



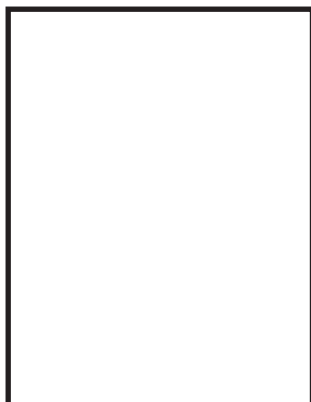
# Bulletin

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## CIRCULATE

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## Garden Mum Production



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Imagine there was a crop ... an easy-to-grow crop that required little work, other than filling a container and planting a cutting; a crop that required minimal investment; a crop with little to no energy input costs; a

fun crop that lets you enjoy the chance to use your growing and marketing skills to produce and sell a wide array of plant sizes and container types; a crop with an ever-growing demand for over 15 years ... It's easy if you try. Is there such a crop?

Yes there is! It is the fall flowering garden mum. The following is a brief primer on "How To Grow Fall Garden Mums," including the principles of garden mum production.

### THE FIELD

Garden mum fields should be level, in full sun, and drain well. The area should ideally be covered with a ground cover fabric that allows water to drain through and that prevents weed growth. If the fabric is lined, it is easier to space out the containers and have a clean, neat, and organized growing area. Irrigation is

ideally accomplished through drip tape or "spaghetti" tubes to 1) Efficiently use water and fertilizer and 2) Reduce free moisture on the foliage to minimize foliar pathogens. Fertilization should be done via constant liquid feeding until a few weeks prior to marketing the crop (see fertilizer).

### CROP SCHEDULES

Each of these schedules allows for the production of high quality garden mums like the plants in Figure 1, page 9. These plants are typically produced in a container such as the 8- by 5-inch

garden mum pan and have head sizes of 16 to 20 inches.

#### A. One Plant per Container

- Plant a rooted cutting or liner approximately June 10 to 20. Pinch once about 10 to 14 days after planting.

- Plant a rooted cutting or liner approximately June 15 to 25. Do not pinch.

#### B. Two plants per Container

- Plant rooted cuttings or liners approximately June 25 to July 10. Pinch once 10 to 14 days after planting.

*Continued on page 8*

## DRIVING FALL RETAIL TRAFFIC

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When consumers think fall, they think mums and pumpkins and that's about it. While those two are still the staples of autumn, savvy gardening retailers are introducing new plants and fall family activities aimed at opening a market beyond mums and pumpkins.







At Country Market Nursery in Mechanicsburg and Hershey, Pennsylvania, a combination of education, improved plant selection, and two fall festivals are driving customer traffic in that traditional valley between the twin peaks of spring planting and Christmas.

Country Market's crowning event of this time period is the annual "Fall Festival," a five-week event that features food, music, family activities, a straw maze, and, of course, lots of mums and pumpkins.

"We extended it last year so that now our Fall Festival begins the last week in September," says Robin Kyle, the

*Continued on page 10*

## JUNE/JULY 2001

	GARDEN MUM PRODUCTION .....PAGE 1
	DRIVING FALL RETAIL TRAFFIC .....PAGE 1
	AGRICULTURAL BIOTECHNOLOGY: CURRENT STATUS, FUTURE PROSPECTS.....PAGE 2
	FALL GARDEN MUM PRODUCTION - MY WAY .....PAGE 4
	PEST CONTROL - MEALYBUGS AND SCALE.....PAGE 6
	PRODUCING TOP-QUALITY ORNAMENTAL VEGETABLES.....PAGE 12

The mission of Ohio Florists' Association, a professional association of individuals in the floral industry, is to help its members be competitive, profitable, and responsive to the needs and interests of consumers; and make a positive contribution to the environment – while increasing public knowledge of the care, use, and value of floral products and services.

The Association will accomplish this by providing leadership in educational programs and services; facilitating research to improve the products and services; and fostering industry cooperation for the global benefit of its members, the floral industry, and its consumers.



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# AGRICULTURAL BIOTECHNOLOGY: CURRENT STATUS, FUTURE PROSPECTS

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What is biotechnology? Most current definitions are very broad, encompassing everyday microbial biochemical processes such as fermentation, leavening, etc. These processes, and conventional approaches to crop breeding (e.g., hybridization, selection), might be considered "traditional biotechnology," which rarely arouses concern today. In contrast, "modern" biotechnology involving human-directed DNA modifications (i.e., "genetic engineering") is discussed daily in the media.

In genetic engineering, genes are recombined by direct manipulation of DNA, and may be transferred across wide evolutionary distances, e.g., the bacterial Bt gene inserted into crops, because sexual compatibility is not required. As a result, crops can acquire novel features or functions absent in nature, including "human-made" genes or gene components yielding new types of disease resistance, flower colors, etc.

Genetic engineering enables scientists to transfer only one or a few specific genes, whereas traditional crossing transfers thousands of genes indiscriminately. Genetic engineering may also enable precise regulation of gene expression and function. The related field of genomics – simultaneous, computerized analyses of the structure and function of thousands of genes – has also helped accelerate progress in crop genetic improvement. Because transgenic (synonymous with "genetically-engineered") maize, soybean, and cotton has yielded significant benefits to producers they were widely and rapidly adopted, and now cover millions of acres in the United States and other nations.

Like all technologies, genetic engineering may involve risks, which must be assessed and managed. In the United States, there is extensive non-regulatory oversight via peer review of scientific programs and publications, and by certification of laboratory quality standards. Furthermore, three federal agencies administer a scientific, risk-based regulatory scheme under the 1986 "Consolidated Framework for the Regulation of Biotechnology." The USDA-Animal and Plant Health Inspection Service (APHIS) regulates any ecological risk posed by plant pests, plants, or veterinary biological material. For example, if a transgenic crop is cultivated near cross-compatible weedy or wild relatives, there is the potential risk that

transgenes may spread to them by pollen or by parasitic and disease organisms, thereby potentially diminishing the genetic integrity of those populations and, with herbicide-resistant transgenes, yielding weeds with innate resistance to herbicides.

The Environmental Protection Agency (EPA) regulates pesticide use in the United States, including new uses of existing pesticides, such as inserting them (e.g., genes for the Bt toxin) into crops. The ecological consequences of these pesticides, such as potential effects on "non-target organisms," and evolution of pest resistance to the pesticide, are scrutinized. The Food and Drug Administration (FDA) is charged with regulating food, feed, food additives, veterinary drugs, human drugs, and medical devices. The FDA examines the potential dietary risk posed by transgenic crops through altered properties of food, such as novel toxicity or allergenicity.

For example, if an ornamental were genetically-engineered for herbicide tolerance, the USDA/APHIS and the EPA would jointly regulate it. The USDA/APHIS would identify potential environmental risks, whereas the EPA would assess this novel use for the companion herbicide. If an ornamental were genetically-engineered to express a novel corolla (flower) color, the USDA/APHIS would assess if it poses any risk of transmitting deleterious genes to the environment.

Why have transgenic crops generated global political controversy? As with all scientific and technological advances, there are some associated potential risks, hence the preceding regulation. There are profound differences in consumer attitudes among Europe, Japan, the United States, and even within the United States, with respect to the magnitude of the perceived risk associated with transgenic crops. Europeans, in particular, mistrust government's ability to effectively regulate transgenic crops, probably because of regulatory controversies associated with mad cow disease, etc. Genetic engineering is partially responsible for the acceptance, especially in Europe, of the "precautionary principle," whereby regulators may ban transgenic plants unless there is a demonstration that no risk is involved. The precautionary principle represents an erosion of "science-based" systems of regulation, because science can never prove complete absence of risk. It can only establish probabilities. The precautionary principle also ignores the benefits of genetic engineering that may counterbalance any risk. So, by establishing absolute safety as a standard, the precautionary principle essentially precludes risk/benefit determinations. As a result of such different national perspectives, disputes over how to regulate commerce of transgenic crops, especially foods, are disrupting global agricultural trade. The European Union is demanding mandatory labeling of transgenic foods, which may require United States producers to segregate those from conventional crops.

Most of the initial transgenic crops have primarily benefited the producer, not the consumer, thereby engendering sometimes vastly different perceptions of comparative risks and benefits. Because of their novelty and comparatively high cost, many tools of genetic engineering, as well as transgenic crops themselves, are protected by legal mechanisms such as patents and exclusive contracts. With such protection, and sometime restrictive licensing, these key scientific tools may



be tightly controlled, thereby potentially impeding scientific progress, because access to the tools may be restricted or very costly. Five or six large "life science" corporations, formed during the 1990s by the merger of seed

and chemical companies, control many patents for these scientific tools. For some, this generates fears of cartels, putting scientists, producers, and consumers at their mercy.

The future for transgenic crops, be they food or ornamentals, may involve labeling of some sort, so that end users can actively choose whether or not to grow or consume transgenic crops. In the United States, such labeling may be voluntary, and would involve segregation of product streams, e.g., organic vs. non-organic vs. non-transgenic crops. Such segregation and associated purity testing will generate additional production and processing costs. Mandatory labeling of food and food crops is unlikely, because the FDA regulates the product itself, not the manufacturing process, and is unlikely to adopt any process-based regulation.

Labeling, even voluntary in nature, presents significant operational challenges. Currently, there is no generally accepted definition of what constitutes a "genetically engineered plant." There is no agreement on the threshold level of "contamination" (5 percent? 1 percent? 0.1 percent?) permitted in "transgenic-free" crops or products. There are no broadly applicable tests for transgenic crops; batteries of tests, diagnostic for individual genes, may be required. Finally, new genetic engineering techniques may yield no trace, thereby necessitating new means to preserve identity, and further complicating the ability to label crop products. Such labels will be necessary to maintain the markets for unique, high-value products (transgenic, organic, or otherwise).

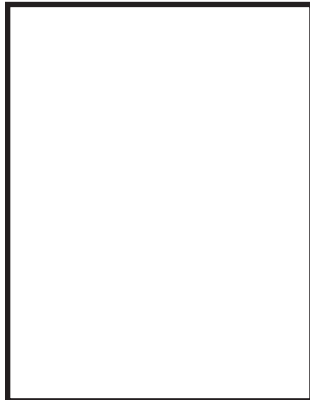
Eventually, transgenic crops may be widely accepted, if the focus of societal concern shifts from the nature of the production process, to the properties of the product itself.

Until then, the future for transgenic ornamentals may be uncertain. Last year's announcement by the Scotts Co. that transgenic turfgrass was undergoing testing elicited this comment: "This is going to put biotech in everyone's backyard. It's going to open up a national debate, because everyone has a lawn. You're going to see a 'not in my backyard' phenomenon." (Jeremy Rifkin, *New York Times*, 8 July 2000). Rifkin petitioned the USDA/APHIS to suspend all field tests of the transgenic turfgrass. USDA/APHIS declined to do so, thus research and development has continued.

In conclusion, perhaps we would do well to consider carefully the comments of Martin Chrispeels, Director of the San Diego Center for Molecular Agriculture "As scientists, we always demand and rely on evidence. It has been claimed that the risks of genetic engineering of crops will be "superweeds" and "superbacteria," the appearance of unknown toxins and allergens in our food, paralyzing crop losses, and extensive ecological damage. We have not seen evidence for these scenarios. We believe that agriculture could be less ecologically damaging and more sustainable, and that GM crops can play a positive role in this development. We also believe that GM crops will make food cheaper to produce and more nutritious." (Foods from Genetically Modified Crops, p. 2., San Diego Center for Molecular Agriculture).

OFA

# Fall Garden Mum Production – My Way



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As summer approaches, I think back to when I was a child growing up on a farm in Georgia, and reflect upon Sunday afternoons during those long hot summer days. I remember what it was like to be carefree. The only thing on my mind was to build a dam across a branch of the small creek behind our barn. Once accomplished there was nothing left to do but find a wild muscadine vine to swing out over the water, once the dam had backed up, and to let go for a cool refreshing dip. Today I find myself with the typical summer responsibilities of a well-entrenched greenhouse owner; I have to plan another quality garden mum crop. The editorial team at OFA asked if I would like to share my experience on how I grow a garden mum crop, and of course, it is a pleasure to do so.

First of all, I usually contact a sales representative of

a garden mum cutting producer. Being a small grower (20,000 sq ft heated space), I buy pre-rooted cuttings. Over the last 18 years I have found it is cheaper to let someone who is set up to propagate, to produce the cutting for me. The sales representative often helps me decide which varieties are best for my growing zone. I prefer to grow varieties that have a mounding habit and are resistant to bacterial leaf spot. I am also very concerned about flowering date, susceptibility to heat delay, and whether or not the varieties are free branching or will require frequent pinching. In the South, we often use “no pinch” mum cultivars based upon the research done by Terri Starman and Jim Faust. Which of these cultivars is best for you is something that representative can help you determine, but the faster they break branches, the better the crop will be weeks later.

Given my traditional customers' requests and my previous sales records, I try to have 65 percent of the crop in some shade of yellow, perhaps 20 percent bronze, 10 percent lavender, and 5 percent white. June 4 to June 18 is a good transplanting window in central Georgia. I try to have my containers already filled with growing media the day the cuttings arrive so as to speed up the transplant process. One thing to remember is that the faster you can get the cutting stuck and under mist, the more vigorous the rooting, and the faster they take

hold. Holding cuttings a day or two is something to avoid if at all possible.

There are many types of soil media on the market. The media should be loose, well drained and provide a solid anchor root system. I have also found that the type of container plays a significant role in the growth and in providing a solid anchor for the root system. I don't use those mum pans. I use trade gallon containers. I have found that Fafard 4P works very well for me. I have the Fafard Company custom mix a “mum media” for me that fits my watering habits and my local weather patterns, which around here means hot and dry!

In Georgia, a scrawny mum will not sell. Garden mums need to be full, thick, and in full-bloom to get a decent price. I use free-branching cultivars and other selections based upon my customers' requests. When the rooted cuttings are shipped to me, I do my first pinch as I transplant the cutting. I know that's not the way the book says to do it! Nevertheless, I do a soft pinch as I place the cutting in the pot. I haven't observed any more shock to the plants than normal and it does initiate a very fast set of breaks that I can build upon later. The cuttings are allowed to root in the greenhouse.

The most important thing I do for newly stuck cuttings is to water-in very, very well. This means mak-

ing very sure they are saturated. For the next two days, my wife and I use a hose end fog attachment and mist them every two hours. By the third day, we back off and fog them four times during the whole day. By the fifth day, the cuttings are only watered once a day, unless it's very hot and they begin to wilt by mid-afternoon. If so, we might fog them again just once.

I only grow in two sizes of containers. I grow in trade gallons and 1/2 bushel copper treated “Apple Baskets.” Your market might call for several different sizes than mine. These larger-sized garden mums are visually very competitive and sell very quickly. I plant one cutting to the pot and four cuttings to the basket. I place containers outside on ground cover, the pot on 15-inch centers, and the baskets on 30-inch centers.

In 10 to 14 days, I am ready for an application of Florel, this being on or around June 25. The plants stay in the greenhouse until the day after I Florel. If certain cultivars don't have the number of breaks I desire, I might use Florel again before July 15. If I use a second application of Florel, I usually see a 10-day delay in flowering. I use a rate of 500 ppm Florel for the first application and 300 ppm Florel for the second application. Most of the time, I don't need to apply the second application. The one thing to remember is to never apply Florel on a hot

day to stressed plants. Once the Florel is applied and a day has passed, plants are brought to the outdoor, cloth-covered mum area. Again, they are watered very, very thoroughly.

Fertilization is very important. I use a constant feed program applying 20-10-20 peat-lite special at 290 ppm. The feed program begins about the fourth day when the cutting is out of the wilt and the new roots take hold. By constant feed, I mean we fertilize when the plants need water at that rate. The constant feed program allows the growth to be uniform. In the South, slow release fertilizers can release too soon if weather is hot and wet. If it's hot and very dry, we can wind up washing out the fertility in the perls within a few weeks of fertigation. A liquid feed program puts you in charge of the growth and keeps your crop growth uniform. I rarely see those early, rapid

bursts of very soft growth that later lead to floppy stems. To avoid salt build-up, I leach the pots with clear water once a week or as needed.

Watering is a very important issue. I use a tube irrigation system, but I turn on the irrigation system manually so I control when things get watered. I scout the containers every day – sometimes twice a day. Over-watering can do as much damage as underwatering. I do not use a timer, as it would be very easy during the poinsettia transplant and pansy transplant seasons to just let the crop grow on a few days knowing the timer is handling watering. Garden mums don't make a huge margin, and losing a few percent of the crop can be the difference between having money in October and not. If you have ever had a mum crop dry out during the first half of production, you know it



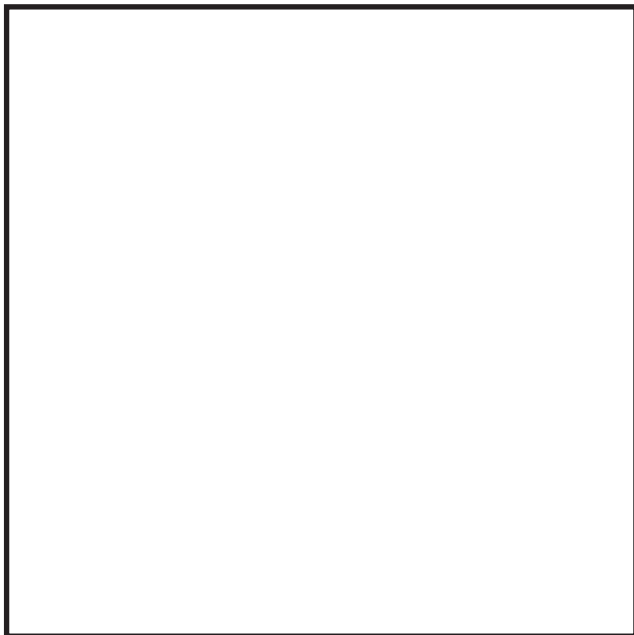
can cause a week or more delay in growth and flowering. Mums are a crop you have to be on top of all the time. Drying the plants out a bit in the later stages is actually a good thing, as it hardens them off and they do better in the garden center. However, be careful! Bud death, curled leaves, and even leaf drop can happen if you go too far with your "hardening off" treatment.

Wind, storms, and a careless scout can knock over mum pots and cause much damage to the new stems. Labor spent up-righting pots can be significant, and even though there is labor time spent setting the system up initially, preventing pots falling over is worth the effort in quality later on.

I devised a system using modified wire tomato stakes, whereby each pot is locked down and can't tip over. Since I grow in trade gallons, this is essential. The fixed pots also keep the mums properly spaced. I can then spray and walk through the crop without tipping over pots. Very few storms are strong enough to push over the pot.

When the garden mums reach 70 percent to 80 percent of the desired height I want (about three inches from finished product), I apply Bonzi at the rate of 15 ppm as a drench through the injection system. This regime works very well in hot dry summers, but may be overkill for northern growers. Our mid-day

*Continued on page 6*



*photos taken by James Stawser, Athens, Georgia*

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## FALL GARDEN MUM PRODUCTION – MY WAY

*Continued from page 5*

temperatures in July can average near 100°F for weeks. In the south a good PGR is essential to keep the plant growth under control.

Insects? Yes! For whitefly and a few other insects I have found that Marathon works well. I apply according to the label recommendations as soon as a good root system develops, usually about 14 days after planting. Be sure to water in the Marathon completely. Thrips are the worst insects to control. I use Mavrik, Conserve, or Avid on a rotation spray program. My biggest challenge is making time to scout the crop on a daily basis. The only way to control some of these problem pests is to catch the infestation early. The conditions in Georgia are perfect for insect populations to explode seemingly overnight. Diseases can

happen, too, especially if we get a rainy period. To minimize the possibility of disease, I try to have all watering completed during the mid-day between 11 a.m. and 1 p.m. I keep water off the leaves and only water when the plants need it. This means watering every couple of days early in the crop, and daily near the end of the crop. I may also have to water more often than other growers because I use a high porosity mix, but that extra work is worth it. Mums that drain well in trade gallon containers and big baskets rarely have root problems.

I have also found that Root Shield incorporated in the soil takes care of most of the root disease problems. Fafard is willing to custom blend this product into my soil mix, although I do sign a waiver to get this service.



This approach works very well, and I generally do not have to spray any fungicides on this crop. Barring a lot of rain, which is rare in the summer in Georgia, my leaves stay dry and rarely have any problems.

I don't sell until the mums show good color. I do sleeve them before shipping to avoid any stem breakage, and I fertilize right up to the ship date so the mums hold well in the garden center. I deliver my own crop and am very careful how I unload them. By delivering a near perfect mum, the product sells very quickly and I can actually command enough of a price to make a decent profit.

By using this culture program described above, I have had a successful crop

year after year. The only unusual problem I have had is that one strange year it rained for five days and nights. I had a major bacterial leaf spot problem, which I could do nothing about. Some years, you just don't win.

Remember, my success might be your downfall if you follow my course of action too closely. So proceed with caution! Check your program plan with one of your mum supplier representatives before you begin. Or better yet, let's go build a creek dam and cool off!

**Author's note:** Thanks to Dr. Paul Thomas, Floriculture Extension Specialist at the University of Georgia for reviewing this article, and providing a few needed suggestions. **OFA**

## PEST CONTROL: MEALYBUGS AND SCALE

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plants are of tropical origin, where mealybugs and scale are serious pests. It is important to manage both pests because large populations can build in a relatively short period of time. Mealybugs and scale can get into interiorscapes or conservatories from holiday or specialty crops – especially orchids – or they may be present on plants when they are shipped to the end user. In addition, technicians may inadvertently move around the crawler stage of both mealybugs and scale when performing plant maintenance.

### MEALYBUGS

The common mealybug species that can be problem in interiorscapes or conservatories are the citrus mealybug, *Planococcus citri*; long-tailed mealybug, *Pseudococcus longispinus*; and root mealybugs. Mealybugs can be very persistent and difficult to eradicate because the crawlers, which are the most susceptible life stage to many pest control materials, are very small and go unnoticed until too late. When the crawlers reach adulthood they are very difficult to manage

Mealybugs and scale are major insect pests of interiorscapes and conservatories. They are a problem in interior plantscape environments because the plants are generally present for a long period of time. In addition, many of these

because most materials do not penetrate the waxy coating. In addition, mealybugs are generally located in areas such as underneath leaves, in leaf junctures, underneath leaf sheaths, roots, and the base of plants that are hard to reach with sprays. Mealybugs feed on a wide variety of plants (Table 1). However, certain interiorscape and conservatory plants are preferred by mealybugs, including cactus, *Cissus*, *Codiaeum*, *Coleus (Solenostemon)*, *Dizygotheca*, *Leea*, *Maranta*, and *Radermachera*.

### SCALE

There are two types of scale that feed on plants in interior plantscapes: soft and hard scale. Soft scale produce honeydew, which is a clear, sticky liquid that serves as an excellent growing medium for black sooty mold fungi. The common soft scale encountered in interiorscapes and conservatories are the brown soft scale, *Coccus hesperidum*; hemispherical scale, *Saissetia coffeae*; black scale, *Saissetia oleae*; and nigra scale, *Parasaissetia nigra*.

Hard scale do not produce honeydew. They cover themselves with wax that hardens to form an impenetrable shell. Hard scale found in interiorscapes and conservatories include boisduval scale, *Diaspis boisduvalii*; Florida red scale, *Chrysomphalus aonidum*; California red scale, *Aonidiella aurantii*; and fern scale, *Pinnaspis aspidistrae*. Similar to mealybugs, the crawler stage in the most susceptible to many pest control materials. Scale may be located underneath leaves, in leaf junctures, underneath leaf sheaths, and along stems. Scale feed on a wide variety of plants (Table 2). Interiorscape and conservatory plants that are highly susceptible to scale are cactus, ferns, *Hedera*, *Maranta*, and *Schefflera*.

### MANAGEMENT

Prevention is the best way to avoid problems with mealybugs and scale. Check plants prior to introducing into new interior plantscape settings. If possible, wash plants with a "hard" stream of water. This will remove mealybug and scale crawlers from plants. Prune plants to allow light in, which will make it easier to notice mealybugs or scale. Prune out heavily infested branches. Grooming/cleaning plants (plant hygiene) by removing old leaf sheaths (especially on orchids), dead or dying twigs, old leaves, and spraying plants frequently with soapy water or insecticidal soap may prevent mealybug and scale populations from building.

Although pest control materials are available for managing mealybugs and scale in interiorscapes (Table 3), they should be used with caution and only when absolutely necessary. The crawler stage of both mealybugs and scale are most susceptible to these pest control materials. Thorough coverage of all plant parts is essential. Be sure to follow label recommendations.

**Table 1.** Interiorscape and conservatory plants susceptible to mealybugs.

Anthurium	Aphelandra
Araucaria	Ardisia
Asparagus	Brassaia
Cactus	Cissus
Codiaeum	Coleus (Solenostemon)
Crassula	Dieffenbachia
Dizygotheca	Dracaena
Ferns	Ficus
Leea	Maranta
Pothos	Radermachera

# OFA Interiorscape

Biological control is another pest management strategy to deal with mealybugs and scale. Biological control agents or natural enemies are best used in large planting areas. Biological control agents are commercially available for mealybugs and scale (Table 4). Consult biological control suppliers or Extension agents on how to implement a biological control program in interiorscapes or conservatories.

**Table 2.** Interiorscape and conservatory plants susceptible to scales.

Anthurium	Araucaria
Asparagus	Aspidistra
Brassaia	Cactus
Chlorophytum	Codiaeum
Ferns	Ficus
Hedera	Maranta
Palms	Polyscias
Radermachera	Schefflera
Syngonium	Yucca

**Table 3.** Pest control materials for use against mealybugs and scales in interiorscapes.

Azadirachtin (Azatin/Ornazin)  
*Beauveria bassiana* (Botanigard/Naturalis)  
 Bendiocarb (Turcam)  
 Bifenthrin (Talstar)  
 Cyfluthrin (Decathlon)  
 Fenoxycarb (Precision)  
 Fluvalinate (Mavrik)  
 Imidacloprid (Merit)  
 Kinoprene (Enstar II)  
 Paraffinic oil (Ultra-Fine Oil)  
 Potassium salts of fatty acids (Insecticidal Soap/M-Pede)  
 Pyriproxyfen (Distance)

**Table 4.** Commercially available biological control agents for mealybugs and scales in interior plantscapes.

#### Mealybugs

##### Predators:

*Cryptolaemus montrouzieri* (Mealybug Destroyer)  
*Chrysoperla spp.* (Green Lacewing)

##### Parasitoids:

*Leptomastix dactylopii*

#### Scales

##### Parasitoids:

*Metaphycus helvolus* (certain soft scale only)  
*Aphytis melinus* (certain hard scale only)

##### Predators:

*Lindorus (Rhyzobius) lophanthae*  
*Chrysoperla spp.* (Green Lacewing)

## GARDEN MUM PRODUCTION

*Continued from page 1*

• Plant rooted cuttings or liners approximately June 25 to July 10. Do not pinch.

### CULTURAL PRACTICES

#### PLANTING

Plant rooted cuttings or stick unrooted cuttings upon arrival. If the cuttings cannot be planted immediately, they may be stored for several days in a 35° to 40°F.

Always plant or stick the cuttings into moist media, never into dry media. Plant rooted cuttings to a depth slightly deeper than needed to completely cover the roots. Stick unrooted cuttings so that approximately 3/4 to 1 inch of the stem is exposed above the media. Do not stick shallow.

Thoroughly water the cuttings immediately after planting/sticking. Never let a garden mum cutting wilt in the first few weeks of its growth. Mist or syringe the plants as needed to prevent wilting in the early days of the crop. Liquid fertilization at planting/sticking will help to get the plants off to a faster start. Always water-in freshly planted/stuck cuttings with a complete N-P-K fertilizer containing 250 to 300 ppm of nitrogen immediately after planting. Unrooted cuttings should be fertilized two to three times during propagation.

#### MEDIA

Many media are available today and most are fine for garden mum growing. Garden mum media should be loose, well-drained, and provide a solid anchor for the root systems. The media must be able to retain sufficient moisture and nutrients to sustain the plants between irrigations. The pH for a soil-based media

should be 6.0 to 6.5. The pH for a soilless media should be 5.5 to 6.0.

#### CONTAINERS

A plethora of container sizes and shapes are used for fall garden mum production. Six- to 10-inch pots, both plastic and fiber, are used, along with 1-, 1-1/2-, and 2-gallon nursery containers are widely used. The 8- by 5-inch mum pan, the 1-gallon and 1-1/2-gallon nursery containers are the most popular. Also rapidly gaining acceptance for upscale sales are 12- to 14-inch color bowls, 1/2 bushel baskets, and hanging baskets. As a general rule, the larger the container, the larger will be the finished plant.

#### SPACING

The desired finished quality and the selling price play important roles in determining spacing. Six-inch pots are usually spaced on 12- to 15-inch centers. Eight-inch pots to 2-gallon containers are usually spaced on 18- to 24-foot centers. Inadequate spacing can cause tall, leggy plants, as well as contribute to foliar disease problems. Beautiful, rounded garden mums develop with adequate spacing.

#### FERTILIZATION

A fertigation program (fertilization with each watering) using 250 to 300 ppm nitrogen from a complete N-P-K fertilizer is an ideal method for producing high quality garden mums. This rate can be adjusted up or down depending upon the root media and weather conditions. For example, bark mixes may need 300 to 350 ppm rates. Balanced fertilizers, such

as 20-10-20, 20-5-19, 21-5-20, are suitable. Use "peat-lite special" type fertilizers that contain extra micronutrients, if growing in soilless root media. Feed until the buds are pea-sized to barely showing color. Apply the liquid fertilizer through spaghetti tubes or drip tape.

If liquid fertilization is not possible, slow-release fertilizers may be used. A top dressing of Osmocote 14-14-14 (3 to 4 months release) or similar types at the rate of 1-1/2 teaspoons per 8- by 5-inch mum pan is often applied at planting or shortly thereafter. For soilless root media, choose a formulation with micronutrients. Be careful to distribute the fertilizer evenly over the soil surface. Applying this fertilizer in a single pile may cause burning of the plants. The fertilizer must be placed so it is moistened at each watering to be effective.

Many growers use a combination of slow-release and liquid fertilization with outstanding results. Example: Use Osmocote as a top dressing and then use liquid fertilization once a week at approximately 500 ppm.

#### WATERING

Proper watering is critical to successfully produce a high quality garden mum. When irrigating, apply enough water so that it soaks thoroughly down through the pot. About 10 percent of the water applied should run out the drainage holes in the bottom of the pot. Garden mums should never be allowed to wilt during the early stages of growth. Wilting during the first few weeks of growth can restrict branching action and overall growth. In the later stages of growth, slight wilting can be beneficial. It can harden the plant off, control height,

and promote more uniform flowering.

Whenever possible, drip or tube irrigation systems should be used in place of overhead watering. Watering the plants overhead, especially in mid- to late-summer periods, can promote the development of leaf-spotting foliar diseases such as bacterial leaf spot, *Botrytis*, *Septoria*, and *Alternaria*. Garden mum foliage should always be dry before evening hours.

#### PINCHING

Years ago, it was common to pinch a garden mum crop two or three times and to plant in early to mid-May. With today's improved genetics, it is easy to produce a magnificent crop with an early- to mid-June planting and one pinch. Recent trials by commercial garden mum growers have demonstrated that garden mums planted into 8- by 5-inch mum pans in mid-June and not pinched at all will develop into plants that look just like their one-pinch counterparts. So it appears that with today's modern varieties and attention to cultural details, garden mums for fall flowerings do not need to be pinched at all.

If you want to pinch, allow the cuttings to achieve approximately an inch of new growth (about 10 to 14 days after planting) and then remove 1/2- to 3/4-inch of the new growth.

#### PRE-MATURE BUDS

Garden mums have a strong tendency to be reproductive. In propagation areas, they should receive "mum lighting." That is, four hours of 10 footcandles of light from 10 p.m. to 2 a.m. to help minimize reproductivity.

In the growing area, it is not uncommon to see buds. With good watering and fertility programs, these buds will be bypassed and simply serve to be a "self-pinching" activity of the plant. This "self-pinching" is actually the basis that allows the no-pinch programs to be effective.

**GROWTH REGULATORS**

B-Nine has been the growth regulator of choice with chrysanthemums for decades. It is not normally needed for fall garden mum crops. If you want or believe that you need to use B-Nine, a starting point would be to spray with 2,500 ppm (0.25 percent) B-Nine solution two weeks after the last pinch. For no-pinch crops, this would be approximately four weeks after planting.

Bonzi is a very effective growth regulator and should be used carefully to avoid stunting the plants. Try a 2 ppm drench when the plants are at the desired finish height. Spray applications must reach all stem tissue uniformly. This is difficult and not suggested.

Florel can be used to 1) delay the response of a variety, 2) eliminate or reduce pinching, or 3) reduce premature budding. Precise scheduling with Florel to delay a variety is not an exact science. A grower has a wide range of season-extending varieties available today to accomplish this goal with no extra work. Today's varieties branch freely given proper moisture, fertility, and spacing. And with no-pinch crops, it is possible to have every leaf node produce a strong flowering stem, so additional branching is not possible in that scenario. Premature budding is not typically a problem with today's free-branching varieties. In fact, with proper water and fertility practices, a premature bud actually serves to act as a "pinch." So, Florel is a potential tool in garden mum production, but does not provide the dramatic benefits in garden mums as it does in geraniums, New Guinea impatiens, and vinca vine.

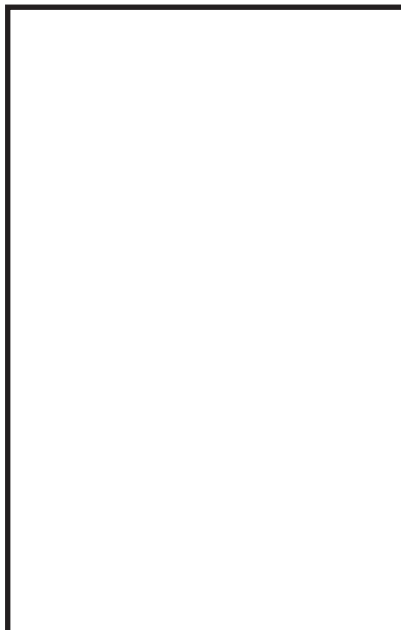
**INSECTS**

Aphids, mites, various



caterpillars, leafminers, and thrips may infest a garden mum crop. Fortunately, insects are not usually a significant problem. A preventative spray program may be employed to guard against outbreaks of insects. Some general-purpose insecticides that are typically safe to use

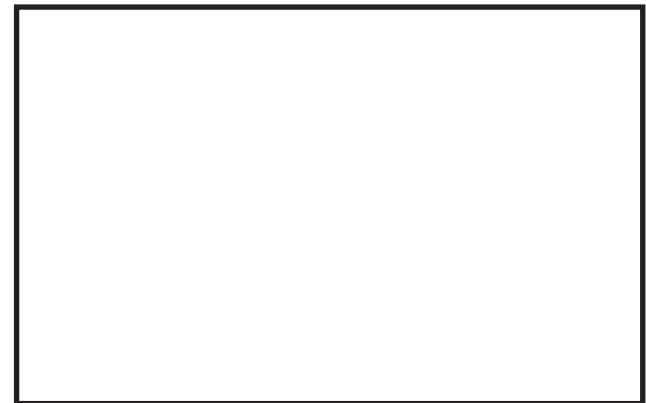
on garden mums are Avid (mites), Conserve (thrips), Diazinon (aphids, whitefly), Dipel (caterpillars), and Marathon (aphids, whitefly). Before using any of these pesticides, be sure that they are registered for use in your state. Check with your *Continued on page 10*



**Figure 1.** A modern garden mum production field of 8-inch by 5-inch pans at Holland Greenhouses Inc., Hightstown, New Jersey. Note the concrete walks, the weed barrier, and the excellence in plant quality. Watering and fertilization is done by drip tape.



**Figure 2.** A typical field of garden mums in August at Henning's Farm & Greenhouses in DeMotte, Indiana. Note the weed barrier fabric and the wide aisles for easy tractor and vehicle access. The quality growth habit of the crop in progress is a reflection of the proper spacing, variety selection, irrigation, and fertility management.



**Figure 3.** North America's most popular fall flower comes in an exciting array of colors. This Yoder garden mum trial field in New Jersey shows part of the scope of the efforts of breeders to bring growers, retailers, and consumers the best genetics in garden mums.

## GARDEN MUM PRODUCTION

*Continued from page 9*

local county Extension agent or state university Extension service. Always follow label directions.

### DISEASES

The most common disease problems found on garden mums are the root rots caused by *Pythium* and *Rhizoctonia*, bacterial leaf spot, and the leaf spots caused by *Alternaria*, *Botrytis*, and *Septoria*. In contaminated root media or field soil, *Fusarium* wilt may also develop.

Root rots are best prevented with the use of well-drained root media. Chemical controls typically involve the use of Banrot, Subdue MAXX, or Subdue MAXX/Medallion drenches. The best control for *Fusarium* wilt centers on disease-free cuttings and pathogen-free root media.

Cleary's 3336 and Medallion have been reported to provide good *Fusarium* suppression.

*Alternaria*, *Botrytis*, and *Septoria* can normally be controlled with chemicals such as Cleary's 3336, Chipco 26019, Daconil 2787, or Medallion used as preventative sprays. As the garden mum grows rapidly in August and develops a dense canopy of leaves, these sprays may be beneficial. Before using any pesticides, be sure that they are registered for use in your state. Check with your local county Extension agent or state university Extension service. Always follow label directions.

Bacterial leaf spot is characterized by black lesions on the foliage. The entire leaf may seem healthy

except for the black lesion. This bacterial disease must have free moisture on the leaf surface for an extended time period in order to develop. Overhead irrigation late in the day and/or daily rains during warm weather can lead to its development and rapid spread. There is no chemical control for bacterial leaf spot. Cultural practices such as good air circulation, proper spacing, and minimal overhead watering are the controls.

### VARIETIES

Variety selection is a key factor in a garden mum crop. Variety selection will determine response time, color percentage, flower form percentage, and growth habit. Your selection of varieties may impact keeping quality, disease resistance, and durability. Most garden mum varieties today are easy to grow, flexible, and display a wide variety of

colors and forms to fill the needs of the retail marketplace. As regions of the country vary in their climates and preferences, it is always wise to consult with knowledgeable sales reps or specialized garden mum breeders and propagators if you have any variety questions.

### KEYS TO SUCCESS WITH GARDEN MUMS

If you remember these keys, you should have outstanding success growing North America's favorite fall flowers:

1. Plant promptly,
2. Use well-drained media,
3. Keep media moist,
4. Keep the plants well-fertilized,
5. Provide adequate spacing,
6. Use the best cultivars possible.

OFA

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## DRIVING FALL RETAIL TRAFFIC

*Continued from page 1*

garden center's marketing manager. "We bring in community groups to sell food and do face painting, pumpkin painting, and scarecrow-making. It's a nice fundraiser for the groups and a way for us to give back to the community."

The festival also is a good traffic-builder for the store. "People come mainly to enjoy the food and music and the fun, family atmosphere," says Kyle. "But while they're here, most people do buy something – at least a mum or a pumpkin if not Halloween items, other plants, or nursery stock."

The family activities include a petting zoo with miniature horses, goats, and other animals; a pumpkin carry; a straw maze with scenes from a popular children's story throughout; a kids' Halloween parade; and a "Land of Scarecrows." The scarecrows are made by staffers, who compete for in-house prizes.

In recent years, Country Market – one of the biggest 100 independent garden centers in the nation – has been attempting to expand customers' fall plant palettes beyond mums.

"We're not taking away from mums, but we've been trying to show other plants that go with them," says Kathy Quarles, the store and greenhouse manager. "Probably the biggest change we've seen is new interest in fall pots."

Quarles says the Fall Magic line of Proven Winners plants has been instrumental in introducing cold-hardy plants that not only pair well with mums but look great themselves through Thanksgiving.

Some of the most popular entries in that line have been the 'Burgundy Glow' and 'Mahogany' ajugas, the golden-green 'Ogon' acorus, silver leaf lavender, 'Purpurea' euphorbia, 'Icicles' helichrysum, and the golden, purple, and tricolor sages.

With ready-to-go potted combinations of those, customers have been willing to pay \$35 to \$50 for a living display that lasts long after the annuals have faded.

"People have been willing to pay \$35 for floral arrangements that last about a month," says Quarles. "This follows a similar principle, only fall pots look good for 8 to 10 weeks. And many of these plants will survive winter. That means people can build new displays around them in the spring using bulbs and cold-hardy annuals."

Country Market also has been making headway with fall-planted pansies. "Pansies have finally taken off," says Quarles. "Growers have been trying for years to get people to buy them in the fall. The difference now is that there are varieties hardy enough that can be planted in fall that reliably bloom into December and come back to bloom again the next spring."

The key for Country Market has been letting customers know that through signage, seminars, "Garden Guru" segments on local television, and its own display gardens that feature mass pansy plantings as well as bulb and pansy combinations.

The same strategies also have been used to introduce customers to other plants that peak in the fall besides the traditional mums and asters.

In the perennials department, species such as sedum, goldenrod, and leadwort are grouped together in a fall color display at the entrance to the department.

In the nursery, some of the most brilliantly colored trees and shrubs also are brought front and center and paired with berried plants such as winterberry holly, beautyberry, pyracantha, and a variety of viburnums.

Breaking down the barriers between greenhouse plants and nursery stock and opening the door to cross-merchandising the fall plant displays has also been successful.

Mums, pansies, leadwort, grasses, and other fall-interest herbaceous plants are taken into the nursery and displayed around trees and shrubs that make ideal fall partners. Similar displays are done at the front entrance to the store.

"The idea is to show people how they can use all of these plants in their own gardens," says Quarles.

This year, Country Market is adding a second festival that will herald prime harvest time in late summer. Called the "Harvest for the Hungry Festival," this family and charitable event ties into the national "Plant a Row for the Hungry" program run by the Garden Writers Association of America and HGTV.

Plant a Row for the Hungry encourages home gardeners to plant extra crops in the spring and then to donate their surplus at one of a network of dropoff points throughout communities that participate. Agencies that feed the hungry pick up the fresh produce and distribute it, usually the same day.

Country Market is serving as a dropoff site this year and is sponsoring a festival in late August that will benefit Channels Food Rescue, the local agency that distributes the food.

Events will include a "Family Food" game show, a barbecue, music, vegetable-gardening seminars, cooking demonstrations, homemade ice cream, educational exhibits, and a host

# OFA Garden Center

of contests, such as Best Harvest Basket, Best-Tasting Tomato, Best Homemade Salsa, and a Watermelon Seed-Spitting Contest.

Customers are being asked to bring a donation of fresh produce as their "entry fee." The produce and food-contest items all will be donated to the hungry.

"Harvest for the Hungry is a perfect way for Country Market to give back to the community," says Kyle. "It involves what we love most, which is plants."

Kyle says it's important for local retailers to get to know their customers' demographics and then to gear events to those interests. "An event that works in one part of the country won't necessarily work everywhere," she says.

What does work everywhere is a great fall display around the exterior of the store.

"You've got to make the store beautiful on the outside," says Kyle. "A store can be its own best advertisement. It has to be exciting to draw people in."

One last trend that has worked for Country Market has been moving up Christmas. Converting the store's Patio Shop into the Christmas Shop now begins in late August.

"By the second or third week of October, we have a Christmas preview in place to whet people's appetite for what we'll be carrying for Christmas," says Kyle. "There are people who are always looking for new items to add to their ornament collection or décor, so it's never too early to set up. On the other hand, people here enjoy fall. So we try to balance both and flow right from fall into Christmas."

Kyle says it takes a team effort and the entire staff to pull off so many different events and changes all within three months or less.

"It's always great to dream big but you also have to be realistic in what you can do," she says. "It's best to pick a few things you can do really well than to try to do too much."

More information on the Plant a Row for the Hungry program is available by calling the Garden Writers Association of America at 877-492-2727.

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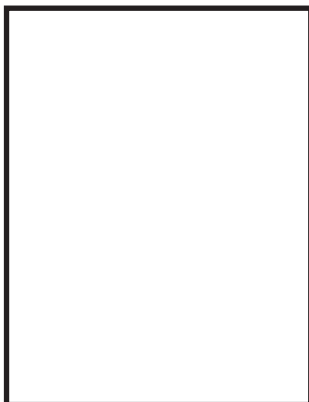
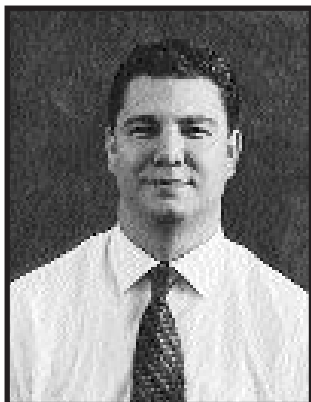
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# Producing Top-Quality Ornamental Vegetables



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Vegetables are plants cultivated for edible purposes, but can be classified as ornamentals when produced for landscape use.

Ornamental vegetables are excellent items for growers to produce during the late summer and fall for sales that can extend into early winter. Several studies and cultivar trials on ornamental vegetables have been conducted at North Carolina State University, and below is a summary of the findings.

### MUSTARDS AND KALES

Several mustard (greens) cultivars, which have been traditionally used

in oriental stir-fry dishes, and kales, which have been used as food for cattle, have outstanding foliar and cold hardiness traits that make them ideal “winter annuals.” One major advantage in the production of ornamental vegetables is the ability to generate several turns from the outdoor pad. These plants have rapid growth rates, and marketable plants can be produced in six to eight weeks from sowing to sales. In general, mustard cultivars should be produced early in the season (late June sowings for the North and mid-July for the South), while kale cultivars should be sown in mid-July for the North and early August for the South. Other leafy vegetables, such as Swiss chard – which performs well in both warm and cool seasons – and lettuce, can be used as bedding or container plants. Listed in Table 1 (page 14)

are 12 ornamental vegetables trialed at the North Carolina State University Horticultural Science Field Lab in Raleigh, NC. (For a detailed description of ornamental vegetable cultivars with color images, visit [www.ces.ncsu.edu/depts/hort/floriculture/crop/crop\\_veggies.htm](http://www.ces.ncsu.edu/depts/hort/floriculture/crop/crop_veggies.htm)).

### MUSTARDS

Mustard greens have become one of the most popular ornamental vegetables used by landscapers in the Southeast. Uses of these large fleshy plants include backdrop plants for entrance gardens, centerpieces for arboreta winter gardens, and mass plantings in shopping center median strips. The plants perform well in protected areas away from winter winds. As temperatures increase in the spring, the fleshy leaves expand rapidly, making the plants attractive with spring



**Figure 1** (above). ‘Joi Choi’, a Pac-Choi, has bright white petioles with large fan-like leaves. **Figure 2** (right). ‘Red Bor’ kale has extremely purplish-red leaves with an outstanding ability to proliferate in the cold.





**Figure 3.** 'Red Russian' kale has a silvery blue-green colored foliage with wavy leaf margins.



**Figure 4.** Ornamental kale serves as a backdrop plant for pansies in this winter garden.

pansies and bulbs. Two disadvantages of the plant are its susceptibility to dieback from freezing temperatures and the potential for early bolting in the growing season. Success with the public's opinion of these plants can be achieved by early production and marketing before the first hard frost. This strategy allows for mustards to be marketed the same time that garden mums are displayed. While the mum provides color to the fall garden, the mustard provides body and texture, along with brilliant color.

#### PRODUCTION

Mustards can be produced quickly with a constant liquid fertility program of 200 ppm N. The substrate should be moist at all times because mustards can quickly dry out due to fibrous root systems. The heights of mustard cultivars were effectively controlled with Sumagic rates between 6 and 15 ppm, or B-Nine at 2,500 ppm sprayed twice or a single application at 5,000 ppm. The lower rates of these two chemicals should be used for more northern climates.

#### IMPORTANT NOTICE

Sometimes pesticides (insecticides, fungicides, or plant growth regulators [PGRs]) are applied to prevent blemishes and establish proportionality with the pot. If growers apply pesticides, then consumers need to be advised not to eat the treated plants. This requires that the plant be clearly marked "for use only as an ornamental." Also, wholesale growers need to provide retailers with a history of pesticides applied to the crop.

#### PAC-CHOI PRODUCTION

Specific ornamental vegetables like the flat Pac-Choi or "Tatsoi" make an excellent border plant in winter gardens because of its low growth habit. If growers desire to have more pronounced white petioles with 'Tatsoi', lower nitrogen rates of 125 to 150 ppm are recommended. The larger Pac-Choi type plant, 'Joi Choi' has a rapid growth rate allowing growers to market plants two to three weeks after transplanting, thus avoiding the use of plant growth regulators (Figure 1).

#### KALE

For the most part, kales have tall growth habits and



**Figure 5.** The number one rated ornamental kale in the 1998 Cultivar Trial was the notched red cultivar 'Flamingo Plumes'.

an outstanding ability to proliferate in the cold. Certain kale cultivars like 'Red Bor' (Figure 2) and 'Red Russian' (Figure 3) "color up" two to four weeks earlier than any of the curly ornamental kale cultivars. Planted in a mass or used just as a specimen in the garden, kales provide any dormant shrub or perennial garden with vibrant color. Unlike mustards, kales have a later bolting response, which still makes them attractive in early spring when accompanied by flowering bulbs and pansies (Figure 4). Kales are very

attractive in the early winter, but as temperatures drop below 20°F, the outer foliage may develop necrosis due to cold damage, especially in more northern climates.

#### PRODUCTION

The production of these kale cultivars is relatively simple. Because coloration occurs much earlier than ornamental kale, plants can be marketed six to eight weeks after sowing. Ornamental cabbage and kale usually begin to color 10 to 12 weeks after sowing and exposure to temperatures 55°F or lower. Fertilize

## PRODUCING TOP-QUALITY ORNAMENTAL VEGETABLES

*Continued from page 13*



**Table 1.** Suggested ornamental vegetable cultivars and seed sources.

Crop	Cultivar	Common Name	Botanical Name	Seed Source*
Kale	Red Bor	Red Bor Kale	<i>Brassica oleracea</i>	CG, J, P, S
	Red Russian	Ragged Jack	<i>Brassica napus var. pabularia</i>	J, S
	Winterbor	Green Kale	<i>Brassica oleracea</i>	CG, J, P, S
	Lacinato/ Toscano	Italian Kale	<i>Brassica oleracea</i>	CG, J, S
Mustard	Red Giant	Red Mustard	<i>Brassica juncea var. rugosa</i>	AT, CG, J, P, S
	Mizuna/ Kyona	Potherb Mustard	<i>Brassica rapa var. nipposinica</i>	AT, CG, J, P, S
	Tatsoi	Flat Pac-Choi	<i>Brassica rapa var. rosularis</i>	AT, CG, J, S
	Southern Giant	Mustard Greens	<i>Brassica juncea</i>	CG, J, P
	Osaka Purple	Red Mustard	<i>Brassica juncea</i>	CG, J
Pac-Choi	Joi Choi	Pac-Choi	<i>Brassica rapa</i>	J
Swiss chard	Bright Lights	Swiss Chard	<i>Beta vulgaris</i>	B, CG, J, N, P, S
	Ruby Red	Rhubarb Chard	<i>Beta vulgaris</i>	J

\* Seed Sources:

AT = American Takii, 301 Natividad Rd., Salinas, CA 93906; Ph: (831) 443-4901; Fax: (831) 443-3976

B = Ball Seed, 622 Town Road, West Chicago, IL 60185; Ph: (800) 879-2255; Fax: (800) 234-0370

CG = The Cook's Garden, PO Box 535, Londonderry, VT 05148; Ph: (800) 457-9703; Fax: (800) 457-9705

J = Johnny' Seeds, 1 Foss Hill Rd. RR 1 Box 2580, Albion, ME 04910; Ph: (207) 437-4301; Fax: (800) 437-4290

N = Syngenta, 5300 S. Katrine Avenue, Downers Grove, IL 60515; Ph: (800) 323-7253; Fax: (800) 327-9736

P = Park Seed, 1 Parkton Avenue, Greenwood, SC 29647; Ph: (800) 845-3369; Fax: (800) 275-9941

S = Shepherd's Garden Seeds, 30 Irene St., Torrington, CT, 06790; Ph: (860) 482-3638; Fax: (860) 482-0532

the kale on a continual basis until sales with a soluble fertilizer (150 to 200 ppm N) that has a high percentage (>70 percent) of nitrate-nitrogen. Two foliar sprays of B-Nine at 2,500 ppm two weeks apart are recommended for height control. Wholesale growers should apply Sumagic at 6 to 15 ppm to control both height and diameter. Northern growers should apply the lower rate of the above mentioned chemicals as a foliar spray.

### OTHER VEGETABLES

The All America Selections winner 'Bright Lights' Swiss chard is not

only a plant ideal for the cool season garden, but it also performs well during the heat of the summer. This widely used cultivar has red, purplish-red, yellow, or white petioles and stems and robust foliage with crumpled leaves. 'Ruby Red' or Rhubarb chard is very similar to 'Bright Lights' in terms of growth habit, but only expresses red or purplish-red stems. Both cultivars do well in containers and can survive low temperatures.

Growers should plant two to three plugs per gallon pot or mum pan to achieve multiple colored clumps of Swiss chard. Seeds

can be direct sown in cell packs and fertility levels should remain at 200 ppm N until sales. The application of B-Nine to 'Bright Lights' Swiss chard resulted in only minimal height control. Research this past fall, using high concentrations of Sumagic at 30 and 60 ppm on Swiss chard, resulted in little control of plant height, therefore it is not economically feasible to apply plant growth retardants to chard-type plants.

### ORNAMENTAL CABBAGE AND KALE

Don't forget to include ornamental cabbage and kale into your fall produc-

tion program. In 1998, 26 cultivars of ornamental cabbage and kale were trialed in 8-inch mum pans at the Horticultural Science Field Lab in Raleigh, NC. You can find the results of the trial with linked images to cultivars at [www.ces.ncsu.edu/depts/hort/floriculture/crop/crop\\_kale.htm](http://www.ces.ncsu.edu/depts/hort/floriculture/crop/crop_kale.htm). Overall, the 'Osaka' ornamental cabbage series, the 'Peacock' ornamental notched kale series, the 'Kamone' and 'Chidori' curly kale series were rated the best in terms of growth habit, center color expansion and timing, and garden performance. The number one rated ornamental kale was the notched kale culti-

var, 'Flamingo Plumes' (Figure 5). Publications addressing chemical plant growth regulation, nutrition strategies, and pinching of ornamental cabbage and kale can also be found at [www.ces.ncsu.edu/depts/hort/floriculture/crop/crop\\_kale.htm](http://www.ces.ncsu.edu/depts/hort/floriculture/crop/crop_kale.htm). For additional information about ornamental cabbage and kale, see NCSU Horticulture Information Leaflet No. 507: Success with Ornamental Cabbage and Kale.

### PGRs

Substrate drenches of Bonzi at 2 to 4 mg active ingredient (a.i.) per pot (\$0.06 to \$0.12/ pot) and Sumagic at 0.5 to 1 mg a.i. per pot (\$0.12 to \$0.23/ pot) produced compact plants for the retail and wholesale grower. (Figure 6). Economically, these rates may not be cost-effective when compared to PGR foliar sprays. B-Nine sprayed at 2,500 ppm was effective in limiting stem elongation of ornamental kale cultivars, and costs \$0.004 per pot as a single application or \$0.01 when sprayed twice. Two applications of 2,500 ppm B-Nine may be applicable to wholesale growers who desire an economical (\$0.01) and effective measure for controlling height of ornamental cabbage and kale. Sumagic foliar sprays

between 8 and 16 ppm were effective in controlling plant growth, but cost the grower \$0.04 and \$0.07 per pot, respectively. Although more expensive, a Sumagic foliar spray of 16 ppm controls height and diameter, and does not cause a significant decrease in color diameter when compared to daminozide applied twice at 2,500 ppm. Lower rates of Sumagic are applicable to more northern climates and the lower growing curly kales.

### NUTRITION

Research on the effects of fertility and the effects of discontinued fertility at coloration on ornamental cabbage was conducted at NC State University. Earlier recommendations have suggested discontinuing fertility upon coloration of the upper-central leaves. Color diameter of the upper-central leaves was not affected by nitrogen concentrations as high as 250 ppm for the cultivar 'Osaka White'. Growers who reduce or discontinue fertilization may intensify the outer leaf color, especially in the red and pink cultivars. Unfortunately, this strategy leads to the increased incidence of mineral deficiencies which mainly occur in ornamental cabbage on the market date or in the retail location.



Normal fertilization practices for floricultural crops at visible flower bud suggest that fertilization be discontinued or reduced significantly because plants require less nutrients for growth during flowering. Flower bud development and visible pollen with ornamental cabbage does not occur until after a vernalization period, and during the time when coloration occurred, dry weight still increased and nutrient demands were still high. Therefore ornamental cabbage should be considered an exception and fertilization needs to be continued.

Plants which are lighter green or lose lower leaves may limit salability. Dramatic decreases in nutrient concentrations will occur at market stage if plants are subjected to clear water irrigations prior to sale. The incidence of nutrient deficiencies can be magnified if growers sell "border-line" nutrient deficient ornamental cabbage plants to retailers who do not fertilize at the point of purchase. Growers should fertilize

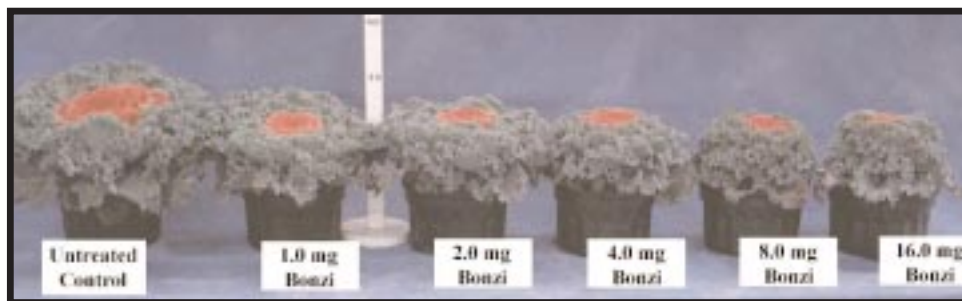
until sales and allow retailers to induce the coloration with clear water irrigations. In order for retail or wholesale growers to maximize sales, ornamental cabbage plants should be fertilized at 200 ppm N, so that if clear water irrigations are conducted, nutrient reserves may be greater in the substrate to provide proper fertility.

Please keep in mind that the research was conducted in a more southern climate and the effects of temperature may have had an effect on nutrient demand late in the season. Nevertheless northern growers should still maintain a fertility program on the crop until sales, and suggested concentrations of nitrogen at 75 to 100 ppm are recommended. Remember it is important to periodically monitor the growing media (Figure 7).

### PINCHING

Ornamental cabbage and kale are best viewed from above or on slopes; the attractive center colors are just more visible to people. How can one create a color display of ornamental cabbage for people who view the cabbage from afar? Answer: You manually pinch the plants or plant multiple plugs per pot (Figure 8). Research trials were conducted in both the fall of 1998 and 1999 at NC State in order to investigate pinching effects on ornamental cabbage and kale.

*Continued on page 16*



**Figure 6.** Substrate drenches of Bonzi at 1 to 8 mg a.i./pot produced compact plants for the retail and wholesale grower.

## PRODUCING TOP-QUALITY ORNAMENTAL VEGETABLES

*Continued from page 15*

Pinching low growing kales is not recommended because internodes are more compact and adventitious shoot formation readily occurs, but pinching the cabbage-type plants created

some attractive specimens. We recommend a hard pinch to the third node 10 days after planting. Three heads have a better proportion of foliage and color and are more aesthetically pleas-



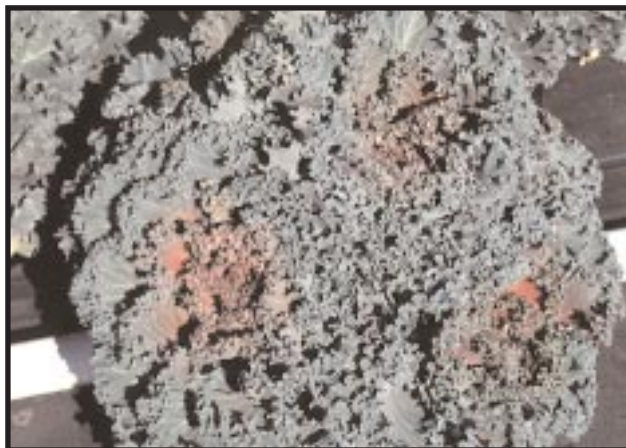
**Figure 7.** Monitoring the pH and electrical conductivity via the PourThru Technique every two weeks is recommended. Specific information is published at [www.pourthruinfo.com](http://www.pourthruinfo.com).



ing. Also, triple plugging is recommended, but PGRs must be applied regularly to maintain proportion with the pot.

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**Figure 8.** Three heads have a better proportion of foliage and color and are more aesthetically pleasing. **OFA**



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