

Biological Controls at D.S. Cole Growers

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D. S. Cole Growers



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D.S. Cole Growers is located in Loudon, NH

- ❑ Founded in 1987 by Doug Cole
- ❑ 5 acres comprised primarily of Dutch glass houses
- ❑ Several acres of outdoor production area





- ❑ Root over 10 million cuttings annually
- ❑ Finish over 400,000 potted crops annually
- ❑ 35 year-round employees and 80 during peak liner season





Why did we become involved in Biocontrols?

- * Promote environmental stewardship
- * Reduce employee exposure to pesticides
- * Minimize pesticide resistance issues
- * Customers also using biocontrol options
- * Involvement in MPS Sustainability Certification Program



D.S.Cole Growers' Beneficial Insect Program throughout the seasons

- ▶ **January–March:**
 - Focus is on liner production
- ▶ **April–June:**
 - Spring potted crops and hanging baskets
- ▶ **July–September:**
 - Poinsettia propagation
 - Cyclamen and poinsettia crops
 - Outdoor crops: Mums, Asters, Cabbage/Kale
- ▶ **October–December:**
 - Finishing poinsettia & cyclamen crops
 - Early liner crops
- ▶ **Year–Round**
 - Potted herb production
 - Foliage program: Hanging baskets and pots



January– March Liner Production

- ▶ Over 85% of the unrooted cuttings come from offshore locations; crop protection agents (CPA's) that were used on stock or cuttings may affect the success of our biocontrol program.
- ▶ We have used liner dips selectively but the volume of cuttings (nearly 1 million on peak weeks) and extra handling were significant.
- ▶ Nematodes are applied to most liner trays in the propagation area on a weekly basis.



Nematode Applications in Propagation Area

- ❑ High volume sprayer used at low pressure with filter removed
- ❑ Dosatron used initially but proved to be much more time consuming and labor intensive
- ❑ One tray of 250 million *Steinernema feltiae* is used to treat the propagation area weekly; an additional tray is used when volume is high.
- ❑ Fungus gnat and thrips issues seem greatly reduced with the consistent use of nematodes
- ❑ Viability of nematodes is checked with each application after they come out of the spray nozzle





Begonias rooted under remay

Nematodes are not used on crops that are propagated under remay since they are covered as soon as possible >>

A combination of Distance and a fungicide such as Mural is applied as a sprench prior to covering.

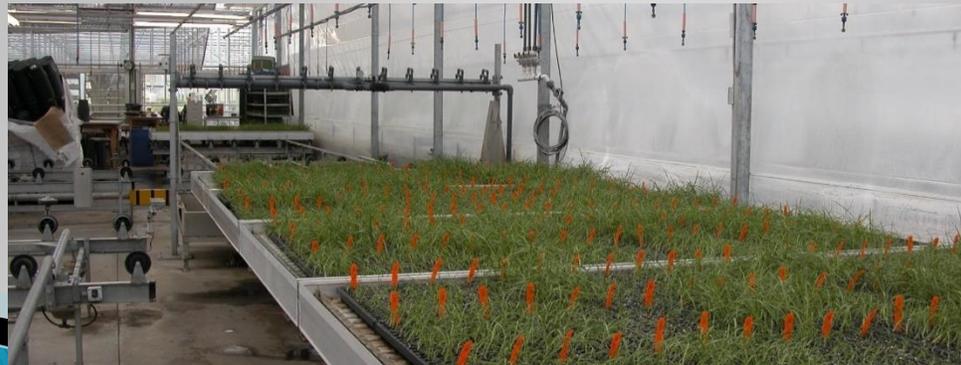
Thrips Control on Liner crops

- ▶ Began using *A. cucumeris* in 2008 on potted Gerbera
- ▶ Now used on most liners and many finished crops
- ▶ Annuals produced as liners and finished crops that benefit greatly:
 - Verbena, Mandevilla, Ipomoea, Thunbergia, Scaevola, Dahlias, Trifolium
- Currently we are using a 5 liter bag (250,000) of *A. cucumeris* weekly and a 1 pint bottle (25,000) of *A. californicus* biweekly



Spider Mite Control

- ▶ Initial trial of *A. californicus* in 2013 was highly successful
 - ❑ Released the predatory mites on tropical plants with significant populations of spider mites
 - ❑ Over the course of about 4 weeks the *A. californicus* overtook the spider mites
 - ❑ No subsequent sprays were needed
 - ❑ After this experiment the use of routine miticides was stopped
 - ❑ Predatory mite releases were integrated into production of Hedera, Cordyline, Mandevilla, Dracaena, and numerous other crops
 - ❑ We currently release about 25,000 *A. californicus* biweekly (diluted with vermiculite)





A “Bug Blower” aids in the dispersal on beneficial insects

This device greatly decreases the amount of time required for releasing predatory mites

Enables growers to spend more time scouting crops



Spring Potted Crops and Hanging Baskets

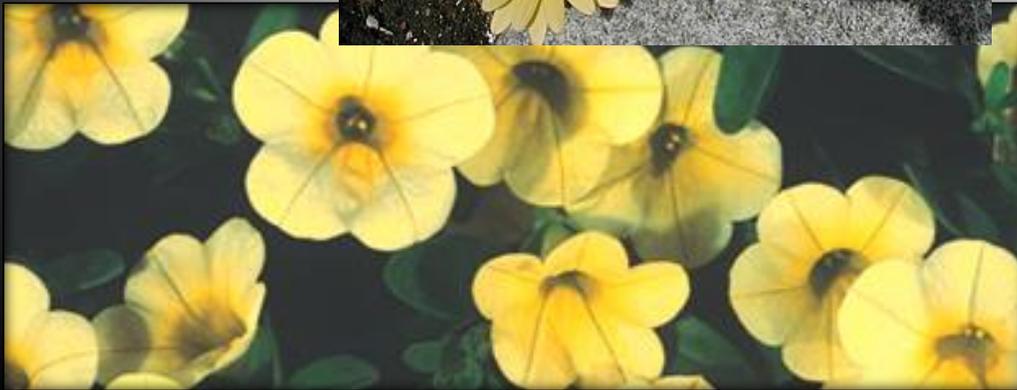
Scouting is an important part of our IPM Program

Sticky cards are placed throughout the greenhouses and rollout area at a rate of 1 card per 1000 ft²

This protocol is part of our Pest Management Plan that has been developed to satisfy the requirements for the Greenhouse Certification Program (for exporting to Canada) and SANC



We are audited four times a year and our sticky card and treatment records are checked Keeps us accountable!!



Scouting includes much more than sticky card counts

- ❑ Growers check their areas daily for signs of pathogens
- ❑ Growers also check for pests such as mealybug and spider mites
- ❑ Random hanging baskets are pulled down and scouted
- ❑ A weekly growers' meeting allows us to share information and discuss control options



A. cucumeris has provided good thrips control on crops such as Dahlias and Gerbera

- ❑ Excellent control is achieved from late winter potting until late spring
- ❑ Some pesticide sprays are generally needed for complete control later in spring
- ❑ Azatin, Mainspring, Conserve, Overture, and Altus are used most commonly
- ❑ We try to avoid products with higher toxicity and long residual issues with beneficials
- ❑ We grow most dahlias in thrips screened houses.





Minisachets on Hanging Baskets

- ❑ Since 2016 minisachets have been used on most spring hanging baskets

This includes about 24,000 baskets each spring

- ❑ Control of thrips and spider mites is excellent
- ❑ We are not able to control aphids on calibrachoa, fuchsia, and combination hangers with beneficial insects

Main spring drenches are used in addition to sachets and are done immediately after hanging. Altus has been excellent as a spray for immediate knockdown.



Minisachet Use Notes:

- ▶ The sachets are put in the hanging baskets just prior to hanging
- ▶ For long term crops or stock plants we put fresh sachets in about every 2 months
- ▶ We prefer the sachets on sticks:
 - ❑ Easier for people to insert correctly into pots
 - ❑ Do not fall out easily when plants are being hung
 - ❑ Sachets are kept off media
 - ❑ They are oriented so water does not easily drip into them

Aphid Banker Plants

- ▶ Used barley banker plants to support *Aphidius colemani* as an aphid control
- ▶ Have used this system on a limited basis especially in Poly Houses
- ▶ Pennisetum, Dracaena, Cordyline and others crops would not work with this system so we need to be selective
- ▶ Growers appreciate seeing “mummies” and evidence that the system is working
- ▶ Customers want clean plants so there is not too much tolerance for “mummies”





A. cucumeris sachets have been effective in spider mite control

These are used in spring flowering and foliage hangers

If chemical sprays are required we try to choose products most compatible with predatory mites

Sultan is an example of a product that works well in IPM programs



Incorporation of Chemicals with Biocontrol Program

- ▶ During winter months few insecticides or miticides needed
- ▶ Some chemical control required during spring and summer
 - ❑ Our most commonly used products include Azatin, Botanigard, Conserve, Endeavor, Mainspring, Altus, and Horticultural Oil
 - ❑ If these products do not achieve control we spot spray with other pesticides and discontinue beneficial releases until pest population is reduced
- ▶ Fungicides are applied in some cases
 - ❑ Milstop, Ranman, Regalia, and Cease are used on herbs as needed
 - ❑ Fungicides are also applied as needed on annuals for prevention and control of foliar and root diseases
- ▶ Plant Growth Regulators are used on some annuals where predatory mites are released

Fall Crops

- Fall crops are started inside
- Moved outside to the rollout yard
- Put down in fields with drip tape:
 - Asters * Mums * Cabbage* Grasses
- Treated with Nematodes soon after potting
- A. cucumeris* and *A. californicus* applied while crops are in the greenhouses
- Pesticide sprays applied as needed
- Preventative fungicide sprays on mums and asters
 - Using a rotation for white rust prevention
(Pageant or Heritage, Eagle, Spectro)
- Treated with Mainspring through drip lines
- Cabbage loopers controlled with Dipel



Ornamental Pepper Production

- ❑ Ornamental Peppers are one of our fall crops
- ❑ Grown in 4" and 6" pots
- ❑ Start in greenhouse and finish in the rollout area
- ❑ Thrips were a major pest when grown indoors
- ❑ Natural predators including *Orius* keep thrips levels low
- ❑ In late summer *Orius* are almost always present when scouting this crop



Poinsettia and Cyclamen Production



- ❑ Approximately 46,000 poinsettias are rooted and used for in-house production
- ❑ About 27,000 Cyclamen are purchased as plugs and finished in 6cm, 4", and 6" pots



Whitefly Control

- ❑ Began using beneficial insects on poinsettias in 2009
 - ❑ Parasitic wasps (*Eretmocerus*) were used for whitefly control
 - ❑ *Stratiolaelaps* and Nematodes used for fungus gnat control
- ❑ Released 5,000 *Eretmocerus* weekly early in crop cycle and increased to 10,000 weekly as crop is spaced
- ❑ The weekly number will increase this year; we feel that we need more coverage; poinsettia production has been increasing slightly
- ❑ *Delphastus catalinae* are used as needed
- ❑ Whitefly hot spots treated with products such as Rycar or Altus if necessary



We find it best to hang the cards on support rings or sticky card holders

Poinsettia Unrooted Cutting Dips

- ❑ Have used some URC cutting dips over the past few years
- ❑ M-Pede (0.5%) plus Botanigard (1.25gm/l) was used last season
- ❑ URC packaging from some suppliers is much easier to work with
 - Cuttings could be thoroughly dipped without removing entirely from paper
 - Made it easier for both those dipping and sticking the cuttings





In 2014 the release of *A. swirskii* predatory mites was added

In 2016 and 2017 we began biweekly applications of pollen to
nourish these predatory mites

Cattail pollen was gathered from the greenhouse property in
July for this purpose



Cattail pollen collection and storage

- ❑ Cattail pollen collected by shaking heads into ziplock bags
- ❑ Harvested around the beginning of July
- ❑ Typically can get about 5gm per cattail head
- ❑ Immediately put in freezer
- ❑ Used about 50gm of pollen spread over the crop biweekly
- ❑ Continued this from July through September
- ❑ Could be attractive to thrips but did not pose a problem





Applying Pollen to the Poinsettia Crop

This helps to maintain the *A. swirskii* population
An adapter allows us to use the “bug blower” for this purpose



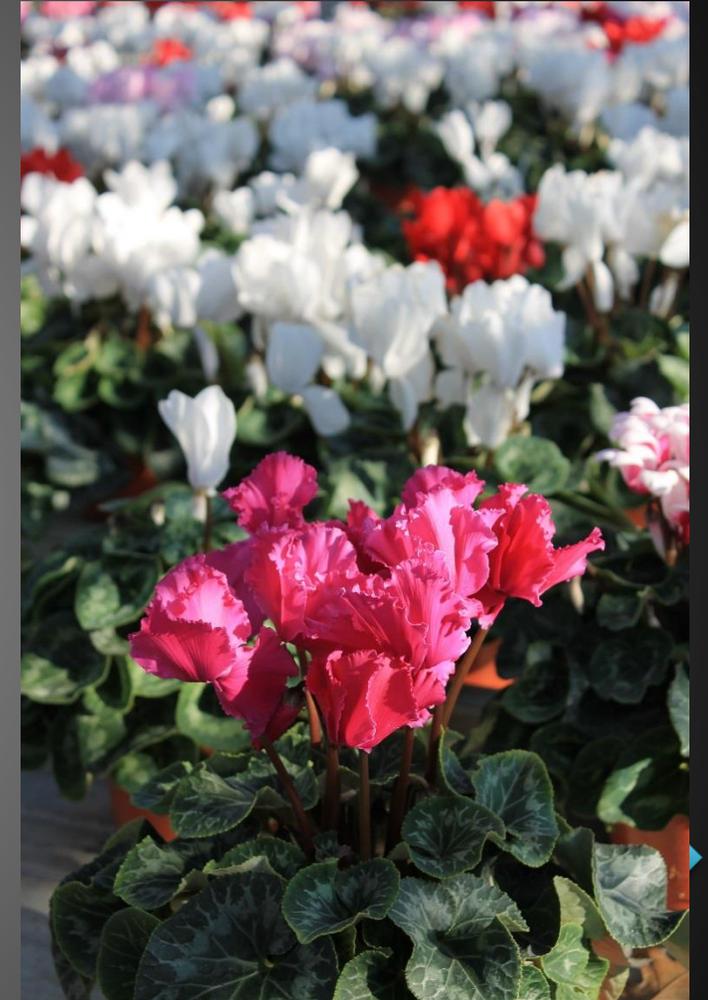


Releasing *Delphastus* in the Poinsettia Crop >>>

- ❑ This beetle feeds aggressively and works well on whitefly hot spots
- ❑ Typically specific varieties are much more likely to harbor whitefly so scouting reflects that knowledge

Cyclamen Biocontrols

- ❑ Starting clean is key to success
- ❑ Plants are not flooded until roots are established and Ebb & Flood system is sanitized
- ❑ Have eliminated preventative fungicide drenches for the past few years
- ❑ Nematodes seem very effective for fungus gnat and thrips control
- ❑ *A. californicus* and *A. cucumeris* released weekly
- ❑ Chemical controls used only as needed
- ❑ Quality of plants enhanced by minimal residue



Year-Round Herb Production



Herbs are produced in 4" pots all year
Most are from seed but some from unrooted cuttings





Currently using *Stratiolaelaps* on newly sown herbs

- ❑ These predatory mites are incorporated into the media used to cover herb seeds
- ❑ Mix them in by hand (about 62,500 mites for 5.6ft³ of soil)
- ❑ Nematodes are also used for fungus gnat control while the pots are in the propagation area
- ❑ Additional nematode applications are done in the finishing areas while the media surface is still exposed.



Unrooted cutting dips used for some herbs:

- ❑ Cutting dips used on mint for aphid control:
 - ❑ Azatin and M-Pede are rotated
- ❑ *A. cucumeris* and *A. californicus* applied weekly in herb finishing areas
- ❑ Sprays for whitefly, thrips, and aphids done if necessary:
 - ❑ Azatin, Conserve, Botanigard, Horticultural Oils



Control of Fungal Diseases

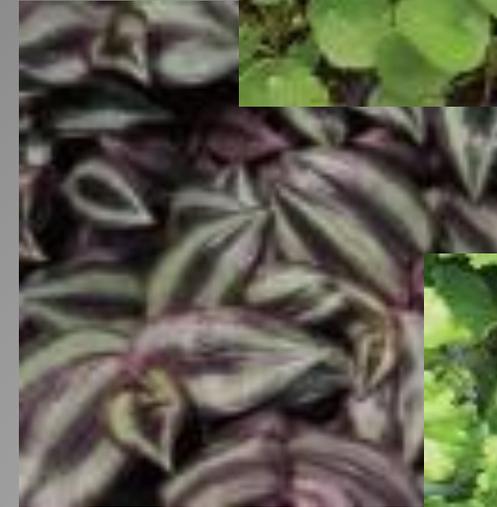
- ❑ Downy Mildew and Powdery Mildew Controls
 - Basil, Gold Sage, Rosemary often affected
- ❑ Use supplemental lighting
- ❑ Increase temperature in the evening
- ❑ Water early in the day

- ❑ Chemical treatments when required:
 - Ranman, Cease, Milstop, Regalia, Suffoil-X



Year-Round Foliage Production

- ❑ Hanging baskets and 4" pots produced year-round
- ❑ Market is gaining in popularity
- ❑ Pilea, Peperomias, Spider Plants, Zebrina, Senecio Gibasis, Swedish Ivy...
- ❑ Nematodes applied in early stages
- ❑ *A. cucumeris* and *A. californicus* applied with blower
- ❑ Minisachets used on hanging baskets
- ❑ Stock plants refreshed frequently to avoid pest issues
- ❑ Mainspring drenches used on stock plants
- ❑ Thrips control important; some genera can harbor INSV





Minisachets Used in Foliage Hangers

These have worked extremely well for spider mite control
It is difficult to effectively have sprays reach the center of
baskets once they are hung



Summary of Current Program with Biocontrols

- ▶ 250,000 *A. cucumeris* released weekly
- ▶ 25,000 *A. californicus* released biweekly
- ▶ 25,000 *A. swirskii* released weekly in early summer
- ▶ Pollen applied biweekly through summer/early fall
- ▶ 10,000 *Eretmocerus eremicus* released weekly on poinsettias
- ▶ 62,500 *Stratiolaelaps* released weekly
- ▶ *Delphastus catalinae* released as needed on poinsettias
- ▶ 250 mil–500 mil Nematodes applied weekly
- ▶ *A. cucumeris* minisachets used in all hanging baskets
- ▶ *Aphidius colemani*/barley banker plants used in spring

Biocontrol Program

- ▶ Benefits achieved from scouting and early treatment:
 - ▶ Significant reduction in overall pesticide use
 - ▶ Elimination of more toxic products
 - ▶ Better efficacy due to targeting pests and life stages more specifically
 - ▶ Decreased resistance to pesticides
 - ▶ Higher quality crops
 - ▶ Less pesticide exposure for employees
 - ▶ Customer appreciation of biocontrols



Effects of Biocontrol Program on Sustainability Initiative

Products Used by MPS Rating System			
2006 Products	2010 Products	2016 Products	2018 Products
16	18	25	24
14	17	15	13
17	11	9	8
		3	6
Green = Least toxic and most environmentally friendly			
Amber = Moderate in toxicity and environmental impact			
Red = Most toxic and/or most negative impact on environment			
White = Very low impact; not included in crop protection agent totals			

- Use of “Green” Crop Protection Agents (CPA’s) greatly increased from 2006 to 2018 (CPA’s include PGR’s, pesticides, herbicides)
- Use of CPA’s with more negative environmental impacts decreased over the same time period
- Majority of “red” CPA’s are PGR’s and fungicides

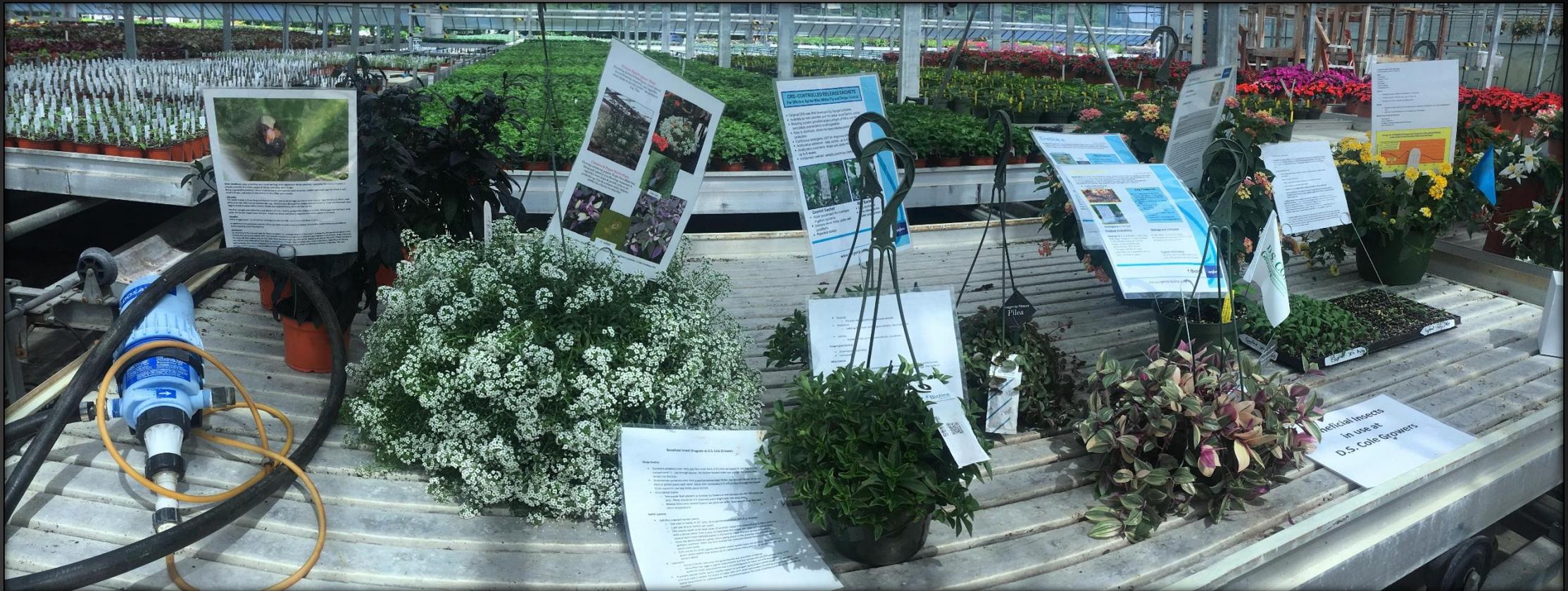


Economic Impact of Biocontrol Program

Costs for chemical purchases were reduced from approximately \$26,000 in 2006 to \$19,000 in 2016

Cost of beneficial insects and biocontrols was approximately \$15,000 in 2016 >>>

Labor cost is less for releasing beneficial insects than spraying the majority of crops as was done prior to 2006



Promoting Biocontrols and Sustainability

Display with information about IPM Program at our Annual Open House

Information about our participation in the MPS Sustainability Certification Program was also displayed

Carol Glenister presented an hour-long talk and was available all day for attendees to visit with.