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NORTH CAROLINA NURSERY AND GREENHOUSE GROWTH CONTINUES

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In 1992, nursery and floral crops became the sixth largest agricultural commodity group in the U.S., moving ahead of the broiler industry (Brooks, 1992). In 1991, greenhouse/nursery crops accounted for 10% of farm cash receipts -- ahead of many agronomic crops such as wheat and cotton. Cash receipts for greenhouse and nursery crops have the fastest annual growth rate of all major segments of U.S. agriculture, with no declines in value over the past 30 years (Johnson, 1992). This trend is true for North Carolina as well as the entire nation.

The value of the North Carolina nursery and floriculture industries continues to increase each year and has increased dramatically over the past ten years (Figure 1). In 1984, nursery/ greenhouse crops accounted for only 2.7% of N.C. agriculture value and ranked eleventh in N.C. commodity value (NCDA, 1986). Ten years later, in 1993, nursery/ greenhouse crops accounted for over 6.2% of N.C. agriculture value and was ranked fifth in N.C. commodity value, behind tobacco, broilers,

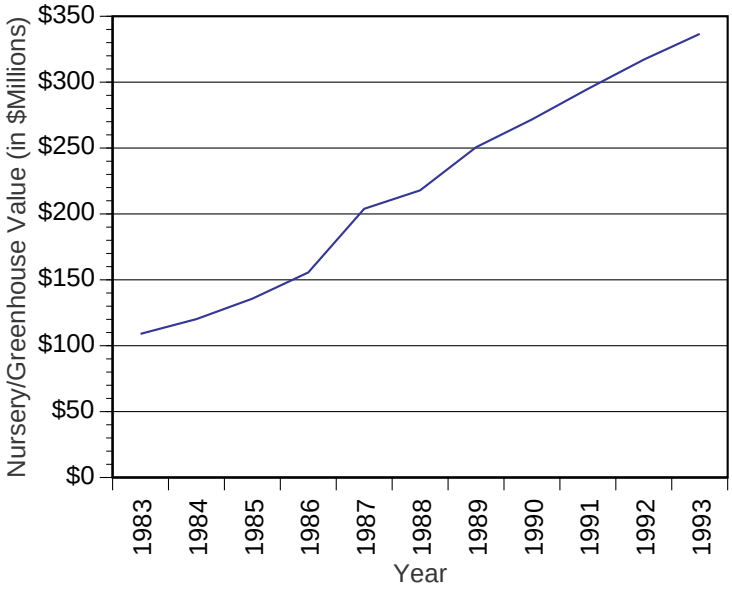

Figure 1. Annual wholesale value of N.C. nursery/greenhouse crops from 1983 to 1993.

hogs, and turkeys. The $337 million value of our industry ranked us second in N.C. crops, with only tobacco having a higher value (NCDA, 1995). In ten years, we more than doubled in importance to N.C. agriculture (from 2.7% to 6.2%) and almost tripled in wholesale value from $120 million to $337 million.

All indications, including production projections for 1995 suggest that North Carolina floriculture will continue to grow in importance both at the State and national level. As the state's population and consumer awareness towards flowering plants continue to increase, our national ranking of floriculture value should also increase.

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N.C.D.A. 1995. North Carolina farm income: 1992–1993. N.C. Agricultural Statistics Division, NCDA.

Your Association is doing its share to publicize this information. Through the efforts of our Executive Secretary, Betty Woodhouse and your Board of Directors, Governor Hunt has proclaimed April 1995 as floriculture month in North Carolina.

Calendar of Events

Event	Date	Time	Location and contacts
Turf and Ornamentals Field	Wednesday 17 May	9:00–5:00	Horticulture Field Laboratory, Raleigh, N.C. Contact Doug Bailey at 919-515-1195 for more information.
PGA Seminar on Advanced Blooming Poinsettia Production	Wednesday 14 June	8:00–12:00	Haywood Area Holiday Inn, Greenville, S.C. Contact the Poinsettia Growers' Association at 619-753-1743 for further information.
Southeast Greenhouse Conference and Trade Show	Thursday–Saturday 15–17 June		Haywood Area Holiday Inn and the Palmetto Exposition Center, Greenville, S.C. See the registration form in this issue of the Bulletin for details!!!
Ohio International Floral Short Course	Saturday–Wednesday 8–12 July		Cincinnati Convention Center, Cincinnati, Ohio. Contact OFA at 614-487-1117 for more details.
N.C. State Bedding Plant Field Day	Wednesday 26 July	8:30–4:30	Horticulture Field Laboratory and the McKimmon Center, Raleigh, N.C. Call Doug Bailey for further details.

GREENHOUSE SCREENING: COMPARISON OF MATERIALS FOR EXCLUDING THRIPS AND WHITEFLIES

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Although pesticides will remain important tools for pest management in the greenhouse, other suppression methods incorporated into a comprehensive integrated pest management approach must be used to reduce environmental risks and human exposure, slow the buildup of pest resistance and conserve the usefulness of the dwindling supply of registered pesticides. Such methodologies include the use of biological control organisms, insect-resistant plants, proper cultural practices, and physical controls such as insect screening. Of these strategies for control of insect pests and the diseases they may transmit, exclusion should be one of the first considered. Screening for pest exclusion is now more cost effective than in the past (Neal, 1992). Reductions in pest population (Baker & Jones, 1989; Berlinger et al., 1983, 1992, 1991; Robb & Parrella, 1988), incidence of disease (Baker & Jones, 1989, 1990; Berlinger et al., 1983, 1992, 1991), and pesticide applications (Berlinger et al., 1983; Hall, 1992; Robb & Parrella, 1988) have been documented when screening is used.

In selecting the proper screening material, one must first determine the most serious pest(s) of the crop and then choose a screen with the appropriate hole size to exclude that pest (Bethke & Paine, 1991). Though it may seem best to purchase and use screens with the smallest hole size available, there are trade-offs involved. As the screen hole size decreases, effort necessary to move air through the screen increases, and greater screening area is required to maintain adequate air flow. Inadequate air flow may result in high static pressure drop, inadequate air exchange, higher energy consumption by fans, excessive wear and tear on the fans, and high greenhouse temperatures.

With the increased popularity of screening as a control measure, a variety of screening materials are available on the market. The most practical materials for use in greenhouse production are woven polyethylene and polyester fiber screens. Polyester screens (polymeric spun resin fibers) break down more quickly in sunlight, due to effects of ultraviolet light, than do polyethylene screens (thermoplastic resin fibers). Both can be chemically treated to inhibit structural breakdown, but inhibitors benefit polyethylene more than polyester. In addition, the greater strand thickness typically used in the manufacture of polyethylene screens makes them stronger than polyester fabrics. Cost is another consideration when choosing a screen as some materials are less expensive than others.

Styles and types of screening material are constantly changing, and selection of the screen most beneficial to a particular grower requires that he or she be well-informed. Independent laboratory and field studies are needed to characterize a variety of screening products for their effects on airflow restriction and their ability to exclude pest insects. The objective of this study was to determine the relative ability of screens to exclude natural populations of thrips, whiteflies and aphids under conditions closely resembling those present in a greenhouse.

Materials and Methods

Four polyethylene plastic covered, wood framed cages (0.5×0.5×1.0 meter in dimension) were used to study the exclusion efficacy of several screening materials. Each cage was constructed with the front open to allow covering with test materials and was equipped with a 2085 cm^3/min (265 ft^3/min) squirrel cage blower on the other end to pull air through the cage. Using a small wind tunnel, Baker and Shearin (1994) generated resistance curves for each of 21 screening materials by plotting fabric pressure drops against a range of air velocities. Screens were categorized as having low, medium or high resistance. These curves were used to equalize the velocity of air entering the cages through the test material. This was done by measuring the difference in pressure inside an unscreened and screened cage using a Dwyer Mark II, Model 25 manometer (Dwyer Instruments, Inc., Michigan City, Ind.). Using a damper to restrict blower output, the pressure increase was adjusted to equal the pressure drop needed to achieve an approach velocity of 92 m/min (300 ft/min), a value within the recommended range of air flow for production greenhouses.

At each installation of the test materials, one 7.5×13 cm yellow sticky trap was placed in each cage to monitor insect pest levels. A trap placed outside the cages served as an experimental control. The number of trapped thrips, whiteflies and aphids was determined at the family level (we did not attempt to key out each species of each family of insect we counted). Using four cages allowed simultaneous testing of three materials plus the fiberglass window screen as a second control. The eight materials we tested in this study included low, medium and high resistance fabrics of both the woven and polyspun types (Table 1).

Table 1. Characterization of greenhouse screening materials by type and relative air flow resistance, and product source list.

Material	Type	Air flow resistance[z]	Product source
Fiberglass window screen	woven	low	hardware and building supply stores
Reemay™	polyspun	medium	Reemay Inc., 70 Old Hickory Blvd., Old Hickory, TN 37138; (800) 284-2780; fax (615) 847-7068
Pak™ 52 × 52	woven	medium	Pak Unlimited Inc., 3300 Holcomb Bridge Rd., Suite 215, Norcross, GA 30092; (404) 448-1917 and (206) 845-9453
FlyBarr™	polyspun	high	Hydro-Gardens, P.O. Box 9707, Colorado Springs, CO 80932; (800) 634-6362; fax (719) 531-0506
Typar™	polyspun	high	Reemay Inc., 70 Old Hickory Blvd., Old Hickory, TN 37138; (800) 284-2780; fax (615) 847-7068
BugBed™ 123	woven	medium	Green Thumb Group Inc., 3380 Venard Rd., Suite 2, Downer's Grove, IL 60515-1178; (800) 240-3371; fax (708) 964-1963
Econet M™	woven	low-medium	LS Americas, 1813-E Associates Lane, P.O. Box 19548, Charlotte, NC 28219; (704) 357-0457; fax (704) 357-0460
Econet T™	woven	high	LS Americas, 1813-E Associates Lane, P.O. Box 19548, Charlotte, NC 28219; (704) 357-0457; fax (704) 357-0460
No-Thrip™	woven	high	Green-Tek Inc., 407 N. Main St., Edgerton, WI 53534; (608) 884-9454 and (800) 747-6440; fax (608) 884-945

[z]As characterized by Baker and Shearin (1994).

Data were collected from May through August 1994. Natural population fluctuations of thrips resulted in two peak collections, one from mid-May to mid-June (Fig. 1) and another from mid-July through August (Fig. 2). Three consecutive experiments were run during the late spring peak in which a total of six materials were tested; data for this test was pooled over runs. A single, continuous test using three fabrics plus the fiberglass screen control was run during the second thrips peak. During this test, populations of whiteflies rose to numbers sufficient for analysis of treatment effects. More whiteflies were trapped inside the fiberglass screened cage than outside, so results are compared with only the fiberglass screen control (Fig. 2). Aphids were not collected at appreciable levels (data not shown).

Testing of a given material on a given cage constituted one replication. Data were analyzed using analysis of variance (ANOVA). There was no significant cage effect, therefore, replications were pooled over cages for each material. Insect count data were transformed into a percentage of the coinciding control counts. Multiple comparisons were made using the least squares means procedure (SAS Institute, 1988). Exclusion efficacy was computed by subtracting percentages compared with the control from 100%.

Results & Discussion

Of the six materials tested during the first thrips population peak, only the BugBed™123 screen provided greater exclusion than the fiberglass control screen (Fig. 1). Results among the other materials were similar, and these screens provided less exclusion than BugBed™123 (Fig. 1). When exclusion is calculated as a percentage of the fiberglass control, again only BugBed™123 was different from the other materials (Fig. 1).

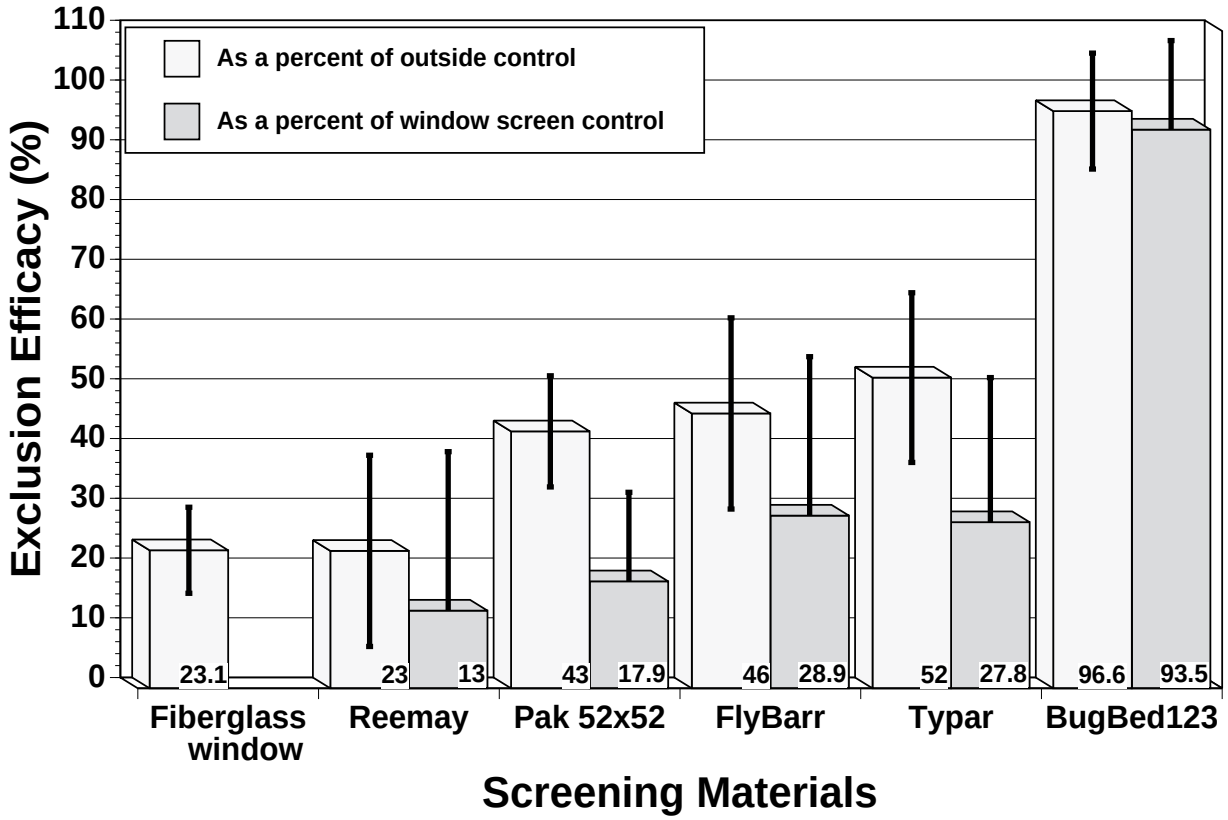

Figure 1. Late spring thrips catches as a percentage of the outside control and the fiberglass window screen control (n = 22, fiberglass; n = 6, Reemay™ and FlyBarr™; n = 16, Pak™ 52 × 52; n = 8, Typar™; n = 14, BugBed™123).

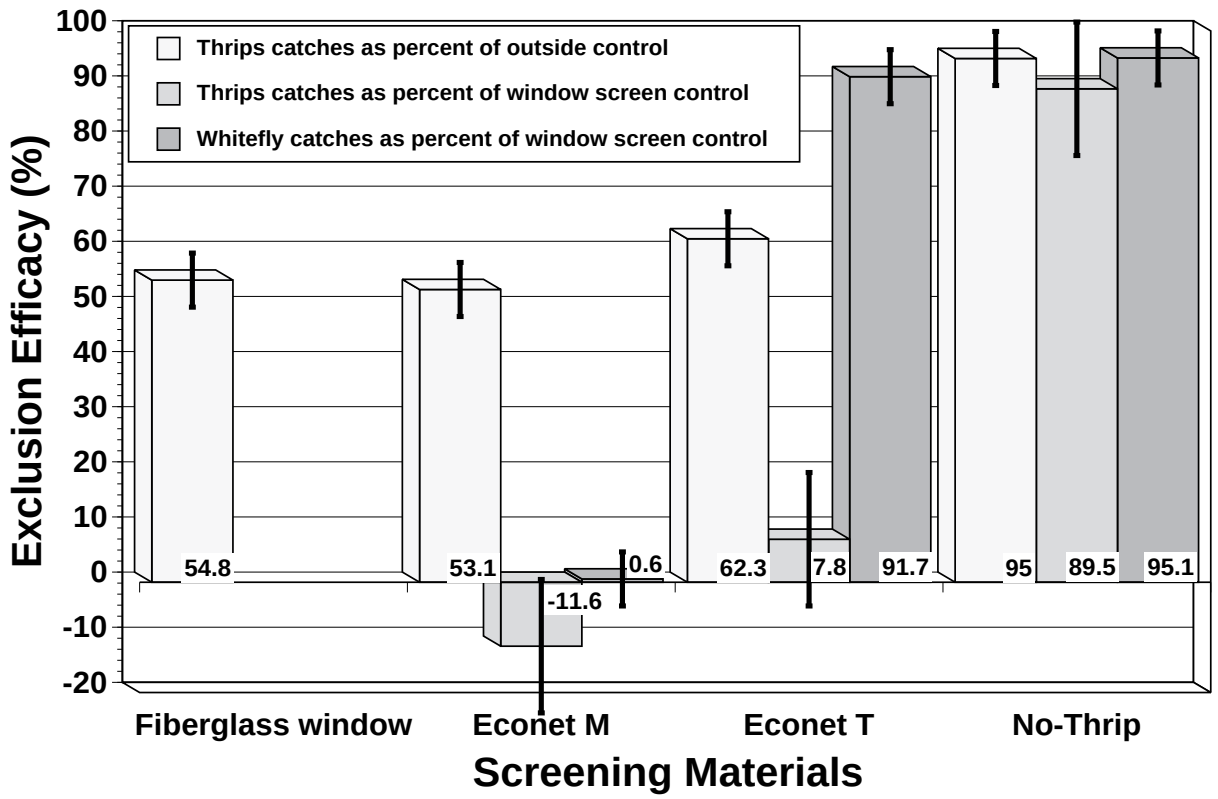

Figure 2. Summer thrips and whitefly catches as a percentage of the outside control and fiberglass window screen controls. (n = 14 for thrips test; n = 10 for whitefly test).

BugBed™123 has been characterized as a medium resistance fabric, yet it proved better able to exclude thrips than Typar™ or FlyBarr™ which are considered highly resistant to air flow. The reason may be that BugBed™123 is a woven fabric whereas Typar™ and FlyBarr™ are polyspun materials. The rigid woven structure may help prevent thrips passage through BugBed™123. Conversely, thrips may be able to wiggle through or are pulled through between the relatively thin, moveable fibers of the polyspun Typar™ and FlyBarr™ screens.

Comparisons made during the second thrips peak showed that No-Thrip™ excluded thrips to a greater degree than the fiberglass control and the two Econet™ products (Fig. 2). As a percentage of the fiberglass control, No-Thrip™ maintained a high level of exclusion against thrips (Fig. 2). Though both No-Thrip™ and Econet T™ have been characterized as high resistance fabrics, No-Thrip™ has smaller holes and can more effectively exclude thrips than Econet T™. Exclusion of thrips by Econet M™ was less than that of the fiberglass control such that when data were transformed to a percentage of that control, the exclusion efficacy of Econet M™ was a negative value (Fig. 2). However, there was no significant difference between Econet M™ and the fiberglass window screen for thrips exclusion (Fig. 2).

For the three screens evaluated for whitefly exclusion, the fiberglass screen serves as the only valid control treatment, since an average of 63% more whiteflies were trapped in fiberglass screened cages than outside (data not shown). Econet M™ was not significantly different from the fiberglass control and thus provided essentially no exclusion when data were transformed as a percentage of the fiberglass control (Fig. 2). No-Thrip™ and Econet T™ very effectively excluded whiteflies (Fig. 2).

Though Econet T™ did not effectively exclude

thrips, it was highly effective in excluding whiteflies. According to Bethke & Paine (1991) greenhouse pests are likely to be excluded by screens with hole sizes smaller than the insects' thoracic width. The authors also noted that projecting body parts such as the wings of whiteflies further prohibit their ability to penetrate many screens. In general, the species of thrips attacking greenhouse crops are narrower than species of whitefly pests of these crops. Data presented here suggest that the holes of Econet T™ allow differential passage of the two pests.

The poor performance of Econet M™, a fabric on the low end of the medium resistance group, is somewhat surprising as its air flow resistance curve is well above that of the low resistance fiberglass window screen. Several low resistance fabrics are presently being marketed for use on commercial greenhouses. It is probable that such fabrics would provide pest exclusion similar to or less than that of Econet M™. This situation points to the pressing need for independent evaluation of screens for their pest exclusion properties.

Conclusions

Greenhouses utilized as high value production areas are usually plagued by one or more relatively small insect pests. Sealing those portions of the greenhouse open to the external environment with insect screening will effectively limit the movement of pests into these production areas. Screening for exclusion coupled with the introduction of insect-free plants will markedly reduce the need for pesticide applications. It is now feasible to fit screens on existing greenhouses, and certainly screening will become a major factor in greenhouse design in the future.

This study tested eight screening materials for thrips exclusion and three materials for whitefly exclusion. Although the screens differed in ability to exclude insects, high air flow resistance did not always correspond to greater pest exclusion. The woven materials were generally more effective than polyspun materials for exclusion. BugBed™ and No-Thrip™ excluded 90% of thrips at peak populations. No-Thrip ™ and Econet T™ excluded 90% of whiteflies at peak populations.

We are continuing our efforts to characterize air flow resistance and to compare pest exclusion for all materials available to growers. Thrips and whitefly exclusion tests comparing 29 commercial screens are presently underway. We will report results with these materials in the near future.

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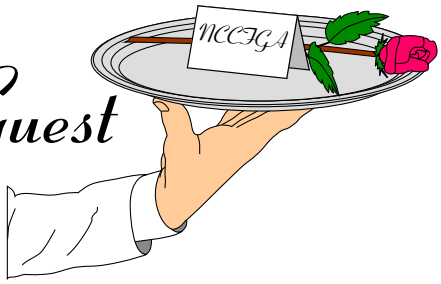
Acknowledgments

We thank Ed Shearin for assistance in generating resistance curves and building cages and Cavell Brownie for help with statistical analyses. We also thank the Fred C. Gloeckner Foundation Inc. and the White and Helmich research grants of the Horticultural Research Institute for financial support.

Be Our Breakfast Guest



The Board of Directors of the North Carolina Commercial Flower Growers' Association is hosting a continental breakfast for its membership plus any other North Carolina growers who are in attendance at the Southeast Greenhouse Conference and Trade Show.

The breakfast will be held at the Palmetto Exposition Center in Greenville, S.C. from 7:00–8:00 AM on Saturday, 17 June 1995. We encourage all our membership, both instate and out-of-state to attend and to get better acquainted with your fellow NCCFGA members. Also, we encourage all our members to bring a North Carolina guest with you. The room for the breakfast will be posted at the SGCTS registration table, and further information will be included in your SGCTS registration packet.

See you at the Southeast Greenhouse Conference in June!

GREENHOUSE FERTILIZATION OF THE FUTURE: IMAGINE THE POSSIBILITIES

Kimberly A. Williams
Department of Horticultural Science, NCSU

This article is based on ideas which have been under development for several years as a part of Dr. Paul Nelson's floriculture nutrition research program at North Carolina State University. Under his guidance, many students and other faculty and scientists have contributed to the evolution of these concepts. Kim Williams recently completed her Ph.D. program under Paul Nelson's direction, and she will join the faculty of the University of Illinois in June 1995. This research has been funded primarily through grants from Sun Gro Horticulture, Inc.

You know those television commercials depicting conveniences that you will be able to enjoy thanks to the next generation of communications technology? Some of the images include sending a fax from the beach, taking a phone call on your watch, scanning prices of an entire cart of groceries at once, and saying "good night" to your child from an airport phone booth with a television screen. With this mind set of imagining the possibilities, can you imagine what the future of greenhouse fertilization might hold?

How about this scenario: A grower could purchase bags of substrate that already contained all of the nutrients that a floricultural crop would require for high quality, commercially acceptable growth throughout its entire production cycle. Rooted cuttings or young seedlings could be potted up in this substrate, set on a bench, and all the grower would have to do is water. No fertilization of any kind would be required during production. Sound crazy?

What if a foliage plant was grown or finished in a substrate that provided nutrients to the plant for two or three years after it was purchased by the consumer? Think about the marketing potential of selling plants that had a "built-in" fertilizer! Perhaps consumers and interiorscapers would no longer have to worry about fertilizing their interior plants.

Maybe the future of greenhouse fertilization includes the use of waste materials as fertilizer sources. Some waste products, like little chips of brick, have been shown to retain the nutrient phosphorus. There are a number of organic waste products, such as feathers and dried bacteria, that contain a substantial amount of nitrogen. Such waste materials might be used as fertilizers during greenhouse crop production, providing consumers with "environmentally friendly" floricultural products.

The research that is the foundation for these ideas was inspired by the foreseeable need of the greenhouse industry to substantially reduce the amount of nutrients in greenhouse irrigation runoff. Leaching of nitrates and phosphates from greenhouses can be an environmental hazard, and across the country, laws are being passed setting limits on nutrient contaminants in water flowing from greenhouse sites.

One of the reasons that nutrients are so easily leached from pots in greenhouses is that the *soilless*, peat-based and bark-based substrates that we commonly use for crop production do not have the ability to "hold on to" or *retain* most nutrients. Take phosphorus for example: Greenhouse mixes containing clay or loam soil aren't used much any more, but these *soil-based* substrates retain a lot of phosphorus. Nutrient retention is important, because if the substrate doesn't retain the nutrients applied, there is nothing to keep them in the pot and they will leach out of the bottom whenever the crop is irrigated.

A second reason that large quantities of nutrients are lost in greenhouse crop leachate is that in many cases, the concentration of nutrients we apply as fertilizer is much higher than what the plant really needs for adequate growth. Again, consider the situation with phosphorus: It has long been known that soil solution concentrations of 0.2 ppm phosphorus or lower, if the low level is sustained (that is the hard part), can produce high quality, commercially acceptable crops of most plant species, including many floricultural crops like chrysanthemums (Beckwith, 1965; Nishimoto et al., 1975). However, the amount of phosphorus that we apply during production results in much higher concentrations of phosphorus in the substrate solution (Fig. 1).

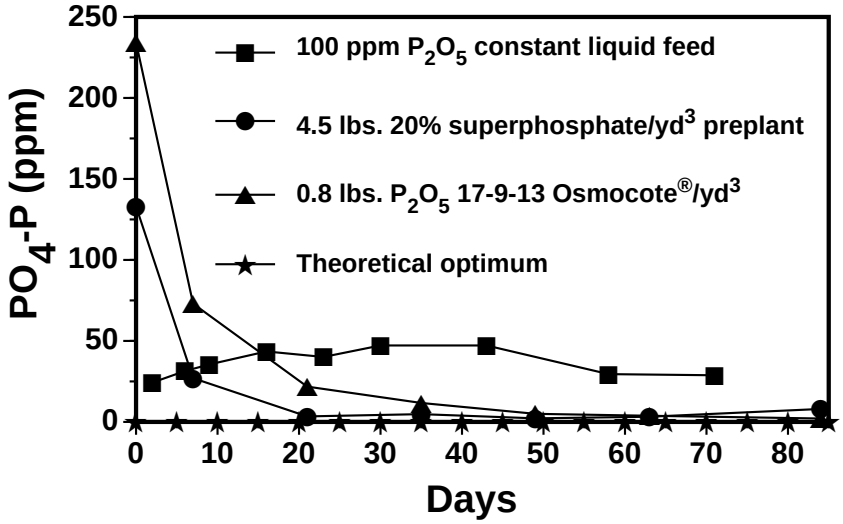


Figure 1. Substrate solution phosphorus concentrations during potted chrysanthemum production. Treatments are constant liquid feed with 100 ppm P_2O_5, a preplant substrate amendment of 4.5 lbs 20% superphosphate per yd^3, or a 0.8 lb P_sO_5 per yd^3 preplant substrate amendment supplied from 17-9-13 Osmocote®. The theoretical optimum phosphorus concentration is 0.2 ppm.

In our research,, constant liquid fertilization (CLF) with 100 ppm P_2O_5 resulted in about 25 ppm phosphorus in the substrate solution over the course of a chrysanthemum cropping cycle. Superphosphate and broken prills of the slow-release fertilizer Osmocote® resulted in excessive levels of phosphorus in the substrate solution during the first couple weeks of the crop (Fig. 1). Although only 0.2 ppm phosphorus is required, standard industry fertilization practices such as our CLF, superphosphate and Osmocote® treatments result in much higher concentrations (Fig. 1). Because the substrate doesn't retain the phosphorus applied, it is vulnerable to leaching.

Mineral soils retain many (although not all) nutrients, so we worked with soil scientists to learn the mechanisms that allow soils to do this. Then, we tried to incorporate the mechanisms into a *soilless,* peat-based substrate. One way to do this is to take some material that has a great ability to retain a particular nutrient and "pre-charge" or soak it in a solution containing that nutrient. This material could then be mixed with peat and perlite and become a component of the soilless substrate. Ideally, this material would establish a low concentration of the nutrient in the substrate solution, and every time the plant absorbed or "took up" a nutrient molecule from the substrate solution, another nutrient molecule would be released from the pre-charged material to replace it (Figure 2 illustrates how this might work for phosphate molecules). This system could *sustain* the desired low concentration of the nutrient in the substrate solution.

One material that we tested to provide phosphorus during pot chrysanthemum production was an oxide of aluminum, alumina (Al_2O_3). We pre-charged alumina with phosphorus and then mixed it with sphagnum peat moss and perlite so that alumina was 30% of the total volume of the substrate. Chrysanthemums were grown in this substrate and did not receive any other kind of phosphorus fertilizer. The growth of these plants was no different from the growth of mums that received 100 ppm P_2O_5 as constant liquid fertilization (Fig. 3). An exciting discovery

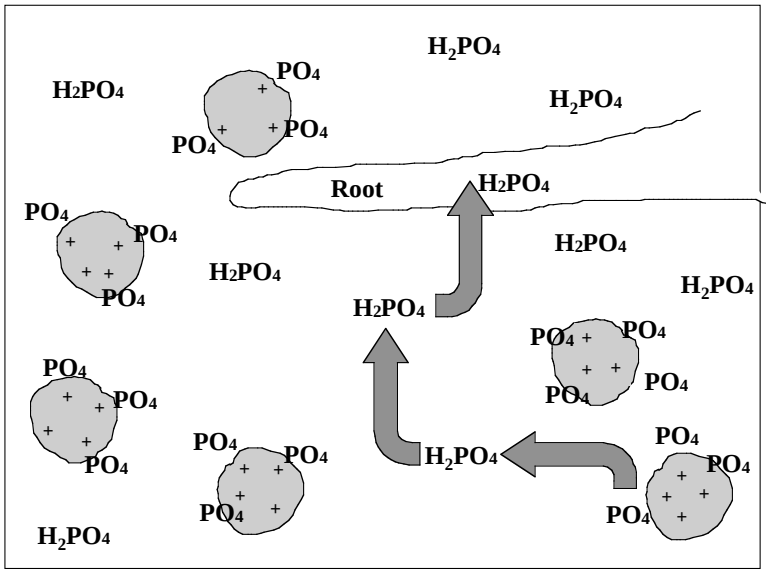


Figure 2. Diagram of a root growing in a substrate containing alumina pre-charged with phosphorus. As the root absorbs a phosphate molecule from the substrate solution, another phosphate molecule is released from the alumina to replace it.

made in this study is that the alumina sustained a phosphorus concentration in the substrate less than 1.5 ppm (Fig. 4)—very low compared to what we normally see in floriculture production, but still, the mums grew fine! Another exciting result is that the pre-charged alumina treatment resulted in *much less, almost 99% less,* phosphorus loss through leaching. Only 1.4 mg of phosphorus was lost from each pot filled with alumina-containing substrate, but an average of 102.6 mg phosphorus was leached from pots that were fertilized with 100 ppm P_2O_5 at each watering. Pots were irrigated using a leaching fraction of 0.2 (20% of the irrigation solution applied leached out of each pot). This experiment demonstrates that commercially acceptable mums can be produced using very low concentrations of phosphorus in the substrate solution, and that leaching of phosphorus can be greatly reduced by incorporating 30% by volume of pre-charged alumina into the substrate.

We tested a different material for potassium retention, the zeolite clinoptilolite. Zeolites are a group of clay minerals that have a unique molecular structure giving them the ability to retain a large quantity of cations, like potassium. Other researchers have successfully grown commercially acceptable plants using zeolite as the sole source of potassium (Pond and Mumpton, 1984), so we decided to test zeolite with a floricultural crop. We pre-charged clinoptilolite with potassium, mixed it with peat

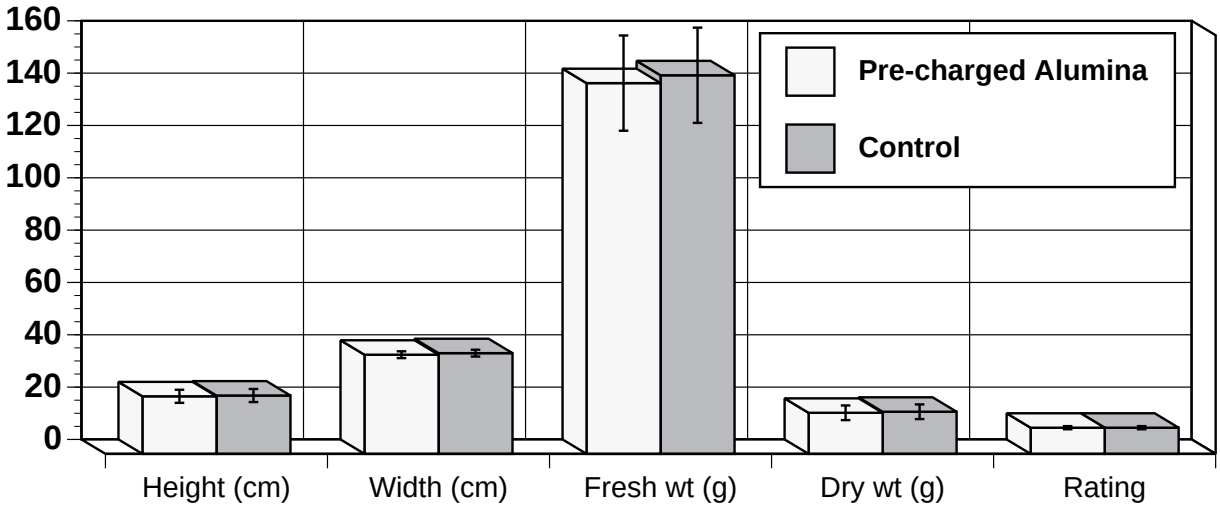


Figure 3. Growth measurements of potted chrysanthemum (one cutting per 4 ½" standard pot) grown with phosphorus supplied from pre-charged alumina or from fertilization at each watering with 100 ppm P_2O_5 (control). The lines on the bars indicates the LSD at $\alpha = 0.05$. Leaching of phosphorus was only 1.4 mg per pot for the alumina treatment while phosphorus lost from the control pots averaged 102.6 mg.

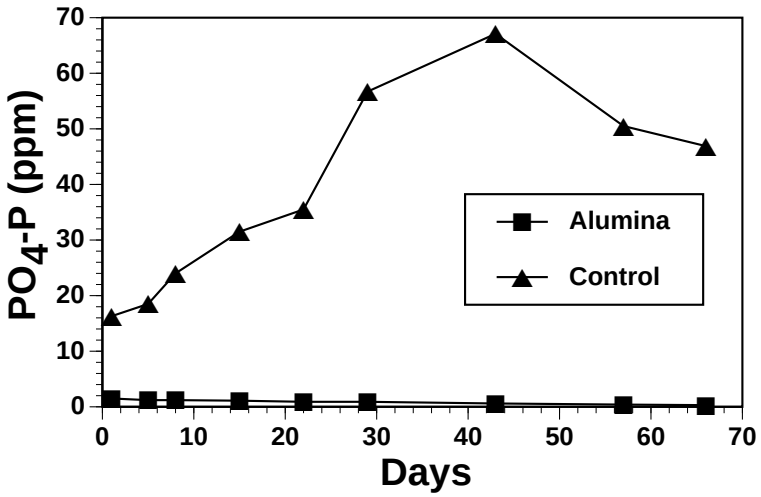


Figure 4. Phosphorus concentrations of the substrate solution during potted chrysanthemum production. Phosphorus was supplied with pre-charged alumina or from 100 ppm P_2O_5 at each watering (control). The standard error for the experiment (SE) is ± 1.0 ppm.

moss and perlite so that 20% of the volume of the substrate was clinoptilolite, and compared this potassium delivery system to standard commercial fertilization practices. The growth of the plants receiving potassium only from pre-charged clinoptilolite was no different than growth of plants fertilized at each watering with 200 ppm K_2O (Fig. 5). The zeolite treatment resulted in a 77% reduction in leached potassium as compared to the 200 ppm constant liquid feed (CLF) K_2O treatment. The amount of potassium leached from the pots containing zeolite was only 42.6 mg per pot compared to 185.5 mg per pot for the CLF treatment.

This research shows that we can engineer soilless substrates that would supply all the phosphorus and potassium required to grow a chrysanthemum crop. Research is continuing to refine these ideas and to work toward the retention of other nutrients in soilless substrates.

Of course, there are disadvantages with pre-charged substrates: ❶ This kind of system would require that growers control and monitor their leaching fraction when they irrigate to be certain adequate nutrient levels are being maintained in the substrate solution. This is very simple to do, but it is not a common practice for

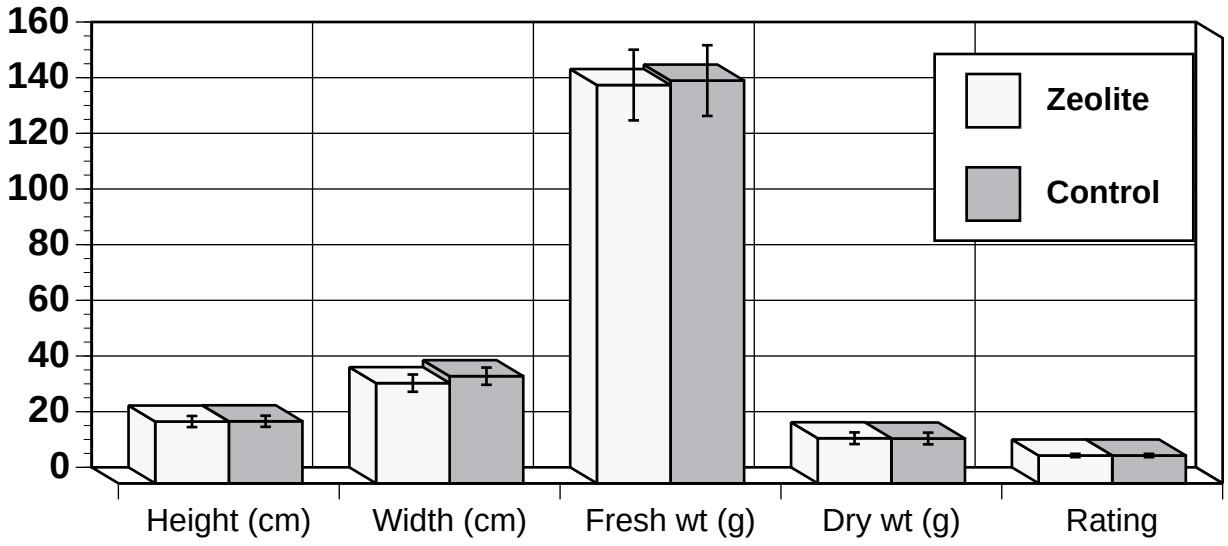


Figure 5. Growth measurements of potted chrysanthemum (one cutting per 4 ½" standard pot) grown with potassium supplied from pre-charged zeolite or from fertilization at each watering with 200 ppm K_2O (control). The lines on the bars indicates the LSD at $\alpha = 0.05$. Leaching of potassium was only 42.6 mg per pot for the zeolite treatment while potassium lost from the control pots averaged 185.5 mg.

many growers. ❷ It would become more difficult to use nutrient stress as a "growth regulator". In other words, growers may not be able to reduce or slow plant growth by withholding fertilizer; its already in the substrate. ❸ Much of the nutrient charge from pre-charging remains in the pots after a three month production cycle and is not utilized by the plants, which is inefficient. However, since the nutrient levels are so low, this continuous supply should not reduce postharvest life due to excess salts and high nutrient levels in the substrate. ❹ It would be difficult for individual growers to pre-charge their own substrate components. Horticultural substrate companies would have to develop this technology and carry out the preparation of specially-treated substrates. Because of these additional steps in the blending of the soilless substrates, substrate cost would be increased for growers.

But consider all of the advantages: ❶ Research has already shown that the amount of nutrients lost through leaching from open crop production systems would be substantially reduced. Therefore, smaller greenhouse operations that cannot afford the equipment costs of closed systems like ebb and flood floors would have an alternative, economically viable method to greatly reduce nutrient runoff. It is also likely that pre-charged substrates would effectively provide nutrients in closed irrigation systems as well as in open systems. ❷ In addition, using pre-charged substrates could simplify or do away with fertilizer applications by growers, and could supply nutrients after plants are purchased by consumers. This may not be as important for a potted chrysanthemum, but it could be of value for plants that consumers would maintain for several months or years, like foliage plants. ❸ And finally, although the substrate would cost more, growers would save money on fertilizers and would likely be able to use the elimination of nutrient runoff as a marketing tool.

Unlike the television commercials that promise the new communications technology that they advertise, we are not ready to make claims that the ideas presented here will be a part of next year's greenhouse fertilization program. But who knows? Two decades ago, many of the biological control methods used today were only academic curiosities. Hopefully, if you ever get an opportunity to support research which pushes the envelope of tradition, or to try a product which defies conventional wisdom, you'll look to the future and . . . imagine the possibilities.

Literature Cited

Beckwith, R.S. 1964. Sorbed phosphate at standard supernatant concentration as an estimate of the phosphate needs of soils. Austrail. J. Expt. Agric. Anim. Husb. 5:52-58.

Nishimoto, R.K., R.L. Fox, and P.E. Parvin. 1975. External and internal phosphate requirements of field-grown chrysanthemums. HortScience 10:279-280.

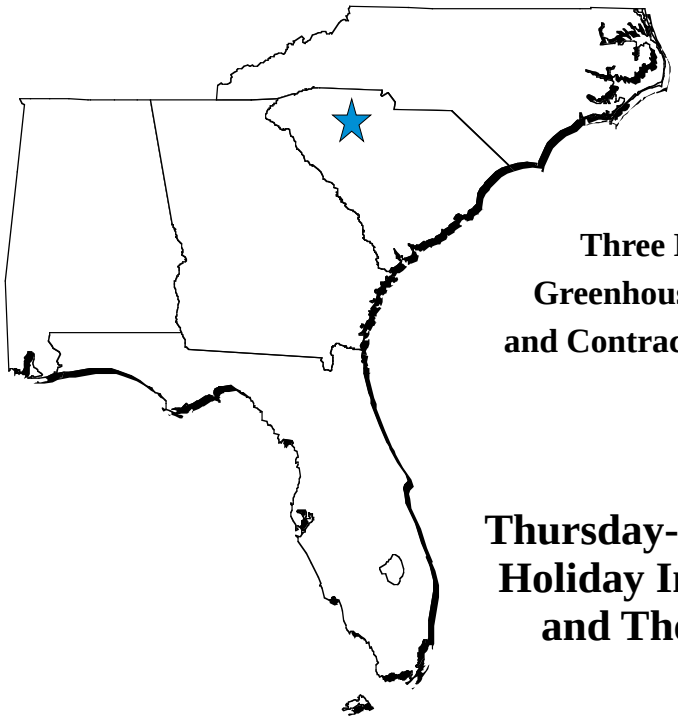
Pond, W.G. and F.A. Mumpton, eds. 1984. Zeo-agriculture: use of natural zeolites in agriculture and aquaculture. Westview Press, Boulder, Colo.

NCSU Horticulture Faculty Awarded

The NCSU Alumni Association Board of Directors has accepted the recommendation that Roy A. Larson and J.C. Raulston, Department of Horticultural Science, be appointed Alumni Distinguished Professors. The award is in recognition of their distinguished service as teachers at North Carolina State University.

In addition to their teaching, both are well know for their close relationships with members of their commodity organizations. Congratulations to both Roy and J.C. on receiving this honor!

1995
Southeast Greenhouse Conference and Trade Show



"Five States Strong and Growing!"

Three Days of the Latest Information for Greenhouse Growers, Landscape Designers and Contractors, and Retail Garden Center Operators

Thursday-Saturday, June 15-17, 1995
Holiday Inn, Roper Mountain Road
and The Palmetto Expo Center
Greenville, SC

Sponsored by the Alabama Nursery Association, Florida Nurserymen and Growers Association, Georgia Commercial Flower Growers' Association, North Carolina Commercial Flower Growers' Association, South Carolina Greenhouse Growers' Association; and the Cooperative Extension Services of Alabama, Florida, Georgia, North Carolina, and South Carolina and the Land Grant Universities of each state.

Program coordinators: Bill Miller, Department of Horticulture, Clemson University, Clemson SC 29634, (803-656-0898); Doug Bailey, Department of Horticultural Sciences, North Carolina State University, Raleigh NC 27695, (919-515-1195); Paul Thomas, Extension Horticulture Department, University of Georgia, Athens GA 30602, (706-542-2340); David Williams, Department of Horticulture, Auburn University, Auburn, AL, 36849, (205-844-3032); and Jim Barrett, University of Florida, 1545 Fifield Hall, Gainesville, FL 32611, (904) 392-7931

1995 Southeast Greenhouse Conference and Trade Show Program

Wednesday, June 14

8:00 - 12:00 **Poinsettia Growers Association seminar on "Advanced Blooming Poinsettia Production,"** hosted by Jack Williams of the PGA. Seminar topics include cultivar selection, scheduling, pest management, postharvest, and crop diagnostics. **Registration and payment directly with the PGA is required.** Contact the PGA at 619-753-1743 for registration and cost details.

Thursday, June 15

8:00 - 12:00 **Golf Tournament**, Verdae Greens Golf Club, 650 Verdae Boulevard, Greenville (803-676-1500). Contact Robbie Bellefontaine, 803-754-5969, for sign ups and more information.

8:00 - 5:00 **Tours of the Fafard Plant in Anderson, SC.** Food and tours will be available throughout the day. Call ahead (1-800-722-7645) for additional details and directions to the plant, or just stop by.

10:00 - 5:00 **Registration - Holiday Inn, I-385 and Roper Mountain Road, Greenville, SC**

8:00 - 6:00 **Exhibitor setup and registration - Palmetto Expo Center, Pleasantburg Drive (Hwy. 291)**

6:30 - 8:00 **Welcoming Social and Get-Together, Holiday Inn**

Worker Protection Standard Program - Holiday Inn

12:00 - 1:30 Complying with WPS - Doug Bailey

Greenhouse Insect Management Program - Holiday Inn

2:00 - 4:00 Pesticide Application Alternatives - Ron Oetting, Jim Baker, Richard Lindquist

Greenhouse Records Program - Holiday Inn

4:30 - 6:30 A rotation of four 20 minute, hands-on demonstrations and discussions on records you should be keeping in your greenhouse:
How to Monitor your Injector - Paul Thomas
Pesticide Application Records - Doug Bailey & Jim Baker
Using Plant Growth Regulators Wisely - Joyce Latimer
Computer Programs for Growers - Bill Fonteno

6:30 - 8:00 **Welcoming Social and Get-Together - Poolside at the Holiday Inn**
Come and join with fellow industry colleagues for an evening of light food, fun, and entertainment to kick off the 1995 Southeast Greenhouse Conference and Trade Show! This event is sponsored in part by the individuals and companies listed at the end of the program.

Friday, June 16

7:30 - 5:00 **Registration - Palmetto Expo Center, N. Pleasantburg Drive, just south of I-385**

8:00 - 5:00 **Trade Show - Palmetto Expo Center**

6:30 - 7:30 **Social Hour - Holiday Inn**

7:30 - 10:00 **Western Roundup BBQ - Holiday Inn** Charles Kremp, president of SAF, will deliver our banquet speech. Mr. Kremp will highlight opportunities for smaller growers in today's competitive industrial environment.

Greenhouse Production Program A - Room 202-B, Palmetto Expo Center

8:00 - 8:45 Fuchsia Production - John Erwin
8:45 - 9:30 Affordable Recirculation Systems - Tom Weiler
9:30 - 10:30 **Break with Exhibitors**
10:30 - 11:15 Success with Forcing Perennials - Tom Weiler
11:15 - 12:00 More Success with More Perennials - Allan Armitage

12:00 - 1:00 **Lunch** in the Trade Show

1:00 - 1:45 Greenhouse Insect Update - Richard Lindquist
1:45 - 2:30 Greenhouse Disease Update - Ron Jones
2:30 - 3:30 **Break with Exhibitors**
3:30 - 4:15 Screening Revisited - Jim Baker
4:15- 5:00 Comparison of Greenhouse Screening Materials - Michelle Bell

Greenhouse Production Program B - Room 202-A, Palmetto Expo Center

8:00 - 9:30 Trucking Regulations - Gene Glance
9:30 - 10:30 **Break with Exhibitors**
10:30 - 11:45 Business Decisions - To Expand or Not to Expand - Grower Panel: Russell Weiss, Hyman Young Jr., and Bob Colton

11:45 - 1:00	**Lunch** in the Trade Show
1:00 - 1:45	What's New in Seed Technology? - Greg Gabrels
1:45 - 2:30	Valid Grower Contract Basics - Pat Dunleavy
2:30 - 3:30	**Break with Exhibitors**
3:30 - 4:15	Product Liability - Bill McElhannon
4:15- 5:00	Light and Plant Growth--There's More Than Meets the Eye - Peg McMahon

Saturday, June 17

7:30 - 3:00	**Registration - Palmetto Expo Center**
8:00 - 3:30	**Trade Show Open - Palmetto Expo Center**
6:00 - 9:00	**Tour and Cookout at Scott's Mix Facility,** Travelers Rest, SC. Details will be available at the show!

Greenhouse Production Program - Room 202-B, Palmetto Expo Center

8:00 - 8:45	Poinsettia Leaf Counting: How to Design the Perfect Poinsettia - John Erwin
8:45 - 9:30	Designing a Crop Fertilization Program - Doug Bailey
9:30 - 10:30	**Break with Exhibitors**
10:30 - 11:15	New Techniques in Chemical Height Control - Jim Barrett
11:15 - 12:00	Poinsettia Cultivar Update - Roy Larson
12:00 - 1:00	**Lunch in the Trade Show**
1:00 - 1:30	USDA Crop Insurance for Ornamentals - Richard Ward
1:30 - 2:30	Automation: Breakthroughs and Breakdowns - Grower Panel: Russell Weiss, Jerry Whitley, Bob Colton, Paul Thomas, Robin Brumfield
2:30 - 3:30	**Break with Exhibitors**
3:30 - 4:15	Marketing Color to Landscapers - Mel Garber
4:15 - 5:00	Coir-based Mixes - Jim Knauss

Garden Center Program - Room 203, Palmetto Expo Center

8:00 - 9:00	Garden Center Survey Results - Charles Safley
9:00 - 9:45	Strategic Planning-Why are You in Business? - Robin Brumfield
9:45 - 10:45	**Break with Exhibitors**
10:45 - 11:30	Spring Promotion Package Ideas - John Erwin
11:30 - 1:00	**Lunch in the Trade Show**
1:00 - 2:30	It Takes More Than Mothers' Day to Make a Good Year! - Robert Hendrickson
2:30 - 3:30	**Break with Exhibitors**
3:30 - 5:00	Battling the Big Boys - Robert Hendrickson

Landscape Program - Room 202-A, Palmetto Expo Center

8:00 - 8:45	Hardy Ferns for the Southern Landscape - Jim Nash
8:45 - 9:30	Go Native - Dick Bir
9:30 - 10:30	**Break with Exhibitors**
10:30 - 10:45	The Georgia Gold Medal Promotional Program - Gary Wade
10:45 - 11:30	Weed Control in Landscape Color Beds - Stu Warren
11:30 - 1:00	**Lunch in the Trade Show**
1:00 - 1:45	Improving Landscape Bed Performance - Tim Smalley
1:45 - 2:30	Topiary in the Landscape - Bobby McCain
2:30 - 3:30	**Break with Exhibitors**
3:30 - 4:15	Hard Data on Amending Landscape Soils - Stu Warren & Bill Fonteno
4:15 - 5:00	New Guineas in the Southern Landscape - Bill Miller

1995 Welcoming Reception and Breaks Sponsored by:

Armin Plastics, Bouldin & Lawson, Inc., Bruce's Greenhouse, Carolina Nurseries, Inc., Cassco/ Southern Growers, Dillon Seed & Supply Co. Inc., Dixie Green, Inc. Duke Power Company, Fafard, Inc., Florists' Mutual Insurance Co., Landmark Plastic Corp., Metrolina Greenhouses, Henry F. Michell Company, Mid-Atlantic Plant Co., M&R Specialty Sales, Rockwell Farms, Inc., Rough Brothers, Inc., Total Gro/SDT Industries, Vaughans Seed Company, Verlite Company, and V-J Growers.

Thanks For Your Support!

Program Participants

Dr. Allan Armitage is a Professor at the University of Georgia in Athens, Ga. He is the author of *Seed Propagated Geraniums* and *Herbaceous Perennial Plants.*
Dr. Douglas Bailey is an Associate Professor in the Dept. of Horticultural Science at North Carolina State University, Raleigh, N.C. and has floriculture extension and research responsibilities.
Dr. Jim Baker is a Professor in the Dept. of Entomology at North Carolina State University in Raleigh, N.C. and has responsibilities in ornamentals extension.
Dr. Jim Barrett is a teacher and researcher at the University of Florida, Gainesville, Florida. He has extensive experience with chemical growth regulators.
Ms. Michelle Bell is a Ph.D. candidate in Entomology and Floriculture at N.C. State University in Raleigh, NC.
Mr. Dick Bir is an Extension Specialist in the Dept. of Horticultural Science at North Carolina State University and is located at the Mountain Horticultural Crops Center in Fletcher, N.C. He is the author of *Growing and Propagating Showy Native Woody Plants.*
Dr. Robin Brumfield is Farm Management Specialist at Rutgers University in the Department of Agricultural Economics and Marketing.
Mr. Bob Colton is Grower/Manager at Sunbelt Greenhouses in Douglas, Georgia.
Ms. Pat Dunleavy is an attorney in Ila, Georgia and co-owner of Pinebush Farm and Nurseries. Inc. in Loganville and Ila Georgia.
Dr. John Erwin is an Assistant Professor and Floriculture Extension Specialist in the Department of Horticultural Science, University of Minnesota in St. Paul, Minnesota.
Dr. Bill Fonteno is an Associate Professor in the Dept. of Horticultural Science at North Carolina State University in Raleigh, N.C. and has extensive experience with floriculture substrates.
Mr. Greg Gabrels is Seed Department Manager at Vaughans Seed Co. in Chicago, Illinois.
Dr. Mel Garber is an Ornamental Extension Specialist at the University of Georgia in Tifton, Georgia.
Mr. Gene Glance is with Penske Truck Leasing in Greensboro, NC.
Mr. Robert Hendrickson is a business and marketing consultant with The Garden Center Marketing Group, Inc. in Ellicott City, MD.
Dr. Ron Jones is a Professor in the Dept. of Plant Pathology at North Carolina State University in Raleigh, N.C., has extension ornamentals responsibilities, and is in charge of the NCSU Plant Disease and Insect Clinic.
Dr. Jim Knauss is a floriculture technical and research specialist with Scott's Company.
Mr. Charles Kremp is owner of four Philadelphia area flower shops and is President of the Society of American Florists (SAF).
Dr. Roy Larson is a Professor in the Dept. of Horticultural Science at North Carolina State University in Raleigh, N.C. and has more than 30 research experience with azaleas, poinsettias, and other floriculture crops.
Dr. Joyce Latimer is an Associate Professor and researcher in the Department of Horticulture at the University of Georgia and is located at the Georgia Experiment Station, Griffin, Georgia.
Dr. Richard Lindquist is a Professor and extension specialist in the Department of Entomology, The Ohio State University and is located at the Ohio Agricultural Research and Development Center in Wooster, Ohio.
Mr. Bobby McCain is a Horticulturist at Callaway Gardens in Pine Mountain, Georgia.
Dr. Bill McElhanon is Director of Technical Services with Fafard, Inc. in Athens, Georgia.
Dr. Peg McMahon is Assistant Professor at The Ohio State University with teaching and research responsibilities in Floriculture.
Dr. Bill Miller is an Associate Professor at Clemson University in Clemson, South Carolina with research, teaching and extension responsibilities in floriculture.
Mr. Jim Nash is owner/operator of Henry's Plant Farm in Snohomish, WA, producers of young hardy ferns and African violets.
Dr. Ron Oetting is a Professor and research and extension entomologist at the University of Georgia and is located at Georgia Experiment Station, Griffin, Georgia.
Dr. Charles Safley is an Associate Professor and extension specialist in the Dept. of Agricultural and Resource Economics at North Carolina State University in Raleigh, North Carolina.
Dr. Tim Smalley is Associate Professor of Horticulture at the University of Georgia in Athens and specializes in landscape horticulture.
Dr. Paul Thomas is the Floriculture Extension Specialist at the University of Georgia in Athens, Georgia.
Dr. Gary Wade is the Landscape Extension Specialist at the University of Georgia in Athens, Georgia.
Mr. Richard Ward is a Claims Specialist with the Consolidated Farm Service Agency (formerly the Federal Crop Insurance Corporation).
Dr. Stu Warren is an Associate Professor and an Extension Specialist in the Dept. of Horticultural Science at North Carolina State University, Raleigh, N.C. and has expertise in weed control of ornamentals.
Dr. Tom Weiler is a Professor and Floriculture Extension Specialist at Cornell University in Ithaca, New York.
Mr. Russell Weiss is owner of Kurt Weiss Florist in Center Moriches, N.Y. and has greenhouses on Long Island and in Georgetown, S.C.
Mr. Jerry Whitley is Sales Manager at Metrolina Greenhouses in Huntersville, North Carolina.
Mr. Hyman Young, Jr. is the owner of Velvet Ridge Greenhouses in Asheville, North Carolina.

Directions to the Holiday Inn

From I-85, take exit 51 (I-385) towards Greenville. Exit at Roper Mountain Road (Exit 37), about 1 mile. Turn left, to pass back over I-385. The Holiday Inn is clearly visible on the right.

Directions to the Palmetto Expo Center

From the Holiday Inn, pass over I-385, and enter it to the left, heading to Greenville. In about 3 miles, exit onto South Pleasantburg Drive/ Hwy. 291 (Exit 40B). The Palmetto Expo center is about 1/4 mile, on the left behind the Krispy Kreme donut shop.

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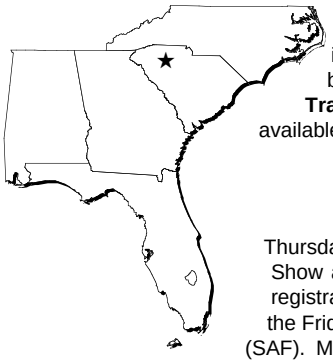


Program Information

Plan now to attend the best **Greenhouse, Landscape, and Retail Garden Center Sessions** available in the Southeast. The three-day educational program is tailored to provide what you need to know to be competitive in the South. The SGCTS also gives you the opportunity to meet with suppliers in the **Trade Show** and keep abreast of the latest products in your field. Pesticide recertification credits are also available (for all five sponsoring states) for those sessions dealing with pest control and pesticide issues.

Registration Information

The registration fee includes the Friday and Saturday luncheons; break refreshments; all seminars on Thursday, Friday, and Saturday; and a trade show badge. **Name Badges** are required to attend the Trade Show and Educational Sessions. The welcoming reception is free to attenders. Please indicate on the registration form if you plan on attending the welcoming reception. A **Western Roundup BBQ** is planned for the Friday night banquet. Our speaker will be Charles Kremp, President of the Society of American Florists (SAF). Mr. Kremp will highlight opportunities for smaller growers in today's competitive industrial environment. Plan for an evening of fun! The banquet will feature an authentic Western buffet and an exciting Western Outfit contest. **Come dressed up and ready to win!** Banquet tickets are $28.00 each, and the banquet cost is not included in the registration fee. A **Golf Tournament** is slated for Thursday morning at the fabulous Verdae Greens Course; call Robbie Bellefontaine at 803-754-5969 for golf questions and registration information. **Scott's is sponsoring a Complimentary Tour and Cookout** on Saturday evening (please indicate on the registration form if you plan to attending the tour and cookout).

Room Reservations

The Haywood Area Holiday Inn located on Roper Mountain Road at I-385, is offering lodging at **special conference rates of $64 per room**. Call 803-297-6300 for reservation information. When making your reservation, indicate that you are with the **Southeast Greenhouse Conference.** Please plan on staying at the Holiday Inn. Staying at the Conference Hotel helps offset the cost the program and helps us keep your registration costs as low as possible. The deadline for conference rates on rooms is June 10, so call well in advance.

ADVANCE REGISTRATION FORM

_____
(Last Name) (First Name) (Middle)

_____
(Firm Name)

_____
(Street Address, P.O. Box Number)

_____
(City, State, Zip Code, Phone Number)

Additional Registrants:

_____

_____

_____

_____

Registrations	*Before June 10:*	_____	@ $ 89.00	_____
	After June 10:	_____	@ $ 99.00	_____
One-Day Registration for _____		_____	@ $ 45.00	_____
One-Day Trade Show Only for _____		_____	@ $ 10.00	_____
(One-day registrations DO NOT include lunch)				
Welcoming Social	*Thursday Evening:*	_____	@ $ FREE	_____
Banquet Tickets	*Friday Evening:*	_____	@ $ 28.00	_____
Extra Lunch Tickets	*Friday:*	_____	@ $ 10.00	_____
	Saturday:	_____	@ $ 10.00	_____
Saturday Cookout and Tour at Scott's		_____	@ $ FREE	_____
			TOTAL:	_____

Please indicate your business descriptor(s):

❑ Grower ❑ Retailer ❑ Landscaper

Please indicate how many attenders from your company will attend each session:

____Grower ____Retailer ____Landscaper

Please indicate if you are a member of:

❑ Alabama Nursery Assoc.

❑ Florida Nurserymen & Growers Assoc.

❑ Ga. Commercial Flower Growers' Assoc.

❑ N.C. Commercial Flower Growers' Assoc.

❑ S.C. Greenhouse Growers' Assoc.

Make checks payable to:

SGCTS

Mail Completed forms and checks to:

Southeast Greenhouse Conference and Trade Show
Route 2, Box 125A
Glenwood, GA 30428

NCCFGA NEWS

Robert Lassiter, President

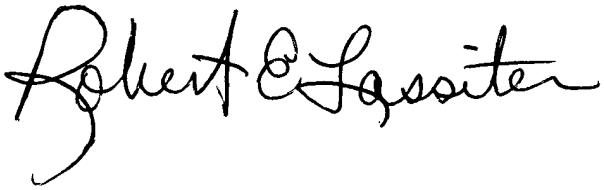
Spring is here! It officially arrived March 21 but you would have trouble believing it was this late getting here. Bedding Plants were on the sidewalks in eastern North Carolina as early as February 24 this year. The folks in Florida must envy us for having such a tolerant temperate zone. Now I'm talking tomatoes, peppers, marigolds, and yes, vinca and ageratum. It made me feel like Spring was here even though that night the temperature was a balmy 27 °F.

I wonder if we aren't creating a whole generation of uninformed gardeners; gardeners who think that this much material put on display in front of major chains signals the beginning of spring planting.

The early bird gets the worm. If Christmas is in November, why not Spring in February? Does it really matter as long as people buy the products? Should our customers know better than us? No one actually knows that day when it is absolutely safe to plant greenhouse tender plants outside. We can not be held responsible for a little snow on our plants. People are usually so tired of winter that a little planting folly somehow seems all right.

Which comes first--the customers demand for product or the retailer's jump on the season? If we actually waited for the long established date (April 15 in our area) for frost-free conditions, would we miss most of the market? Probably. This market driven reestablishment of the season seems unfortunate for the newest generation of gardeners. Plants that survive this new Spring date probably won't live up to the hopes and dreams the gardener has. I do not know of scientific research involving cold-stressed warm weather plants. Intuitively, I would say it does not seem like a plus for the plants. When a customer says he just does not have any luck with plants, I wonder if he was one of those "New Spring" customers.

I wish I could suggest the answer to this problem. I do not think that growers will insist that time honored dates for outside planting be adhered to. Retailers will find it hard to resist winter-weary customers' demands for spring plants. I will worry about my customers buying "New Spring" vinca at another store, because mine doesn't like soil temperatures below 50 °F. I will worry about a generation of gardeners that determine growing times by sidewalk availability. Maybe I worry too much. Hang on--Autumn is almost here.



Robert E. Lassiter

Make plans NOW to attend the Southeast Greenhouse Conference and Trade Show, 15–17 June, 1995.

NORTH CAROLINA
COMMERCIAL FLOWER GROWERS' ASSOC.

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