kg per 1 m^3. Superphosphate was added to the two media at the rate of 1.6 kg per 1 m^3. Plants were fertilized every 2 weeks with 25-10-10 fertilizer at the rate of 3.1 g per liter of water. Plants were grown in a shaded greenhouse.

Observations were made on the growth of the plants. The dry weight of 10 plants of each cultivar in each treatment was taken at flowering.

Plants of both cultivars flowered earlier when grown in the soil and compost mixture than when grown in the soil and peat mixture. Most flowering occurred early in July; however, some of the compost-grown plants flowered in late June. The foliage of plants grown in the soil and compost mixture was a lighter green than the foliage of peat-grown plants. The two most striking differences between plants grown in the two mixtures were leaf shape and size.

Peat-grown plants had the normal oblong-ovate leaf shape; whereas, the leaves of compost-grown plants were oblong, almost strap-like or nearly oblanceolate. The leaves of plants grown in soil and peat were approximately 30 to 40% larger (mostly in width) than the leaves of compost-grown plants.

Influence of Peat- and Original Compost-Amended Media on the Growth of Two Flowering Groups of Snapdragons

Two crops of snapdragons (Antirrhinum majus L.) were grown to study the influence of peat and compost on their growth. The first crop consisted of snapdragons belonging to the flowering response Group II which is recommended for winter flowering in the South. Seedlings of the cultivars 'Jackpot', 'Twenty Grand', and 'Sakata No. 148' were benched on January 18. The second crop consisted of snapdragons belonging to the flowering response Group IV which is recommended for summer flowering in the South. Seedlings of the cultivars 'Potomac White' and 'Potomac Pink' were benched on March 7. A spacing of 10 x 10 cm was used on both crops. All plants were grown single stem. The seedlings were transplanted into six media as shown in Table 15. The pH of the media was adjusted to 6.0. Fertilization consisted of watering every 2 wks with a solution containing 3 g of 25-10-10 fertilizer per liter of water.

At flowering, 20 plants from each media were cut at the soil line; and from these samples, plant height, plant weight, and flower head or spike length were determined. Five plants from each media were stripped of all foliage, cut to 50 cm in length and weighed. A weight/height reading was thus obtained as an index of stem strength.

Plants were the shortest (89.4 cm) when grown in soil, perlite, and peat, Table 15. Soil, perlite, and compost produced the tallest plants (86.8 cm) and soil, peat, and compost, (73.3 cm), and soil and compost (73.5 cm) averaged the shortest plants for the Group II snapdragons. Soil, peat, and compost (111.5 cm) and soil, perlite, and compost (98.3 cm) yielded the tallest and shortest plants, respectively, for the Group IV snapdragons.

The mean plant fresh weight ranged from 78.3 g (soil, peat, and compost) to 48.3 g (soil and compost), Table 16. The media had little effect on fresh weight of Group II plants. Soil, peat, and compost (112.3 g) produced Group IV plants more than twice as heavy as plants grown in soil and compost (52.2 g).

The greatest differences in the mean length of flower head or spike occurred between soil and compost (22.9 cm), soil, perlite, and compost (22.9 cm), soil, perlite, and peat (22.8 cm); and soil and peat (19.8 cm), Table 17. Group II snapdragons produced the longest spikes in soil, perlite, and compost (24.5 cm) and the shortest spikes in soil and peat (17.0 cm). In the Group IV snapdragons, spike length was greatest in soil and compost (27.3 cm) and least in soil, perlite, and compost (21.3 cm).

Soil, perlite, peat, and compost (.028 g/cm) yielded plants with the strongest stems as measured by weight/height ratio, Table 18. Plants grown in soil, perlite, and compost (.019) had the smallest ratio. Group IV cultivars produced the largest and smallest weight/height ratios when grown in soil, perlite, peat, and compost (.041 g/cm) and soil, perlite, and compost (.041 g/cm), and soil, perlite and peat (.023 g/cm), respectively.

Table 15. Influence of Peat- and Original Compost-Amended Media on the Mean Height of Two Flowering Groups of Snapdragons

Media	Group II	Group IV	Mean
	cm	cm	cm
Soil and peat 1:1	78.3	110.3	94.3
Soil and compost 1:1	73.5	109.3	91.4
Soil, peat and compost 2:1:1	73.3	111.5	92.4
Soil, perlite and peat 1:1:1	76.8	102.0	89.4
Soil, perlite and compost 1:1:1	86.8	98.3	92.6
Soil, perlite, peat and compost 2:2:1:1	82.0	113.0	97.5

Table 16. Influence of Peat- and Original Compost-Amended Media on the Mean Fresh Weight of Two Flowering Groups of Snapdragons

Media	Group II	Group IV	Mean
	g	g	g
Soil and peat 1:1	42.8	81.5	62.2
Soil and compost 1:1	44.4	52.2	48.3
Soil, peat and compost 2:1:1	45.3	112.3	73.3
Soil, perlite and peat 1:1:1	44.3	69.4	56.9
Soil, perlite and compost 1:1:1	46.9	73.3	60.1
Soil, perlite, peat and compost 2:2:1:1	43.8	71.8	57.8

Table 17. Influence of Peat- and Original Compost-Amended Media on the Mean Flower Head Length of Two Flowering Groups of Snapdragons

Media	Group II	Group IV	Mean
	cm	cm	cm
Soil and peat 1:1	17.0	22.5	19.8
Soil and compost 1:1	18.5	27.3	22.9
Soil, peat and compost 2:1:1	18.0	22.8	20.4
Soil, perlite and peat 1:1:1	19.0	26.5	22.8
Soil, perlite and compost 1:1:1	24.5	21.3	22.9
Soil, perlite, peat and compost 2:2:1:1	22.0	22.0	22.0

Table 18. Influence of Peat- and Original Compost-Amended Media on the Weight/Height Ratio of Stems of Two Flowering Groups of Snapdragons

Media	Group II	Group IV	Mean
	g/cm	g/cm	g/cm
Soil and peat 1:1	.014	.030	.022
Soil and compost 1:1	.016	.029	.023
Soil, peat and compost 2:1:1	.016	.035	.026
Soil, perlite and peat 1:1:1	.016	.023	.020
Soil, perlite and compost 1:1:1	.016	.041	.019
Soil, perlite, peat and compost 2:2:1:1	.015	.041	.028

Growth and Foliar Analysis of Miniature Carnations in Compost-Amended Media

The optimum pH range for carnations is 5.5 to 7.0 which is higher than the optimum for many other floricultural crops. Boron, calcium, and potassium are nutrient elements which often require special consideration in carnation culture. Compost might be useful in the culture of carnations since it has a high pH and contains considerable amounts of boron, calcium, and potassium.

Miniature carnations (Dianthus caryophyllus L.) were selected for these experiments because they can be grown at a higher temperature than standard carnations, thus are better suited to Southern culture. The cultivars, 'Elegance' and ''White Elegance', were selected since current nutrient level standards forminiature carnations are based on 'Elegance' cultivars.

In one experiment media treatments were as shown in Table 19. Alive compost is a product of the Lone Star Organic Plant, Houston, Texas. Ten 15 cm pots of each of the two 'Elegance' cultivars were planted in each media on August 7. Plants were fertilized by watering with a solution containing 200 ppm nitrogen and 160 ppm potassium. Plants were grown in an air-conditioned greenhouse with the temperature maintained between 16 and 21° C.

Foliar analysis samples were taken on October 10. At the time of sampling, plants grown in Alive compost had not produced enough leaves for an adequate sample. All the leaf tissue above the fifth node was taken for tissue analysis. All plants had at least 7 pair of leaves at the time of sampling. The leaves were dried in a forced draft oven at 80° C for 24 hours. When dry, the tissue was ground in a Wiley Mill to pass through a 20-mesh screen. Analysis of the tissue samples were made for nitrogen, phosphorus, potassium, calcium, magnesium, sodium, zinc, manganese, iron, copper, boron, and aluminum.

Five months after planting, the dry weight of five plants per treatment was obtained for each cultivar. Plants were cut at the soil line, placed in paper bags, dried in an oven at $80^{\circ}C$ for 24 hours and then weighed.

The growth of plants in compost was not as good as the growth of plants in the soil, peat and perlite. Plants grown in Alive compost appeared stunted. The mean dry weight of plants grown in Alive compost was 7.4 g, in Mobile Aid 24.0 g, and in the soil mixture 27.1 g, Table 19.

Table 19. Mean Dry Weight of cv. 'Elegance' and cv. 'White Elegance' Carnations Grown in Unamended Composts and Unamended Soil Mixture

Media	Cultivar 'Elegance'	'White Elegance'	Mean
	g	g	g
Alive compost	7.0	7.7	7.4
Mobile Aid compost	26.1	21.9	24.0
Soil, peat and perlite 1:1:1	30.8	23.4	27.1

Foliar analyses of plants grown in Mobile Aid and in soil, peat and perlite are presented in Table 20. Plants grown in Mobile Aid contain more potassium, calcium, zinc, and boron than plants grown in soil, peat and perlite. Plants grown in a soil, peat, and perlite mixture contained more nitrogen, phosphorus, magnesium, sodium, manganese, iron, and aluminum than plants grown in Mobile Aid.

Table 20. Foliar Analysis of 'Elegance' Carnations Grown in Compost and in Amended Soil Media[1/]

Media	N	P	K	Ca	Mg	Na	Zn	Mn	Fe	Cu	B	Al
Mobile Aid compost	3.60	.44	5.32	3.07	.62	318	835	72	74	15	108	64
Soil, peat, and perlite	4.22	.79	4.93	1.73	.90	660	505	144	98	16	46	112

1/ Figures represent means of 2 cultivars, 'Elegance' and 'White Elegance'.

An experiment utilizing Mobile Aid as a soil amendment for carnation culture in greenhouse benches was established on August 7. The media treatments were as given in Table 21. The pH of the four media was adjusted to 6.5 using either dolomitic limestone of sulfur. Gypsum at the rate of 0.8 kg per 1 m^3 was added to the media that was adjusted with sulfur. All media received superphosphate at the rate of 1.6 kg per 1 m^3. Fertilization consisted of watering with a solution containing 200 ppm nitrogen and 160 ppm potassium. Plants were grown in an air-conditioned greenhouse with the temperature maintained between 16 and 21°C. The carbon dioxide content of the atmosphere was enriched with a CO_2 generator from 5 a.m. to 9 p.m. daily.

Treatments were randomized in blocks with three replications. The two 'Elegance' cultivars appeared in each treatment. Leaf samples were collected 64 days after planting of the rooted cuttings and prepared for spectrographic analysis.

Early growth of plants grown in compost-amended media was retarded. Four months after planting, both cultivars were in flower in the peat-amended soil but were not in the compost-amended soil. The height of the plants grown in compost-amended media was approximately 15 cm less than that of plants grown in peat-amended soil.

More nitrogen, phosphorus, potassium and magnesium were found in plants grown in peat than in compost, Table 21. Tissue of plants grown in compost-amended media contained more calcium, sodium, manganese, copper, and boron than plants grown in peat-amended media. Plants grown in soil and peat contained the most nitrogen, potassium, magnesium, and aluminum but the least calcium of the media treatments. More phosphorus but less sodium and boron were found in plants grown in soil, perlite, and peat than the other media. The tissue of plants grown in soil and compost contained more sodium and boron but less magnesium than the other treatments.

Table 21. Foliar Analysis of Miniature Carnations Grown in Peat- and Mobile Aid Compost-Amended Media1/

	Per cent by weight					Concentration in ppm						
Media	N	P	K	Ca	Mg	Na	Zn	Mn	Fe	Cu	B	Al
Soil and peat 1:1	3.90	.65	4.57	1.34	.87	730	575	290	87	12	70	108
Soil and compost 1:1	3.41	.44	4.31	2.12	.52	2622	646	335	86	15	145	88
Soil, perlite and peat 1:1	3.75	.69	4.47	1.45	.72	457	654	262	93	12	65	83
Soil, perlite and compost 1:1	3.29	.45	4.18	2.31	.59	1382	608	365	89	15	128	89

1/ Figures represent means of two cultivars, 'Elegance' and 'White Elegance' replicated three times.

Plants grown in soil, perlite, and compost contained the most calcium but the least nitrogen and potassium of the four media. According to standards established by Nelson and Boodley, all plants were low in nitrogen but contained sufficient amounts of phosphorus, pottasium, calcium, and magnesium.

Effect of Various Additions and Recomposting on the Chemical Analysis of Original Compost

Phytotoxicity was observed in plants grown in compost-amended media. The margin of older leaves of chrysanthemums, petunias, and snapdragons appeared burned or scorched when grown in garbage compost media. Poor leaf color, resembling nitrogen dificiency, was often observed. Tests revealed that original compost contained excessive soluble salts, low nitrogen and phosphorus, and high pH. Some of the problems encountered resembled those reported in saline and alkali soils.

To investigate these problems, experiments were conducted on recomposting with various chemical additions used in garden composting or in amending alkali soils.

Mobile Aid compost which had been composted at the processing plant for an estimated 12-16 weeks was mixed with various chemicals to lower the pH and soluble salts and increase fertility. Spurway analysis of the Mobile Aid prior to treatment revealed nitrates 0-2 p.p.m., phosphorus 0-1 p.p.m., potassium 20-40 p.p.m., and calcium 150-300 p.p.m. The compost had a pH of 8.6 and a soluble salt reading of 70 mhos (1:5 dilution). Treatments are shown in Table 22. Following treatment, the Mobile Aid was recomposted for 3 months. Every 2 weeks the treatments were moistened and remixed in a cement mixer. Recomposting was conducted in wooden baskets.

Table 22. Spurway Analysis, pH and Soluble Salts of Mobile Aid Compost 3 Months after Treatment

Treatment	Spurway analysis (p.p.m.)				pH	Soluble salts (mhos)
	NO_3	P	K	Ca		
1.6 kg 8-8-8 Fertilizer per m^3 plus -						
0.4 kg Sulfur	10	1	20-40	200	7.2	34
2.4 kg $AlSO_4$	10	1	20-40	200	8.2	29
2.4 kg $FeSO_4$	10	0.5	20-40	200	8.5	31
2.4 kg $MgSO_4$	5-10	1	20-40	200	8.5	30
2.4 kg NH_4SO_4	10	1	20-40	200	8.1	29
0.8 kg Lime-sulfur	2-5	1	20-40	200	8.5	33
0.8 kg $CaSO_4$	5-10	1	20-40	200	8.4	34
1.6 kg NH_4SO_4, 0.8 kg $Ca(H_2PO_4)_2$, 0.4 kg KCl, 0.1 kg $MgSO_4$, and o.1 kg NaCl per m^3 plus -						
0.8 kg CaMg $(CO_3)_2$	25	1	20-40	200	8.3	33
0.4 kg Sulfur	10-25	1	20-40	200	8.2	28
2.4 kg $AlSO_4$	10-25	1	20-40	200	8.1	30
2.4 kg $FeSO_4$	10	1	20-40	200	8.1	30
2.4 kg $MgSO_4$	10	1	20-40	200	8.2	26
2.4 kg NH_4SO_4	10-25	0.5	20-40	200	8.2	30
0.8 kg Lime-sulfur	5-10	0.5	20-40	200	8.2	27
0.8 kg $CaSO_4$	10-25	1	20-40	200	7.9	27
No treatment						
Control	2-5	0.5	20-40	200	8.6	31

Nitrate levels were increased to 10-25 p.p.m. when the fertilizer consisting of NH_4SO_4, $Ca(H_2PO_4)_2$, KCl, $MgSO_4$, and NaCl plus either $CaMg(CO_3)_2$, sulfur, $AlSO_4$ or $CaSO_4$ was added to the compost, Table 22. Combinations of 8-8-8 fertilizer plus other chemicals did not raise the nitrates above 10 p.p.m. Recomposted Mobile Aid, which received no chemical treatment had 2-5 p.p.m. nitrates. Phosphorus and potassium were not influenced by treatment. All treatments had 200 p.p.m. calcium. The pH of the compost resisted change. Recomposted Mobile Aid without chemical treatment had a pH of 8.6. The greatest change in pH occurred with the addition of 8-8-8 fertilizer plus sulfur which resulted in a pH of 7.2. The NH_4SO_4 fertilizer plus $CaSO_4$ reduced the pH to 7.9. In all treatments, soluble salts decreased from 70 nhos to 26-34 mhos. Leaching was probably responsible for this reduction since the unamended check had a reading of 31 mhos. Chemical treatment had little effect on soluble salts.

SUMMARY AND CONCLUSIONS

Compost products of the Municipal Compost Plant of the City of Mobile, Alabama were used in experiments as a potting media for ornamentals. Two composts were used. One contained a small amount of sewage, was coarsely ground and was referred to as original compost. The second contained no sewage, was finely ground and was marketed by the City of Mobile under the name Mobile Aid. The nutrient composition of the two composts were similar A large amount of plastic was prominent in the original compost but the plastic was not noticeable in the Mobile Aid since it was finely ground.

Conclusions from the experiments were as follows:

1. The composts were dificient in nitrogen and phosphorus when used as a media for plant growth.

2. Composts were not as satisfactory as peat in potting media for ornamentals.

3. Mobile Aid compost was generally more satisfactory than original compost for potting media.

4. Foliar analysis of carnations and chrysanthemums grown in compost-amended media revealed high concentrations in the tissue of aluminum, boron, calcium, copper, manganese, potassium, sodium, and zinc.

5. Mobile Aid increased flower number in chrysanthemums.

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