Agri-Plastics Report

American Society for Plasticulture

Spring 2003

AWARD NOMINATIONS

The 31st National Ag Plastics Congress provides us with another opportunity to recognize individuals who have distinguished themselves by their leadership and dedication to the industry we are part of, and the Society we support.

Please give thought to nominations for the Distinguished Service Award and the Pioneer Award to be presented at Plasticulture 2003. The presentation of the awards will occur during the Plenary Session at the opening of the Congress, allowing recipients to be congratulated throughout the rest of the Congress.

The Distinguished Service Award recognizes exceptional or special activity by one of ASP's members beyond expectations of usual member responsibilities. The last recipient of this award was Dr. Katrine A. Stewart of McGill University.

The Pioneer Award recognizes a member who has broadened or deepened the importance of ASP by exemplary research or developmental efforts, which have contemporary and future impacts to the field of plasticulture. Dr. Sal Locascio of the University of Florida received this award at the last Congress.

Please give some thought to your colleagues among the ASP membership. Submit your suggestions directly, and confidentially, to the ASP office to be passed along to the Awards Committee. Your suggestions must include a brief statement describing the accomplishments of your nominee in support of the award consideration.

Our strength as a Society is only as good as the collective benefit resulting from each member's individual contribution. Help us honor those who set the best examples of leadership. The ASP website includes a complete listing of past award recipients.

Plasticulture 2003

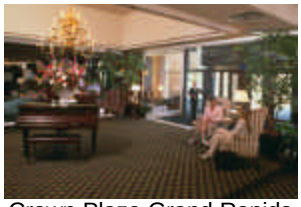
August 16-19, Grand Rapids, Michigan

This summer the world's leading researchers in plasticulture, the top extension professionals, and the horticultural industry's cutting-edge companies will assemble at the Crowne Plaza in Grand Rapids, Michigan, for the 31st National Agricultural Plastics Congress. For almost 40 years this unique gathering of the best minds in the industry has served as the birthplace of innovations that increase agricultural productivity and profitability through the use of plastic .

To date 50 research papers have been accepted for presentation at Plasticulture 2003. Presenters from around the world will be reviewing their research in areas such as:

- Crop Production Systems with Plasticulture
- Drip Irrigation/Chemigation
- Fruit Production
- Greenhouses and Controlled Environments
- Mulch Film Technology
- Plastics Technology and Recycling of Plastics

A complete list of all accepted papers is available on the ASP website, www.plasticulture.org, along with everything you need to register for the Congress.



Crown Plaza Grand Rapids

Topping off the three-day event are field tours that provide two different choices for examining plasticulture technology in action. This year, as an added attraction, the two tour groups will come together at the end of the day for field demonstrations and conclude with a catered dinner at an award-winning vineyard. These tours not only provide real life examples of plasticulture, they offer a chance to build on the networking that starts in the Congress sessions and continues in the Exhibit area. Relationships created at the Congress often develop into new opportunities for individuals and strengthen the industry as a whole.

Our mid-August meeting dates create a wonderful opportunity to combine business with a family vacation. Grand Rapids will surprise you with its big-city amenities, but one thing you won't find is typical "city" prices. Visitor attractions and family-friendly fun abound. It's proximity to Lake Michigan's most magnificent beaches and local highlights such as the Frederik Meijer Gardens; the Van Andel Museum Center, featuring a children's museum; the John Ball Zoo; symphony, opera, and ballet performances, and a new downtown River District make Grand Rapids a terrific place to visit for the entire family. Learn more about this exciting city at www.Grandrapids.com.

Plasticulture 2003 registrations have already started to arrive from a diverse bank of presenters, researchers, extension professionals and manufacturers. Our commercial partners are also signing up as sponsors and exhibitors. You'll want to plan to be there too.

Grand Rapids -- A City of Surprises

Photos courtesy of Grand Rapids/Kent County Convention & Visitors Bureau

Thanks to Loyal Members
ASP Is Recovering Financially

There's no question of loyalty among ASP members. That old saying about putting your money where your mouth is came to the foreground over the past year in the face of the Society's possible bankruptcy.

Faced with a huge debt to the Hershey Lodge and Convention Center resulting from the international Congress held there in 2000, the Board brought the problem to the membership at the San Diego Congress in February of 2002. But instead of wringing their hands about the situation, members made impassioned speeches about how valuable ASP has been and will be to the ag plastics community. And the members voted for a special assessment of commercial members to pay off the debt and keep the organization afloat until the next Congress could help in the financial recovery.

In response to the voluntary appeal for additional funds, our commercial members contributed $11,075. Then, members in the academic community asked to help, and their contributions added another $975 to the pot. In addition, Techmer PM contributed legal assistance to negotiate the bill with Hershey Lodge, resulting in all interest and penalties being waived, a significant savings! And as a final gesture of support, ASP president Mark Jordan also arranged for Techmer to provide a "loan" to ASP to pay the final bill at the negotiated time.

With the Society's management firm, Calabrese & Heuser suspending its billing through 2002, the operational work got done and the planning for the 31st Congress is well underway. Financial projections through the rest of 2003, with a successful Congress in August, indicate that ASP can survive this year and begin a steady recovery of financial stability into 2004.

Thank you doesn't begin to say it – but ***THANK YOU*** to our members for keeping ASP alive! A list of contributors is posted here and on the ASP website to honor them for their outstanding support and commitment.

Company Contributions:

Chris Davey -- Agricultural Products, Inc.
Victor Mimeault -- Ampacet Corp.
Tom Gipson -- AT Plastics
Bill Chapin -- Chapin Watermatics, Inc.
Nicola Lelli -- CIBA Specialty Chemicals
George Upton -- Colortech, Inc.
Sari-Beth Samuels -- Cytec Industries, Inc.
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Tom Burke -- Pliant Corporation
Michael Sarao -- Poly Expert, Inc.
Keith Williamson -- Sonoco Products Co.
Mark Jordan -- Techmer PM
Clayton Morton -- T-Systems International
Dennis Peoples -- Tyco Plastics LP

Individual Contributions:

Michelle Infante-Casella from Rutgers Cooperative Extension
Bill Courter (Retired)
Gene Giacomelli from the University of Arizona
Bob Hochmuth from the University of Florida
Herman Hohlt from Virginia Tech
Gary Honea from the University of Tennessee
Sylvie Jenni from Agriculture & Agri-Food Canada
Mark Jordan from Techmer PM
Michael Kasperbauer from USDA
William Lamont from Penn State
Sal Locascio from the University of Florida
Bill Roberts (Retired)
David Ross from the University of Maryland
Henry Taber from Iowa State University
William Tietjen from Rutgers Cooperative Extension
William Wolfram from Toro Ag

Every ASP member owes these individuals and companies a debt of gratitude for insuring that the society will survive. When you have the opportunity, please offer them your personal thanks.

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For the Inter-Congress Period
February 2002 through September 2003

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CALL FOR NOMINATIONS

At the Society's business meeting in August (during the Congress in Grand Rapids), our voting members will elect officers and directors to manage the affairs of the Society until the next Congress in 2005.

This "Call for Nominations" is to encourage participation by as many members as possible in the nomination and election process. Volunteer leadership of the Society is vital to its continued success and to its growth as a voice for plasticulture science and utilization. The Society needs leaders who are committed through their contributions of time, energy, and shared expertise to nurture the growth of our organization.

The Nominating Committee encourages all ASP members to think carefully about those you feel have potential to help lead this organization.

The ballot will have two industry representatives and one academic representative to fill positions being vacated by Dennis Peoples of Tyco, Bill Wolfram of Toro Ag, and Pete Nitzsche of Rutgers University. Those remaining on the Board until the following Congress will be Hank Monahan of MIPCO Ag Films, Jim Garthe of Penn State, and Gene Giacomelli of the University of Arizona.

Please send your suggestions of candidates to the ASP office no later than June 15, 2003 to be passed along to the Nominating Committee. Send email to info@plasticulture.org or fax your suggestions to 814-238-7051.

Remember, a Nominating Committee is the most important committee of any organization – help them do the job you want in finding your future leaders!

Your Representatives

The people who are members of the ASP Board of Directors serve as your representatives. If you have ideas, comments, concerns, or suggestions, these people are your link to insuring that ASP is an organization that fulfills your needs. Please feel free to contact these Board Members or the ASP office.

DRIP IRRIGATION

Bill Wolfram
Toro Ag Irrigation www.toroag.com

Drip irrigation is the application of water and nutrients delivered directly to the root zone at a low controlled rate from an emission device. Water is applied more efficiently with less loss due to evaporation or run off and has the added benefit of not watering weeds in middles. A drip irrigation system allows you to produce bountiful high quality crops efficiently, by putting the water where you need it, when you need it. Most vegetable crops are susceptible to water stress which will cause a reduction in yields. A quality drip irrigation system is the perfect means for watering crops in a timely manner resulting in a higher crop yield. Unlike sprinkler irrigation, drip irrigation allows you to maintain a more uniform moisture level in the root zone and eliminates some of the drying and soaking that happens with other types of irrigation.

Drip irrigation may be a line source, meaning the emission outlets are preinstalled or are a component of the tubing such as Aqua-Traxx® drip tape or Drip In® dripline in which the emitters are uniformly spaced and each emitter puts out the same amount of water. Aqua-Traxx comes in with 4, 6, 8 12, 16 and 24 inch spacings with flows ranging from .11 to 1.34 gallons per minute per 100 ft with .22, .34, .45, .50, .67 GPM/100ft being the more common flows. Aqua-Traxx is referred to as a drip tape and comes in 4, 6, 8, 10, 12 and 15 mil wall thickness. Aqua-Traxx is also available as a true pressure-compensating drip tape for use in difficult topographical conditions. The advantage of this product is the increased uniformity of emitter flow along the length of each row. Drip In, is a thick walled tubing with the emitters preinstalled on a uniform spacing and a specific flow rate with a .53 or 1.0 GPH emitter the most common.

The other style of drip irrigation is point source emission devices such as Toro's punch in emitters used to water plants at irregular or wide spacing or by using a multi-distribution device, such as Toro's Black Spider, to directly water into pots. Your local irrigation dealer can help you with your design and system needs.

What are the advantages of Drip Irrigation?

Improved crop quality and yields: Almost all vegetable crops have increased quality and yields when irrigated properly with drip irrigation.

Water is applied directly to the root zone: This allows for the plants to have the water that it needs plus it allows the middles between the rows to stay dry, slowing the germination and/or growth of weeds.

More precise nutrition management: Drip irrigation allows you to apply the nutrients when needed versus applying all at one time where they may be leached out of the root zone. This allows for a lower cost of fertilizer per unit produced.

Water savings: By applying water directly to the root zone, drip irrigation is considered to be 85 to 95 percent efficient with little or no evaporation, runoff or wind drift.

Less disease pressure: Because the plants do not get wet from irrigation, you may have less disease pressure and reduced spray requirements.

Drip irrigation will fit into irregular shaped fields.

Less water and energy consumption

System Design

If you are just starting, or are considering a new field, it is highly recommended that you visit a full service irrigation dealer who can help you with the planning and design of your irrigation system. To design a field, a dealer will need the following information:

1/ What crops will be in the field and estimated planting and harvest dates.
2/ What is the water source, pond, well stream, and do you have a water analysis? (If not get one.)
3/ A drawing of the field or fields with the following information:
   Field measurements, length and width, of all sides
   Direction of slope or elevations in inches per 100 feet
   Water source location, where it will supply the field and distance from the field
   Existing pipe or risers
   Row direction, which way will the rows be planted? This may be determined with the help of your dealer depending on slope.
   Are there drive rows down or across the field for spraying or harvest, if so how wide?
4/ What is the soil type: sand, loam, clay or mixed?
5/ Is there an existing pump, if so what is it, or what is the pressure and GPM?
6/ What is the desired amount of water per week in inches?
7/ Is plastic mulch being used? (see note below about clear plastic)
8/ Row spacing, center of row to center of row, single or double row planting.
9/ Is expansion planned in the future?
10/ What is the power source available? None, diesel, single or three phase electric?

With this information, and maybe a visit to the field, your dealer can design a trouble free drip irrigation system that will meet your needs, fit your fields and help improve your crops.

What are the components of a Drip Irrigation System?

If you are considering an irrigation system, the following is a list of components that you will need:

1/ Water Source; are you using a pond, well or stream?
2/ Water Sample; this is just as important as a soil sample.
3/ A pump to match your system
4/ Back Flow Prevention; this is to prevent contamination of your water source and is generally required by law.
5/ Chemical Injection system; fertilizer injection and line cleaning solution.
6/ Filtration
7/ Flow Meter – a quick indicator of trouble.
8/ Pressure gauges, one on each inlet and outlet side of the filter so you know when to back flush and one to check lateral pressures. Filters can also be automated to back-flush on pressure differential or time.
9/ Automation/Controller; saves time, water, fertilizer and allows you to irrigate more accurately. Automating a system generally pays for itself with these savings.
10/ Valves; Pressure Regulating, Zone Valves, etc.
11/ Air/Vacuum Relief at high points
12/ Mainline; PVC, Aluminum, Layflat Hose
13/ Sub-main / Header; Oval Hose
14/ Lateral / Emission Device; Aqua Traxx® drip tape, Drip In® dripper line, Blue Striped® Round Hose and emitters.
15/ Fittings
16/ Flush Valves / End Closures
17/ Irrigation Plan, helps you to plan your watering schedule and needs.
18/ Fertigation and Maintenance Plan; with a plan you are more likely to do it on time and more accurately and have a trouble free system.

Words of caution:

If you use clear plastic mulch, be sure that your tape is completely buried to prevent sunburn, or holes, being caused by the magnification of the sun's rays through water droplets. Although the tape works better if slightly buried, sunburn is not a factor under black or white plastic mulches.

Before and while laying drip tape, be sure to inspect your installation equipment for burrs and wear, which may score or cut drip tape. (An easy way to check this is to pull a pair of ladies nylon hose through the injection tube to check for burrs.) Depending on the soil type, installation shanks can wear quickly becoming razor sharp and therefore cutting the drip tape, which leads to very costly repairs and replacement.

Injection shank tubes should be of seamless construction and large enough that the side edges of the tape do not rub on the tube. Always have your emitters on top or right side up as indicated by the blue stripes on Aqua-Traxx drip tape.

Although a drip system has several components, if it is properly installed, it will be easy to manage and take less work than other irrigation systems. This will give you a head start on having your best crop ever.

RETROGRESSIVE PROGRESS : A Current View of High Tunnel Technology

Otho S. Wells
Professor of Plant Biology/Extension Vegetable Specialist (Emeritus)
Department of Plant Biology, University of New Hampshire, Durham, NH

In American agriculture, progress is often equated with size — larger farms, bigger tractors, more barns, and oodles of what-nots. Never mind burdensome debt loads, horrendous paper work, and untold local and federal regulations. In many agricultural aspects, the era of the 60's and 70's was no doubt one of "keeping up with the Joneses" – and perhaps going down with Joneses.

Then came the 80's and 90's when environmental and sustainable philosophies came to bear heavily on the decisions made in agricultural policy and practice. Bigness was not so big after all. Rather, the focus turned more inward to making the best out of what was at hand, whether 50 acres, 100 acres, 5 acres, or even one acre. Slowly but surely, the philosophy of "leaving it better than you found it" began to take root in the agricultural community. Production is not an independent entity; it is interdependent with the environment, marketing, and the social community.

From my perspective, I think one of the most innovative, yet so elementary, production techniques is the high tunnel – a simplified unheated, plastic-covered greenhouse with neither permanent supplemental heating nor mechanical ventilation. In contrast to highly sophisticated, computer controlled greenhouses, high tunnels are not much more than mere protective coverings for plants. The system cannot get much simpler – or can it?

Over the years greenhouses have taken a route similar to that of outdoor American agriculture. From the infancy of plastic greenhouses pioneered by Professor E. M. Emmert back in the early 50's in Kentucky and from the well-known "Cornell 21" greenhouse fashioned by Ray Sheldrake at Cornell, greenhouses have gotten bigger and better. But the "bigger and better" inadvertently skipped over the basic needs of so many growers who in fact did not (and do not) need the full trappings of a modern, double-layered plastic greenhouse or a double-paned glass greenhouse.

What then is the purpose of a greenhouse? The standard answer is to provide better control of the environment where plants grow. That generally connotes year-round production, or at the very least a significant extension of the growing season. But another question to be offered up is: "What does the plant really need to grow well?"

I am reminded of the energy crisis during the 70's when every greenhouse grower in the country was riding the backs of agricultural engineers to come up with miraculous energy-saving techniques. It almost came to the point that greenhouses were turning into energy fortresses – "not a single BTU is going to escape from this greenhouse." But it took practical-minded engineers like Bill Roberts from New Jersey to poignantly remind growers (and the rest of us) that the ultimate purpose of a greenhouse is "to grow plants and not save energy." Again, what does a plant really need to grow well?

Not so startlingly, many greenhouse growers in Europe and Israel had early on (late 70's) found that unheated greenhouses (hoop houses, walk-in-tunnels, high tunnels) were just the ticket for economically optimizing production of vegetables, small fruits, flowers, and herbs. The outcome was acres and acres of quonset-shaped structures covered with a single layer of poly, heated by natural radiation, and cooled by manually opening the sides and roofs. It was an integrated system of least input to give maximum economic output – a system that proved meritorious and worthy of emulation by American horticulture, especially for growers of high value horticultural crops grown intensively for retail markets.

So now, almost "retrogressively," we have come full circle back to our pioneering friend, Professor Emmert who in effect built the first high tunnel – with a thin plastic cover, but without a furnace for heat or ventilation fans for cooling. And it should not be surprising, that in this whole journey, the basic requirements for growing a tasty tomato, a juicy strawberry, or a fragrant flower have remained the same.

In only a few years the interest in high tunnels in America has escalated from "what is it?" to full-blown research programs in many states. And significantly enough, the focus is not so much on how mechanically intriguing high tunnels can be, but how simple they can be and yet meet the "needs" of plants. The real discovery process is not primarily in the mechanics of hardware but in the subtle intricacies of plant biology.

I think it fair to say that high tunnels had a good jumpstart in New Hampshire. Thanks to an outstanding grower, Ed Person (Moultonborough, NH), who being very thoughtful and creative, came up with a homegrown design of a high tunnel outfitted with roll-up sides for easy ventilation. Coupled with several years of high tunnel research at the University of New Hampshire, sufficient baseline data were generated to effectively demonstrate the efficacy of high tunnels as a system for economic season extension for high-value horticultural crops. Rapid and early adoption by growers also reinforced the idea, which in turn gave greater credence to the benefits of simple technology in a high-tech world.

A decade of high tunnel prosperity in New Hampshire was reason enough for the westward migration of this "new" technology. Even as New Hampshire-born Horace Greeley encouraged the eastern folks to "Go west young man, go west," so high tunnels took the same route. (John Soule from Indiana was the real author of those exact words, but taken from Greeley's admonition for farm families to seek better living conditions west of the Appalachians.)

Today, the evidence that high tunnels fit a niche need of horticulture is seen in the expansive research programs at Penn State University under the leadership of Drs. William Lamont and Michael Orzolek, along with many County Extension Agents and growers – with a tremendous multiplicity of crops and growing techniques. *(See related article)*

Moving westward and southward into Oklahoma, the Noble Foundation with Steven Upson is funding high tunnel research that is proving very advantageous for growers.

Westward ho! A tri-state high tunnel research and extension project is going full steam ahead in Kansas, Missouri, and Nebraska under the leadership of Drs. Ted Carey, Lewis Jett, and Laurie Hodges, respectively — along with several other university personnel and collaborating growers.

And scattered throughout the country, there are many other high tunnel projects that are making critical contributions to the knowledge of how to make simple technology the servant of growers who are besieged with the pressures of high-cost high- tech. While it seems almost a paradox, there is keen excitement in tweaking a simple system to make it even simpler to exact more benefits than Professor Emmert could have ever dreamed.

Why do high tunnels work? For one reason, they provide a unique protection for plants that is difficult to attain even in the best of modern greenhouses. Over a period of time (weeks or months) there is an incremental daily increase in heat units while at the same time avoiding high levels of relative humidity – a disease control factor. It is a naturally controlled environment conducive to the basic requirements of plant growth. Furthermore, with the proper selection of cool season crops, a high tunnel has the potential for year-round crop production, even in the cold winters of New England. A little bit of protection goes a long way.

It can never be said that a simple high tunnel will provide the precise growing environment as that of a bona-fide greenhouse utilizing a dazzling array of computerized controls. But it can be said that a new entry grower such as a high schooler or a fresh-out-of-college graduate, or a farmer looking for diversification, or any person looking for a side income can get into business at about $1.50 per square foot for a high tunnel versus $6 or $8 or $10 or $12 per square foot for a higher-tech or highest-tech greenhouse. And at least in most states, the "tax man does not cometh" for a high tunnel.

HIGH TUNNELS-A GROWING TECHNOLOGY

William James Lamont, Jr. and **Michael D. Orzolek**
Department of Horticulture, The Pennsylvania State University, University Park, PA

For centuries a wide variety of techniques have been used to extend the growing season of horticultural crops. Glass jars, glass cloches, hotcaps, cold frames, hotbeds, and greenhouses of various types have all contributed to season extension. More recently, high tunnels have become popular with growers because of their simplicity and effectiveness in protecting crops from low temperatures in both spring and fall.

High tunnels do not offer the precision of conventional greenhouses for environmental control, but they do sufficiently modify the environment to enhance crop growth, yield, and quality. Although they provide some frost protection, their primary function is to elevate temperatures a few degrees each day over a period of several weeks.

In addition to temperature control, there are also the benefits of wind and rain protection, soil warming, and in some instances control of insects, diseases, and predators such as varmints and birds. Overall, these growing systems should be considered protected growing systems that enhance earliness and higher yields, improve quality, and reduce the use of pesticides in some cases.

High tunnels have sufficient versatility to make them useful on a wide diversity of crops and in various cropping systems. Vegetables, small fruits, flowers and even tree fruits, such as sweet cherries, are all suited to these growing systems; but the specific crops which might be grown will to a large extent depend on marketing opportunities for individual crops by individual growers. In addition, use of high tunnels should be considered by home gardeners to increase their production and extend the gardening season.

High tunnels encompass a crop growing system that fits somewhere between row covers and greenhouses. They are relatively inexpensive (about $1.30/sq. ft, excluding labor), permitting entry into high tunnel crop production with limited capital. This system is particularly appealing to new-entry growers who utilize retail-marketing channels.

What Are High Tunnels

High tunnels are not conventional greenhouses. But like plastic-covered greenhouses, they are generally peaked quonset-shape, constructed of metal bows that are attached to metal posts which have been driven into the ground about two feet deep. They are covered with one layer of 6-mil greenhouse-grade polyethylene, and are ventilated by manually rolling up the sides each morning and rolling them down in early evening. There is no permanent heating system although it is advisable to have a standby portable propane unit to protect against unexpected below-freezing temperatures. There are no electrical connections. The only external connection is a water supply for drip irrigation. Dr. Otho Wells, a Past-President of ASP and also Pioneer Award Winner, was an early promoter of the use of high tunnels in the northeastern United States and developed the New Hampshire design and system of production that involved covering the entire soil surface inside the tunnel with a solid sheet of 6-mil thick plastic.

At The Pennsylvania State University researchers re-designed the endwalls so that they can be raised up to facilitate easy access into the tunnel of a small tractor, rototiller and other machinery. The Penn State system of production differs from the New Hampshire system in that it utilizes individual 18- inch wide raised plastic mulch covered beds with drip irrigation tape buried 2-3 inches beneath the bed instead of a solid piece of 6 mil thick black poly cover the entire inside soil surface of the high tunnel. The raised mulch beds are 44 inches apart, which allows 4 rows in a 17- foot wide high tunnel.

Benefits of High Tunnels

The primary benefit of tunnels is earliness. Tomatoes in a high tunnel mature on average about one month before field tomatoes. Earliness is the combination of being able to plant in high tunnels about two weeks earlier than in the field and faster ripening (about two weeks) inside the tunnel. Overall, the cost of a tunnel is recovered the first year when selling at retail prices. Another highly beneficial advantage of tunnels is disease control. The plastic cover is a rain shelter, the raised plastic mulch bed is a barrier against evaporation of soil moisture, and early morning ventilation reduces relative humidity. Therefore, the leaves of crops are dry for most of the day and night. Because of low humidity, plant leaves remain dry, impeding the incidence and spread of disease. For example, early blight of tomatoes, a serious foliage and fruit disease on field tomatoes, is not a problem in high tunnels when the tunnels are vented daily, though powdery mildew can be a problem since the conditions in a high tunnel are more favorable for the development of this disease.

Although tunnels do require more manual attention than do greenhouses, the benefits of high tunnels in a diversified farm operation have proven to be a valuable asset in overcoming a short growing season. Both cool- and warm-season crops do well in the spring. With cool season crops, the season may easily be extended into early winter and even throughout the winter for some hardy crops. Fall-planted strawberries ripen the following spring about six weeks earlier than field-grown berries.

Other High Tunnel Programs

Other high tunnel research and demonstration programs that we are aware of that are on going or under development are at University of New Hampshire, Kansas State University, University of Nebraska, University of Missouri, The Ohio State University, University of Kentucky, Rutgers University, Michigan State University, University of Minnesota Cooperative Extension, University of Maryland Cooperative Extension, University of Florida.

For addition information on the plasticulture contact the following websites:

American Society for Plasticulture: **http://www.plasticulture.org/**
Center for Plasticulture, Penn State University: **http://plasticulture.cas.psu.edu**

Calendar of Upcoming Events

JUNE 2003

18-21 Southeast Greenhouse Conference and Trade Show, Greenville, S.C. Information available at www.sgcts.org/2002/attendees/attendees_index.html

23-27 It's All About Plastics, McCormick Place, Chicago, IL. Sponsored by The Society of the Plastics Industry. For information and registration visit: www.npe.org

JULY 2003

31- Aug. 1 SNA Convention and SNA 2003. Georgia World Congress Center, Atlanta, GA. Contact Southern Nursery Association at 770-953-3311 or go to www.sna.org/tradeshow/.

AUGUST 2003

16-19 Plasticulture 2003, National Agricultural Plastics Congress, Crowne Plaza Hotel, Grand Rapids, MI. Call 814-238-7045 or visit www.plasticulture.org

SEPTEMBER 2003

28 - Oct. 1 Perennial Production Conference. Pleasant Run Resort, St. Charles, IL. Sponsored by *GrowerTalks* magazine. Contact: Michelle Mazza 630-208-9080, mmazza@ballpublishing.com

OCTOBER 2003

3-6 American Society for Horticultural Science (ASHS) Centennial Conference. Providence, RI. Visit: www.ashs.org/annualmeeting/Index.html

16-17 National Greenhouse Manufacturers Association Fall Meeting. Hilton Airport, Tampa, FL. Additional information at: www.ngma.com

21-23 New England Greenhouse Conference, Worcester, MA. At: www.uvm.edu/~pass/greenhouse/negc.html

NOVEMBER 2003

9-11 Southeast Strawberry Expo. Sheraton Imperial Hotel, Research Triangle Park, NC.

DECEMBER 2003

7 - 11 16th International Congress on Plastics in Agriculture. Sheraton Hotel, Algiers, Algeria

16 - 18 New England Vegetable & Berry Conference. Center of New Hampshire-Holiday Inn, Manchester, New Hampshire. Joint meeting with the New England Fruit Growers. For information visit: http://www.nevbc.org/

FEBRUARY 2004

22-25 North American Berry Conference, Hilton Westshore Hotel, Tampa, FL. Sponsored by the North American Berry Growers Association. For information go to www.NASGA.org.

ISHS First Call and Announcement
International Symposium on
Protected Culture in a Mid-Winter Climate
March 23-27, 2004, Orlando, Florida, USA

TOPICS TO BE PRESENTED

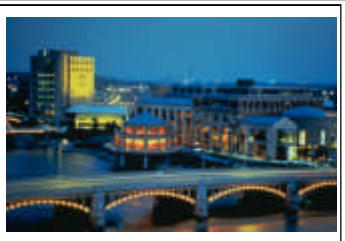
- Horticultural Crop Production/Culture including Nutrition and Irrigation Management in Soilless Culture
- Pest Management
- Economics and Product Quality / Global Marketing & Competition

CALL FOR ABSTRACTS

A Call for Abstracts is posted on the symposium website. Abstracts are due November 1, 2003, and must be submitted electronically following the detailed submission instructions posted on the symposium web site. Authors will be asked to submit full manuscripts for publication in a formal proceedings to be published post-conference by ISHS.

Find More Information at:
www.conference.ifas.ufl.edu/ishs

Plasticulture 2003
Grand Rapids, Michigan



August 16 to August 19, 2003
The Crown Plaza
Grand Rapids, Michigan

Registration Information on the web at:
www.Plasticulture.org