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## ORNAMENTAL CABBAGE AND KALE PRODUCTION

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*(This article is from a presentation made by Dr. Brian Whipker at the 1996 Southeast Greenhouse Conference and Trade Show)*

Ornamental cabbage and kale have become increasingly popular as a fall flowering crop because of its long lasting colorful foliage. They will often remain colorful until temperatures drop below 20 °F and are well suited to areas of the Southeast which have mild winters. Ornamental cabbage and kale are also an excellent complement to garden chrysanthemums and fall pansies in increasing autumn sales.

### **Cultivars**

Ornamental cabbage and kale cultivars have red, pink, or white foliage. They are further grouped by leaf shape, with the round, smooth leaf types constituting the ornamental cabbages and the feathered or fringed types constituting the ornamental kales. Table 1 lists the characteristics of some of the most popular cultivars.

### **Scheduling**

Plants generally required between 2 1/2 to 3 months of growth to achieve marketable size, when produced in 6" pots. Allow an extra 2 weeks of growth for 8" pots. For northern locations, seeds should be sown in June, while for southern locations a July sowing is optimal.

### **Seeding and Containers**

Germination takes around 10 days at 70 °F. Germination is best in the presence of light. Seeds can be sown in plug flats, germination trays, or directly into an 806 flat. Avoid letting the plants become root bound in the container before transplanting them. Restriction of the roots will result in stunted plant growth. Transplant the seedlings into 6" or 8" pots when sufficient growth has occurred. If the plants have become too tall in the seedling flats, they should be planted deep (up to the first set of leaves).

**Table 1. Characteristics of ornamental cabbage and kale cultivars (Adapted from McAvoy, 1994).**

Cultivar Name	Color	Growth Habit	Leaf Type
Red Peacock	Red	Tall	Feathered
White Peacock	White	Tall	Feathered
Coral Queen	Pink	Medium-tall	Feathered
Coral Prince	White (pink center)	Medium-tall	Feathered
Red Feather	Dark Red	Very tall	Feathered
White Feather	White	Very tall	Feathered
Red Pigeon	Light Red	Dwarf	Round
White Pigeon	White (pink center)	Dwarf	Round
Pink Beauty	Pink	Dwarf, early	Round
Rose Bouquet	Bright Red	Dwarf, early	Round
White Xmas	White (pink center)	Dwarf, early	Round
Red Sparrow	Red	Dwarf	Fringed
White Sparrow	White	Dwarf	Fringed
Prima Donna	Light Red	Tall	Fringed
White Lady	All White	Tall	Fringed
Red Kamome	Red	Dwarf, early	Fringed
White Kamome	All White	Dwarf, early	Fringed
Red Chidori	Dark Red	Dwarf	Fringed
White Chidori	All White	Dwarf	Fringed

**Spacing**

The plants required adequate spacing to encourage growth and prevent foliar diseases. Use 6" centers for 4" pots, 11" to 12" centers for 6" pots, and 16" to 18" centers for 8" pots.

**Substrate, Irrigation and Nutrition**

**Substrate.** Plants can be grown in any good quality soilless substrate that has good water holding capacity. If the plants are to be grown outdoors, a soil based substrate or the addition of sand may help avoid toppled plants during windy weather.

**Irrigation.** During the summer months the plants will require adequate moisture. Using an automated watering system similar to one used on garden chrysanthemums will assist in irrigation. Ornamental cabbage and kale are not tolerant of drought stress. This will result in the stalling of plant growth and the yellowing and drop of the lower leaves.

**Nutrition.** Maintain a substrate solution pH between 5.8 and 6.5 for best nutrient uptake. Irrigation water alkalinity should be adjusted to a

maximum of 2 meq/L (100 ppm CaCO<sub>3</sub> or 120 ppm HCO<sub>3</sub><sup>-</sup>) to avoid a general increase in pH over the growing season. If alkalinity is higher than 2 meq/L, consider using an acidic fertilizer (as long as the NO<sub>3</sub>-N to NH<sub>4</sub>-N ratio is greater than 2:1) or acid injection. Fertilize the plants with a balanced fertilizer such as 20-10-20. For the seedling stage, fertilize at the rate of 50 to 100 ppm N on a constant liquid feed basis. After transplanting into the final container, fertilize at the rate of 150 to 250 ppm N and K. Electrical conductivity should be maintained between 1.0 and 2.0 mS/cm. Some recommendations suggest fertilization should be discontinued during color

development. Excessive fertilization will prevent good coloration, but deficient levels of plant nutrients will result in the yellowing and loss of the lower leaves. Deficiency symptoms are more likely to occur in a soilless substrate that has a lower cation exchange capacity (the ability to hold nutrients) than in a soil-based substrate. For the final three weeks of growth, a fertilizer rate of 50 ppm N and K should be sufficient to allow the plants to develop color and avoid deficiency symptoms.

Extensive research on the nutritional requirements of ornamental cabbage and kale are not available, but numerous studies have been completed for vegetable cabbage. Cabbage is susceptible to **internal tipburn** which appears as a browning of the tissue. It is caused by an inadequate supply of calcium (Ca) (Becker, 1986). Members of the cabbage family (crucifer crops) require high levels of Ca, and fertilization rates of 50 to 100 ppm Ca may be beneficial, if your irrigation water is low in calcium content. **Black Petiole** is another internal disorder of cabbage which appears as an internal blackening of the

cabbage head. It is thought to be a nutritional imbalance that occurs when the potassium (K) levels are low and the phosphorus (P) levels are high (Becker, 1986). **Boron (B) deficiency** has also been reported to cause a brown spotting of broccoli heads (Latin and Helms, 1990). Growers should make sure that B is part of their fertilizer mix and that Ca is not being added in excessive amounts (excessive Ca can tie up B, making it unavailable to plants). Maintain a substrate pH between 5.8 and 6.5 to enhance B availability (B availability decreases at pHs above 6.5). Foliar analysis interpretation values for cabbage are listed in Table 2 and may be useful for ornamental cabbage and kale production.

**Table 2. Foliar concentrations of elements in cabbage plants (*Brassia oleracea* var. *capitata*). Values are from wrapper leaves of cabbage plants sampled near harvest when the heads had formed (adapted from D.J. Reuter and J. B. Robinson (eds). *Plant Analysis: An Interpretation Manual*)**

Element	Units	Adequate Range
N	%	2.5 to 4.0
P	%	0.25 to 0.5
K	%	2.0 to 4.0
Ca	%	1.5 to 3.0
Mg	%	0.2 to 0.6
Na	%	<1.0
B	ppm	20 to 60
Cu	ppm	5.2
Fe	ppm	50 to 200
Mo	ppm	0.3 to 0.5
Zn	ppm	10 to 200

### Growth Regulators

Ornamental cabbage and kale are unsuitable as a warm season crop because hot summer temperatures cause excessive stem elongation. Stem elongation can also occur with crops grown for fall sales, but it may be avoided by use of the plant growth regulator (PGR) applications. (PGRs can only be applied to ornamental cabbage and kale grown as a nonfood crop.) Luczai (1992) recommended using B-Nine at 1,500 to 3,000 ppm to achieve desired height reduction. McAvoy

(1994) recommended multiple applications of B-Nine at 1,500 ppm.

Research conducted at Purdue University (Whipker et al., 1994) compared B-Nine at 2,500 and 5,000 ppm; Bonzi at 15 ppm; and Sumagic at 5 ppm on two ornamental kale cultivars.

On 'Coral Prince', foliar spray applications of Sumagic and B-Nine at 2,500 and 5,000 ppm had the greatest effect on plant height, with a reduction of 16%, 18% and 26%, respectively, compared to the control (Table 3). These treatments resulted in plants with uniform shape. At the rate used, Bonzi had little effect on reducing plant height and resulted in a more open rosette head. The PGRs had no influence on 'Coral Prince' plant diameter.

All PGR treatments reduced 'Red Kamone' shoot elongation by at least 14% compared to the untreated plants (Table 3). Although 'Red Kamone' plant diameter was reduced by B-Nine (both rates), the shoot (head) growth was very uniform. Bonzi and Sumagic applications resulted in reduced plant height, with no change in plant diameter. Plants treated with Bonzi, although marketable, had an undesirable head due to a more open rosette and looser appearance as a result of increased internode length. The variations in cultivar response to the PGRs observed in this study is probably due to differences in vigor and growth characteristics of the two cultivars. 'Coral Prince' is an upright, aggressive cultivar that grew 26% taller than 'Red Kamone' when no PGR was applied.

The choice of PGRs to control the growth of ornamental kale should be based on the response of the cultivar and the cost of the PGR (Table 3). 'Coral Prince' was controlled for the lowest cost (\$0.87 per 100 square feet of bench area) by using B-Nine at 2,500 ppm. For 'Red Kamone', the desired control of growth was obtained for the lowest cost by using Bonzi, at the cost of \$0.77 per 100 square feet of bench area). Although B-Nine at 2,500 ppm also provided an inexpensive height control of 'Red Kamone', it also reduced plant diameter by about 1". Rates of B-Nine

**Table 3. Chemical growth retardant effect and cost comparison on growth of ornamental kale 'Coral Prince' and 'Red Kamone' (Adapted from Whipker et al., 1994).**

Treatment	Conc. (ppm)	Coral Prince		Red Kamone		Chemical cost per 100 ft <sup>2</sup>
		Ht (in)	Diam (in)	Ht (in)	Diam (in)	
Control	—	12.6	15.7	10.0	14.4	
B-Nine	2500	10.4	16.3	7.3	12.8	\$0.87 <sup>x</sup>
	5000	9.3	15.4	7.6	13.0	\$1.74
Bonzi	15	11.6	16.0	8.3	14.4	\$0.77
Sumagic	5	10.6	15.3	8.5	13.8	\$1.52
Significance		***y	NS	**	**	
LSD		1.1		1.4	1.0	

<sup>y</sup>Nonsignificant (ns) or significant at P 0.01 (\*\*) or 0.001 (\*\*\*).

<sup>x</sup>Cost comparison of plant growth regulators applied to ornamental kale. Chemical cost (rounded) based on the use of foliar applications of plant growth regulators using a volume of 1/2 gallon of spray per 100 ft<sup>2</sup> of bench area. Corresponding to the cost of \$71 per pound of B-Nine, \$103 per quart of Bonzi, or \$76 per quart of Sumagic.

lower than the 2,500 ppm used in this study may be effective in reducing plant height of both cultivars at a more economical cost, without reducing 'Red Kamone' plant diameter. The ultimate selection of optimal PGR rates will have to be based on the differences in cultivar growth habits in order to achieve the desired growth effects.

### Temperatures

Optimal growth occurs with plants grown in outdoor production, similar to a system used with garden chrysanthemums. Temperatures inside the greenhouse may be too hot and be detrimental to plant growth. After the plants have achieved marketable size, they must be exposed to 3 to 5 weeks of temperatures below 55 to 60 °F to allow the plants to develop coloration.

### Pests and Diseases

**Insect and Related Pests.** The most common insect and related pests that attack ornamental cabbage and kale are: aphids, caterpillars, flea beetles, slugs, and whiteflies. For a complete listing of pesticides labeled for each of these pests, readers should refer to "Greenhouse ornamental insect and related pest control", pages 5–18 of the October, 1995 NCCFGA Bulletin or refer to the 1996 N.C. Agricultural Chemicals

Manual. Some control measures are listed below:

**Aphids** (many species; mainly cabbage aphid and turnip aphid): acephate (Orthene<sup>®</sup>), diazinon (Knox-Out<sup>®</sup>), endosulfan (Thiodan), horticultural oil (Sun Spray<sup>®</sup>, Ultra-Fine<sup>®</sup>), imidacloprid (Marathon<sup>®</sup>), and insecticidal soap (M-Pede<sup>®</sup>).

**Caterpillars** (cabbage looper [*Trichoplusia ni*], cutworms [black cutworm (*Agrotis ipsilon*) and variegated cutworm (*Peridroma saucia*) are the two most common in North Carolina], diamondback moth larvae [*Plutella xylostella*], and imported cabbage worm [*Artogeia rapae*): acephate (Orthene<sup>®</sup>), azadirachtin (Azatin<sup>®</sup>, Margosan-O<sup>®</sup>), *Bacillus thuringiensis* (Bt) (Dipel<sup>®</sup>, Victory<sup>®</sup>), bifenthrin (Talstar<sup>®</sup>), and pyrethrins.

**Flea beetles** (many genera and species): acephate (Orthene<sup>®</sup>), bifenthrin (Talstar<sup>®</sup>), fluvalinate (Mavrik<sup>®</sup>), and pyrethrins.

**Onion Thrips (*Thrips tabaci*):** acephate (Orthene<sup>®</sup>), bifenthrin (Talstar<sup>®</sup>), fluvalinate (Mavrik<sup>®</sup>).

**Slugs** (many genera and species): metaldehyde (Deadline Bullets<sup>®</sup>, Snarol<sup>®</sup>).

**Whiteflies** (many genera and species; sweetpotato whitefly is the most difficult to control): acephate (Orthene<sup>®</sup>), azadirachtin (Azatin<sup>®</sup>, Margosan-O<sup>®</sup>), endosulfan (Thiodan),

horticultural oil (Sun Spray<sup>®</sup>, Ultra-Fine<sup>®</sup>), imidacloprid (Marathon<sup>®</sup>), insecticidal soap (M-Pede<sup>®</sup>), and kinoprene (Enstar II<sup>®</sup>).

**Diseases.** There are a number of pathogens that attack ornamental cabbage and kale. The following disease descriptions are adapted from Latin and Helms, 1990.

**Root Rots** (*Pythium* spp. and *Phytophthora* spp.). Symptoms include: a general decay of the roots. Affected plants typically exhibit wilting, due to the destruction of the root system and the resulting inability of the root system to supply adequate amounts of water to the top growth. Control with fungicide drenches if symptoms appear (etridiazole [Truban<sup>®</sup>, Banrot<sup>®</sup>] and metalaxyl [Subdue<sup>®</sup>]).

**Alternaria leaf spot** (*Alternaria brassicae*). Symptoms include: round, brown lesions on infected leaves and oval or elongated lesions on stems. These lesions can enlarge to the size of a dime and are characterized by the presence of concentric rings within the dead tissue. Control with sanitation and applications of fungicides (iprodione [Chipco 26019<sup>®</sup>] and Terraguard<sup>®</sup>).

**Black leg** (*Phoma lingam*). Symptoms include elongated, light brown, sunken areas with purplish margins near the soil line. Stem lesions expand and girdle the entire stem, killing the plant. Control with sanitation.

**Black rot** (*Xanthomonas campestris pv campestris*). Symptoms of the initial infection is the presence of small, yellow-brown, V-shaped areas at the leaf margin. As lesions enlarge, the nearby veins turn black. A cross-section of an infected stem cut near the soil surface will show a distinct ring of decayed tissue. Control with sanitation and use disease resistant cultivars.

**Club root** (*Plasmodiophora brassicae*). Symptoms include stunted and wilted tops and an enlarged root system. Control with sanitation.

**Downy mildew** (*Peronospora parasitica*).

Symptoms are the appearance of purplish, irregular spots on the leaves. During cool, wet weather, the spots will enlarge and become yellow-brown in color. A white mold on the underside of the leaves may also develop. Control with sanitation and good air flow. Apply fungicides if needed (mancozeb [Manzate<sup>®</sup>]).

**Fusarium yellows** (*Fusarium oxysporum conglutinans*). Symptoms include plants with a dull cast, and lower leaves that turn yellow-green in color. Control with sanitation and use disease resistant cultivars.

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## NEW GUINEA IMPATIENS PRODUCTION

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**N**ew Guinea impatiens have steadily increased in popularity since their introduction into the U.S. in 1972. Today's varieties offer a wide range of flower colors as well as variegated foliage types. The versatility of this plant allows for its sale as bedding plants, 4 inch potted plants, and up to 12 inch hanging baskets.

### Propagation

New Guinea impatiens are started from rooted cuttings, except for Spectra F<sub>1</sub> hybrids, which are grown from seed. Most cultivars are patented, so do not take cuttings of New Guinea impatiens unless you are a licensed propagator or you are certain you are growing a non-patented variety. A <sup>3</sup>/<sub>4</sub> to 1 inch tip cutting is the best material to propagate. Root cuttings using 72 to 75 °F bottom heat in a mist bed. Cuttings root in 8 to 18 days, depending on the variety; most well-drained substrates are adequate for propagation purposes.

### Substrate Selection and Potting

Plant rooted cuttings in a well-drained substrate that does not contain a large nutrient charge; New Guineas are very susceptible to salts injury. A substrate pH of 5.8 to 6.2 is preferable for a soilless substrate. Substrates containing 20% or more mineral soil by volume should have a pH of 6.2 to 6.8. The number of cuttings per container depends on the container size and the production schedule. In general, use a single cutting for 4 and 5 inch pots; two for 6 inch pots; three to four for an 8 inch and four to five for a 10 to 12 inch basket.

### Pinching

Newer New Guinea impatiens varieties are free-branching and **do not** require pinching. Pinching will delay flowering by 2 to 3 weeks.

Pinching can be used as a timing device to delay flowering, if necessary.

### Watering

After potting, water only with clear water (no fertilizer) for the first two weeks. New Guineas grow best if the substrate is allowed to dry out between waterings, but not to the point of severe wilting. Avoid overwatering plants throughout production.

### Nutrition

Do not over fertilize New Guineas. They are susceptible to salts injury. Micronutrient toxicities can occur if substrate pH is too low. Excess micronutrients cause dieback of the growing tips, marginal necrosis of leaves, and eventual plant collapse.

Fertilization should begin once roots are visible in the soil ball at the edge of the pot. Use 100 to 150 ppm nitrogen, 50 to 75 ppm phosphorus, and 100 to 150 ppm potassium at each watering, once plants are established. If fertilizer is not applied at every watering, then use 300 to 350 ppm nitrogen, 100 ppm phosphorus, and 300 to 350 ppm potassium every third watering. Use recommended saturated media (paste) substrate tests and foliar analysis test levels for New Guinea impatiens as guides to monitor the crop's nutrient status (Tables 1 and 2).

### Light

Full light is needed during winter and early spring. A minimum of 3000 to 4000 footcandles (fc) is suggested. Too low of a light level reduces variegation and color intensity in leaves and results in poor flowering. Apply shade cloth if light levels exceed 6000 fc to avoid sun burn of foliage.

**Table 1. Recommended saturated media (paste) substrate test ranges for New Guinea impatiens grown in a soilless substrate.\***

pH	EC	NO <sub>3</sub> -N	NH <sub>4</sub> -N	P	K	Ca	Mg	Na	Fe	Mn	Zn	B
5.8 to 6.2	1.5 to 2.25	75 to 125	0 to 10	5 to 10	75 to 125	100 to 200	30 to 70	0 to 20	0.3 to 3.0	0.02 to 3.0	0.3 to 3.0	0.05 to 0.5

\*From the University of Minnesota. Units for EC are dS/cm (mmhos/cm). Units for all elements are ppm.

**Temperature**

Proper plant development requires relatively warm temperatures. After rooting, use a 65 to 68 °F night temperature and a 75 °F venting temperature. Night temperatures above 72 °F can cause a delay in flowering and should be avoided. Once plants are well established, the night temperature can be dropped to 62 to 64 °F.

**Height Control**

Excessive stretching is best controlled through maintaining high light levels, adequate spacing, and proper fertilization and watering practices. Many of the newest cultivars have a compact growth habit and do not require chemical height control. For cultivars that stretch, use a foliar spray of Bonzi™ at 5 to 30 ppm. New Guinea impatiens also respond to a negative DIF, and height can be controlled by maintaining slightly higher night temperatures than day temperatures.

**Spacing and Scheduling**

Spacing too close will result in excessive stretching. After cuttings are potted, maintain pot to pot spacing until plant canopies reach the edge of the pot. Afterwards, space out according to need (Table 3).

The timing of New Guinea impatiens depends on several factors, including cultivar, light level, temperature, number of cuttings per pot, and pot

**Table 2. Recommended tissue analysis standards for New Guinea impatiens.\***

Macronutrients (%)	
Nitrogen	2.5 to 4.5
Phosphorus	0.3 to 0.8
Potassium	1.9 to 2.7
Calcium	1.0 to 2.0
Magnesium	0.3 to 0.8
Sulfur	0.13 to 0.75
Micronutrients (ppm)	
Iron	150 to 250
Manganese	100 to 250
Zinc	40 to 85
Copper	5 to 10
Boron	50 to 60
Mo	1 to 10

\*From the University of Minnesota.

size. Use Table 3 as a guide in scheduling your New Guinea crops.

**Cultivars**

The number of varieties available to growers increases each year. A recent survey conducted by Clemson University concluded that growers are producing the following percentages of each flower color for their New Guinea impatiens hanging baskets: reds = 30 to 35%; pinks plus pink bicolors = 45 to 50%; lavenders = 10 to 15%; and whites = 5%. This is a good starting point in planning a marketing mix for colors. The problem arises when trying to determine the percentage of leaf colors and variegations. Table 4 lists many of the currently available cultivars to assist in cultivar selection. The final column in Table 4 indicates the landscape

*(Text Continued on Page 12)*

**Table 3. Spacing and scheduling recommendations for New Guinea impatiens.**

Pot or basket size (inches)	Spacing (inches)	Number of cuttings per container	Weeks to finish
4	7 × 7	1	6 to 8
5	8 × 8	1	7 to 9
6	10 × 10	2	8 to 10
8	14 × 14	3	8 to 10
10	18 × 18	4	12 to 14
12	20 × 20	5	12 to 14

**Table 4. New Guinea impatiens cultivars sorted by flower color and cultivar.**

Flower Color	Series <sup>z</sup>	Cultivar	Leaf Color	Variegated Growth Landscape		
				Foliage? <sup>y</sup>	Habit <sup>x</sup>	Rating <sup>w</sup>
White	Twice As Nice	Allegro	Medium Green	No	2	
White	Mikkel Sunshine	Cirrus	Medium Green	Yes	4	2.2
White	Lasting Impressions	Innocence	Dark Green	Slight	3	2.8
White	Mikkel Sunshine	Milkyway	Medium Green	Yes	3	3.5
White	Paradise	Moorea	Medium Green	No	2	2.6
White	Celebration	Pure White	Medium Green	No	2	3.4
White	Danziger	Waltz	Medium Green	No	3	2.1
White	Patriot	White	Medium Green	No	3	
White	Pot O' Gold	White	Medium Green	No	2	
White	Spectra	White	Dark Green	Yes	2	2.8
White <sup>w</sup> / Pink Eye	Celebration	Blush White	Medium Green	No	2	4.1
White <sup>w</sup> / Pink Eye	Paradise	Samoa	Medium Green	No	3	4.1
Light Pink	Twice As Nice	Canon	Medium Green	No	2	
Light Pink	Mikkel Sunshine	Equinox	Bronze	Yes*	3	3.4
Light Pink	Lasting Impressions	Illusion	Medium Green	No	4	4.6
Light Pink	Spectra	Light Pink Shades	Medium Green	Yes	3	2.1
Light Pink	Bull	Melanie	Dark Green	No	3	3.4
Light Pink	Patriot	Soft Pink	Medium Green	No	3	
Light Pink <sup>w</sup> / Fuchsia Eye	Celebrette	Apple Blossom	Medium Green	No	1	
Pink	Pure Beauty	Aglia	Medium Green	Yes**	3	
Pink	Bull	Barbara	Medium Green	No	2	1.4
Pink	Celebration	Deep Pink	Dark Green	No	2	3.7
Pink	Mikkel Sunshine	Gemini	Medium Green	Yes	5	3.3
Pink	Pure Beauty	Kallima	Bronze	No	2	1.9
Pink	Twice As Nice	Minuet	Medium Green	No	2	
Pink	Patriot	Pink	Medium Green	No	3	
Pink	Pot O' Gold	Pink	Medium Green	No	2	
Pink	Lasting Impressions	Rosetta	Dark Green	No	3	2.3
Pink	Twice As Nice	Waltz	Medium Green	No	2	
Dark Pink	Pure Beauty	Apollon	Dark Green	No	5	
Dark Pink	Paradise	Bonaire	Dark Green	No	3	2.9
Dark Pink	Danziger	Dandin	Dark Green	No	4	3.6
Dark Pink	Danziger	Dangal	Medium Green	No	3	4.9
Dark Pink	Pure Beauty	Dark Delias	Medium Green	No	1	4.2
Dark Pink	Bull	Doerte	Dark Green	No	3	2.0
Dark Pink	Celebration	Electric Pink	Dark Green	No	3	4.0
Dark Pink	Mikkel Sunshine	Enterprise	Dark Green	Yes	4	0.0
Dark Pink	Twice As Nice	Etude	Medium Green	No	2	
Dark Pink	Pure Beauty	Melissa	Dark Green	No	3	
Dark Pink	Patriot	Pink Salmon	Medium Green	No	2	
Pink <sup>w</sup> / Rose Bicolor	Celebration	Candy Pink	Dark Green	No	3	2.9

Table 4, Continued.

Flower Color	Series <sup>z</sup>	Cultivar	Leaf Color	Variegated Growth Landscape		
				Foliage? <sup>y</sup>	Habit <sup>x</sup>	Rating <sup>w</sup>
Pink <sup>w</sup> / Rose Bicolor	Twice As Nice	Duet	Medium Green	No	2	
Pink <sup>w</sup> / Rose Bicolor	Lasting Impressions	Impulse	Medium Green	No	3	4.9
Pink <sup>w</sup> / Fuchsia Bicolor	Paradise	Guadeloupe	Dark Green	No	2	
Pink <sup>w</sup> / Fuchsia Bicolor	Liberty	Lilac & Red	Dark Green	No	4	
Pink <sup>w</sup> / Fuchsia Bicolor	Pot O' Gold	Purple Bicolor	Dark Bronze	No	2	
Pink <sup>w</sup> / Red Eye	Paradise	Tahiti	Medium Green	No	2	
Pink <sup>w</sup> / Red Bicolor	Pure Beauty	Octavia	Medium Green	No	4	
Pink <sup>w</sup> / Red Bicolor	Paradise	Pago Pago	Dark Green	No	2	3.8
Pink <sup>w</sup> / Lavender Bicolor	Paradise	Tonga	Dark Bronze	No	1	
Pink <sup>w</sup> / Purple Eye	Danziger	Danlight	Dark Green	No	4	2.9
Light Salmon	Celebration	Light Salmon	Medium Green	Yes	3	5.0
Lt. Salmon <sup>w</sup> / White Eye	Celebrette	Peach	Bronze	No	1	
Salmon	Paradise	Grenada	Dark Green	No	2	3.0
Salmon	Celebration	Salmon	Medium Green	Yes	3	5.0
Salmon	Pot O' Gold	Salmon	Bronze	No	2	
Salmon	Liberty	Salmon Orange	Dark Green	No	3	
Salmon	Spectra	Salmon Shades	Medium Green	No	3	2.2
Dark Salmon	Celebration	Bright Coral	Dark Green	No	3	5.0
Dark Salmon	Celebration	Deep Coral	Bronze	Yes	3	4.1
Salmon Pink	Lasting Impressions	Cameo	Medium Green	Slight	4	3.1
Salmon Coral	Bull	Inge	Bronze	No	2	0.0
Salmon Coral	Bull	Rosemarie	Dark Green	No	3	1.4
Salmon Orange	Lasting Impressions	Charade	Dark Green	No	2	2.5
Salmon Orange	Danziger	Danshir	Dark Green	No	2	3.7
Orange	Lasting Impressions	Ambrosia	Dark Green	No	4	3.4
Orange	Lasting Impressions	Escapade	Dark Green	No	3	5.0
Orange	Bull	Mathilde	Dark Bronze	No	3	2.5
Orange	Mikkel Sunshine	Nebulous	Dark Green	No	4	4.9
Orange	Celebration	Orange	Medium Green	No	3	
Orange	Patriot	Orange	Medium Green	No	3	
Orange	Pot O' Gold	Orange	Bronze	No	2	
Orange	Twice As Nice	Sonata	Medium Green	No	2	
Orange	Paradise	Timor	Dark Green	No	1	5.0
Orange	Mikkel Sunshine	Zenith	Medium Green	Yes	3	2.4
Dark Orange	Paradise	Antigua	Medium Green	No	3	
Dark Orange	Celebration	Bonfire Orange	Dark Bronze	No	2	4.4
Dark Orange	Pure Beauty	Marpesia	Dark Bronze	No	3	
Dark Orange	Mikkel Sunshine	Nova	Dark Green	Yes	2	2.8
Dark Orange	Bull	Suzanne	Medium Green	No	4	2.5
Dark Orange	Paradise	Tanna	Dark Green	No	3	1.9
Orange <sup>w</sup> / Fuchsia Eye	Celebrette	Orange Crush	Dark Green	No	1	

Table 4, Continued.

Flower Color	Series <sup>z</sup>	Cultivar	Leaf Color	Variegated Growth Landscape		
				Foliage? <sup>y</sup>	Habit <sup>x</sup>	Rating <sup>w</sup>
Orange <sup>w</sup> / White Bicolor	Lasting Impressions	Tempest	Dark Green	Yes	1	1.2
Orange <sup>w</sup> / Pink Bicolor	Lasting Impressions	Ambience	Medium Green	No	3	2.4
Orange <sup>w</sup> / Salmon Bicolor	Mikkkel Sunshine	Sunburst	Bronze	Slight	3	3.5
Orange <sup>w</sup> / Salmon Bicolor	Mikkkel Sunshine	Sunglow	Dark Green	Yes	1	1.4
Orange <sup>w</sup> / Salmon Bicolor	Mikkkel Sunshine	Twilight	Bronze	Yes	3	1.0
Orange <sup>w</sup> / Red Bicolor	Danziger	Danova	Dark Bronze	No	3	1.9
Orange <sup>w</sup> / Red Bicolor	Pot O' Gold	Red Bicolor	Dark Bronze	No	2	
Rose	Celebration	Rose	Medium Green	No	3	
Rose	Spectra	Rose Shades	Medium Green	Slight	3	2.0
Fuchsia	Paradise	Papete	Medium Green	No	1	
Fuchsia	Mikkkel Sunshine	Pulsar	Dark Green	Yes	3	3.6
Fuchsia	Mikkkel Sunshine	Radiance	Medium Green	Yes	2	4.6
Fuchsia Red	Bull	Anna	Dark Green	No	3	1.1
Fuchsia <sup>w</sup> / Purple Eye	Celebrette	Hot Rose	Medium Green	No	1	
Red	Pure Beauty	Anaea	Medium Green	No	3	
Red	Celebration	Bright Scarlet	Medium Green	No	2	5.0
Red	Celebrette	Cherry	Dark Green	No	1	
Red	Celebration	Cherry Red	Medium Green	No	4	
Red	Danziger	Danhill	Medium Green	No	4	3.3
Red	Celebration	Deep Red	Dark Green	No	2	
Red	Bull	Karina	Dark Green	No	2	1.9
Red	Paradise	Lanai	Medium Green	No	3	
Red	Twice As Nice	Largo	Medium Green	No	2	
Red	Paradise	Martinique	Medium Green	No	2	2.6
Red	Lasting Impressions	Masquerade	Dark Bronze	No	3	
Red	Mikkkel Sunshine	Mirach	Medium Green	Yes	3	4.2
Red	Pure Beauty	Prepona	Dark Green	No	2	1.6
Red	Celebration	Red	Dark Green	No	3	4.9
Red	Patriot	Red	Medium Green	No	2	
Red	Pot O' Gold	Red	Medium Green	No	2	
Red	Spectra	Red Shades	Medium Green	No	3	3.2
Red	Danziger	Rhondo	Medium Green	No	3	2.0
Red	Celebrette	Scarlet	Medium Green	No	1	
Dark Red	Lasting Impressions	Blazon	Dark Green	Slight	3	3.1
Dark Red	Patriot	Dark Red	Dark Green	No	3	
Red <sup>w</sup> / Pink Bicolor	Celebration	Apple Star	Dark Green	Slight	4	1.8
Red <sup>w</sup> / Pink Bicolor	Celebration	Cherry Star	Dark Bronze	No	2	2.9
Lavender	Twice As Nice	Baroque	Medium Green	No	2	
Lavender	Danziger	Flamenco	Medium Green	No	3	1.8
Lavender	Lasting Impressions	Heathermist	Dark Green	No	3	3.4
Lavender	Celebrette	Lavender	Medium Green	No	1	

Table 4, Continued.

Flower Color	Series <sup>z</sup>	Cultivar	Leaf Color	Variegated Foliage? <sup>y</sup>	Growth Habit <sup>x</sup>	Landscape Rating <sup>w</sup>
Lavender	Liberty	Lavender	Dark Green	No	2	
Lavender	Patriot	Lavender	Medium Green	No	3	
Lavender	Celebration	Light Lavender	Medium Green	Yes	4	4.8
Lavender	Celebration	Light Lavender II	Medium Green	No	3	
Lavender	Lasting Impressions	Serenade	Medium Green	No	3	3.6
Lavender	Lasting Impressions	Tiffany	Dark Green	No	3	
Purple	Paradise	Anguilla	Dark Green	No	2	
Purple	Paradise	Aruba	Dark Green	No	1	
Purple	Paradise	Bora-Bora	Medium Green	No	2	
Purple	Danziger	Danserra	Dark Green	No	2	2.5
Purple	Celebrette	Grape Crush	Medium Green	No	1	
Purple	Patriot	Lilac	Medium Green	No	2	
Purple	Celebration	Purple	Medium Green	No	3	
Purple	Danziger	Samba	Dark Green	No	3	1.6
Purple	Patriot	Violet	Medium Green	No	3	
Purple	Pot O' Gold	Violet	Bronze	No	2	
Dark Purple	Patriot	Purple Lilac	Medium Green	No	3	
Dark Purple	Lasting Impressions	Rhapsody	Medium Green	No	4	1.7
Purple Rose	Celebration	Raspberry Rose	Medium Green	No	2	4.5
Purple Red	Danziger	Lambada	Bronze	No	2	4.3
Purple Lavender	Mikkel Sunshine	Antares	Medium Green	Slight	2	3.9
Purple <sup>w</sup> / Lavender Bicolor	Celebration	Purple Star	Bronze	No	3	
Purple <sup>w</sup> / Lavender Bicolor	Lasting Impressions	Shadow	Dark Green	No	3	2.8
Purple <sup>w</sup> / Lavender Bicolor	Mikkel Sunshine	Sunregal	Dark Green	Slight	1	3.1

<sup>z</sup>Bull series is a product of Gartenbau Norbert Bull, Goennebek, Germany.

Celebration and Celebrette series are products of Ball FloraPlant, West Chicago, Illinois.

Danziger series is a product of Dan Flower Farm, Beit Dagan, Israel.

Lasting Impressions<sup>TM</sup>, Mikkel<sup>®</sup> Sunshine<sup>TM</sup>, Pot O' Gold<sup>TM</sup> and Twice as Nice<sup>TM</sup> series are products of Mikkelen, Inc., Ashtabula, Ohio.

Liberty and Patriot are products of Dümme USA, Vancouver, Washington.

Paradise<sup>®</sup> and Pure Beauty<sup>TM</sup> series are products of Kientzler Jungpflanzen, Gensingen, Germany.

Spectra<sup>TM</sup> series is a product of PanAmerican Seed Company, West Chicago, Illinois.

<sup>y</sup>Foliage is either non-variegated (No); has white variegation that is prominent (Yes) or slight (Slight); has red variegation (Yes\*); or has yellow variegation (Yes\*\*).

<sup>x</sup>The growth habit number indicates how the cultivar develops in the greenhouse during production. The rating ranges from 1 (very compact) to 5 (very vigorous).

<sup>w</sup>Landscape ratings were conducted at Clemson University in a full sun situation. The rating ranges from 5.0 (excellent flowering) to 0 (very poor flowering). Cultivars lacking a landscape rating were not included in the evaluation.

(Text Continued from Page 7)

performance of many of the cultivars. The performance ratings are from a study conducted at Clemson University in the summer of 1994 under full-sun conditions. These ratings should assist growers in selecting cultivars best suited for the Southeastern landscape.

### **Insect and Related Pests**

The main pest problems of New Guinea impatiens are the two-spotted spider mite, cyclamen mite, and western flower thrips. Western flower thrips is the most serious pest on New Guineas, as they serve as a vector for Impatiens Necrotic Spot Virus (INSV; formerly called Tomato Spotted Wilt Virus), a destructive disease. Thrips can spread this virus to susceptible species throughout a greenhouse, including New Guinea impatiens, garden impatiens, gloxinias, cyclamen, gerbera daisies, and many other floricultural crops. Careful routing of infected plants, monitoring of sticky cards, frequent inspection of flowers to check for the presence of thrips, and thorough spraying are essential in controlling thrips and INSV.

Other insects that can be a problem include fungus gnats, mealybugs, and aphids. Consult the current year's N.C. Agricultural Chemical Manual for suggested control measures for all of these pests.

### **Diseases**

Impatiens Necrotic Spot Virus is the most serious disease on New Guinea impatiens. It starts as foliar and stem lesions and eventually destroys the marketability of plants. The only control is prevention via purchasing plants from reliable propagators, rouging infected plants, and control of the vector, western flower thrips.

*Botrytis* blight can be a serious disease on New Guinea impatiens. Too cool night temperatures and / or too high relative humidity can increase the severity and incidence of *Botrytis*, so maintain at least 62 °F night temperatures and vent to reduce humidity in the greenhouse whenever possible. The other major above-ground disease is *Rhizoctonia* stem rot and web blight.

Root rot caused by *Pythium* spp. or *Phytophthora* spp. also affect New Guinea production. Avoid overwatering plants as a water-soaked substrate can increase the incidence of root rot. Consult the current year's N.C. Agricultural Chemical Manual for control measures for the diseases mentioned above.

### **For Further Information**

Contact your County Cooperative Extension Center for related Horticulture Information Leaflets, Ornamental Disease Notes, and Ornamental and Turf Integrated Pest Management Insect Notes. Also consult the current edition of the N.C. Agricultural Chemicals Manual for pest and disease control recommendations. Other general information sources on New Guinea impatiens production used in the development of this article include:

- Ecke, P. 1994. New Guinea impatiens cultural information guide. Paul Ecke Ranch, Encinitas, California.
- Erwin, J. 1992. New Guinea impatiens production. Minnesota Commercial Flower Growers Association Bulletin. 41(3):1-15.
- Mikkelsen, E. 1994. Cultural information for New Guinea impatiens. Mikkelsen, Inc., Ashtabula, Ohio.
- Miller, W.B. and M.S. Williams. 1994. 1994 New Guinea impatiens landscape trials. South Carolina Greenhouse Newsletter. 8(5):8-10.

## NCCFGA NEWS

### Jerry Whitley, President

Greetings to all from the cool climes of Huntersville, North Carolina where 90 °F temperatures seem to be the current New Wave life-style (we don't get too many waves in Huntersville other than heat waves and "howdies"). I hope all of you came out of our roller coaster spring season as survivors and not casualties. This would indeed have been the year to invest in an accurate crystal ball to predict when and where the market was going to break.

There are a few items of Association business that each of you should take note of: the Southeast Greenhouse Conference and Trade Show; the Bedding Plant Field Day; and the upcoming **NCCFGA General Membership Meeting**.

If you missed this year's Southeast Greenhouse Conference, you missed an excellent event. Record attendance, over 1,200 participants, listened, learned, and enjoyed the wonderful fellowship in Greenville. The best social event of the Conference had to be the surprise (at least to Roy it was a surprise) roasting of Roy Larson at the banquet. The show has grown tremendously over its 4 year history and is now cosponsored by

six states (AL, FL, GA, NC, SC, and VA). The educational sessions were well done, and the 214-booth trade show (a sellout!) was full of state of the art supplies, equipment, and plant materials. Your Association had a booth, and hopefully we can continue to increase membership and promote our industry. Many thanks to Bonnie Holloman for all of her time and energies in representing NCCFGA at the conference and thanks also to NCDA for helping develop the booth display. I hope to see all of you at our conference booth next year.

By now you should have received a flyer announcing this year's Bedding Plant Field Day (If you have not received it, give Bonnie a call at 919-779-4618 or contact Doug Bailey at 919-515-1195). NCCFGA helps sponsor this event and we appreciate your support via attendance. This year's program is especially interesting, with Roy Larson's perspective on floriculture as a keynote talk (Roy is retiring at the end of August, so this is your last chance to heckle him in a talk in North Carolina before he's retired!). Paul Nelson will fill us in on poinsettia nutrition, and there are also talks of interest to landscapers and retailers dealing in the bedding plant trade.

Speaking of the field day, it is especially important that you attend this event, as we have our annual membership meeting scheduled during the program. We will be voting on officers and board members for the upcoming year and need your input. Nominations from the floor will be entertained and encouraged. We would also like the opportunity to inform the membership "in person" of ongoing NCCFGA projects, such as the Roy A. Larson Scholarship Fund (it's still not too late to make contributions; open up that checkbook and contact Bonnie or Doug) and cosponsorship of the 1996 poinsettia trials at State; and keep you up to date on the status of



*NCCFGA was well represented at the 1996 Southeast Greenhouse Conference and Trade Show.*

hopefully getting a replacement faculty to fill Roy's position at N.C. State. University Administration will be present at the Bedding Plant Field Day, and it certainly help our efforts to promote a replacement for Roy if we have a strong industry showing at the event. Please try to attend! We need your vote and your input into potential future projects.

Last year, YOUR Association contributed enough composted bark to amend the trial beds and greatly improve the quality of the trial plots. The plants are looking great this year and should assist you in your seed and plant selection for

next year. NCCFGA is also sponsoring a summer intern who is assisting with the maintenance of the trials; Doug Bailey passes on his gratitude for our support of the trial gardens.

I do hope your summer is going well and I look forward to seeing all of you at the Bedding Plant Field Day in July,



Jerry E. Whitley

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## NEW PUBLICATIONS / INFORMATION FOR NORTH CAROLINA GROWERS

**A Grower's Guide to Water, Media, and Nutrition for Greenhouse Crops**, edited by Dr. David Reed is available from Ball Publishing. This comprehensive 324-page volume draws upon the knowledge of 10 university, extension, and industry experts. Information included: sampling, testing, and interpretation of water, media, and plant tissue samples; greenhouse recirculating water systems; recycling water in a nursery / greenhouse; and plant micro and macronutrients. The book price is \$55 can be purchased from Ball Publishing by calling 708-208-9080.

**NCSU Plant Growth Regulator Calculator**, designed by Doug Bailey. This Excel® 5.0 spreadsheet calculates the amount of product required to create any concentration of final solution. It will also calculate the chemical cost (does not include labor cost) of the pgr application. Finally, it will estimate to total amount of active

ingredient received by each pot or plant that was treated. Use the outputs to mix your spray solutions of A-Rest, Atrimmec, B-Nine, Bonzi, Cycocel, Florel, and Sumagic; and your drench solutions of A-Rest, Bonzi, Cycocel, and Sumagic. The amount of product is given in metric and U.S. units to allow you to select which units you desire to use for mixing. Costs are based on the chemical cost the user inputs. By entering the average pot or plant diameter, the user can estimate how much solution and active ingredient was applied to the pot or plant. The spreadsheet does require Excel® 5.0. The plant growth regulator calculator is free and is available on the world wide web at: <http://www.ncsu.edu/unity/lockers/project/floriculture/www/index.html> or you can send a formatted disk with your return address to: Doug Bailey, Department of Horticultural Science, Box 7609, NCSU, Raleigh, NC 27695-7609.

# CALENDAR OF EVENTS

<b>Event</b>	<b>Date</b>	<b>Time</b>	<b>Location and contacts</b>
Ohio International Floral Short Course	Saturday–Wednesday 13–17 July		Cincinnati Convention Center, Cincinnati, Ohio. Contact OFA at 614-487-1117 for further information.
1996 NCSU Bedding Plant Field Day	Wednesday 31 July	9:00 am to 4:00 pm	Horticulture Field Lab & the McKimmon Center, Raleigh, N.C. Contact Bonnie Holloman at 919-779-4618.
NCCFGA General Membership Meeting	Wednesday 31 July	3:30 pm to 4:00 pm	McKimmon Center, Raleigh, N.C. Contact Bonnie Holloman.
NCCFGA Board Meeting	Wednesday 31 July	4:00 pm to 4:30 pm	McKimmon Center, Raleigh, N.C. Contact Bonnie Holloman.
PPGA 29th International Bedding Plant Conference and Trade Show	Tuesday–Saturday 1–5 October		Hyatt Regency Hotel, Dearborn, Michigan. Contact PPGA at 800-647-7742 for further information.
NCCFGA Board Meeting	TBA mid-October		TBA. Contact Bonnie Holloman for further details.
Association of Specialty Cut Flower Growers 9th National Conference and Trade Show	Wednesday–Monday 6–11 November		Denver Marriott Tech Center, Denver, Colorado. Contact ASCFG at 216-774-2887 for more details.
NCSU Poinsettia Open House	Thursday 5 December	10:00 am to 3:00 pm	Horticulture Field Laboratory, Raleigh, N.C. Contact Roy Larson at 919-515-3133.
GrowerExpo '97	Thursday–Sunday 9–12 January 1997		Pheasant Run Resort, St. Charles, Illinois. Call 800-456-5380 for more information.
NCCFGA Board Meeting	TBA mid-January, 1997		TBA. Contact Bonnie Holloman for further details.



**NORTH CAROLINA  
COMMERCIAL FLOWER GROWERS' ASSOC.**

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