Final Project Report to the NYS IPM Program, Agricultural IPM 2002-2003

Title: Prevention of Diseases in Zinnia Plug Production

Project Leaders: Jana Lamboy, NYS IPM Program
Nellie Call, Flower Fields, Elba
Roxanne McCoy, Lilies of the field, West Falls

Cooperators: Art Harrington, Harrington's Greenhouses, Elba
Karen Hall, Erie Co. CCE, East Aurora
Deborah Kwasniewski, Taylor Greenhouse, Portland
Karen Snover, Plant Disease Clinic, Cornell University

Type of Grant: Demonstration and Implementation, Greenhouse Ornamentals
Use of microbials and active composts
Cultural methods, sanitation

Project Location: Ontario, Genesee, Tompkins
Results will be useful across NY, the Northeast, and nationally

Abstract:
Nearly all cut flower and bedding plant growers plant zinnias. Many growers observe losses in crop quality due to leaf spot diseases. This project entailed seed treatment trials to study source of inoculum and an efficacy trial of disease suppressive compost in the greenhouse. Zinnia seeds from all sources tested were contaminated with many microorganisms. Clorox at 20% for 20 minutes reduced general contamination significantly, but possible *Alternaria* and *Xanthomonas* were isolated from the treated seeds of all six varieties. Hot water treatment (52°C for 20 minutes) reduced the presence of fungi and bacteria completely from seeds of 5 varieties. One greenhouse grower is using PlantShield preventively now on bedding plants. The goal in the other greenhouse is to avoid growing zinnias under hanging baskets, and to move the plants out when small so that they are not crowding each other in the flat.

Background and Justification:
A primary goal of integrated pest management is to understand the sources of pest problems and the cultural practices that could be used to prevent them. Greenhouse plug production can be the site of infestation and disease development for many pests; it is worth the effort involved to ensure that the plugs are free of disease and insects when they are transplanted. Nellie Call, a commercial vegetable IPM scout who has her own cut flower business near Batavia, suggested that we study the sources of inoculum and develop a strategy to prevent zinnia diseases in the plug stage in the greenhouse. *Xanthomonas campestris* pv *zinniae* and *Alternaria zinniae* can be disseminated by seed; *Botrytis cinerea* is likely to be present in greenhouses. Nellie's zinnia plugs are grown by Harrington's greenhouse in Elba. Her fields are on windy land that slopes toward the west. Roxanne McCoy's fields lie in a very different environment, sheltered by woods, and are subject to some different key pests. Her plugs are grown at Taylor Greenhouse in Portland.

Objectives:

1) Compare disease incidence of tall zinnias from
   - a. different seed sources and varieties
   - b. seed treatments: hot water or Clorox
   - c. in the greenhouse and in the field
   - d. plugs grown in suppressive compost

2) Note the earliest appearance of disease symptoms; send samples to the Plant Clinic for identification from both greenhouse and field.

3) Observe greenhouse cultural practices to see if some changes are necessary- nitrogen too high? ventilation poor? sanitation adequate?

4) Project evaluation: Summarize the project with a slide presentation for extension educators and growers at meetings- develop the "elements" for growing zinnia with minimal pesticide use

Procedures:

1) a and b. Zinnia seed treatments were conducted two times: at the IPM House kitchen with the seeds air dried and then planted in compost or peat lite mix at Harrington's; and treated at the Plant Diagnostic Clinic in Ithaca followed by plating seeds on agar and isolating pathogens.

In Geneva, seeds from two different tall zinnias were treated, Cut and Come Again and Envy. At the Plant Disease Clinic, six varieties were tested: Benary Giant, Cut and Come Again, Envy, Magnificent Mixture, Ruffles, and State Fair. In both experiments the seed treatment consisted of 52° C water for 20 minutes, and 20% Clorox for 20 minutes. At the Ithaca Clinic, seeds were examined using acidified potato dextrose agar (medium for fungi) and on Tryptic soy agar (medium for bacteria). Five seeds were positioned on each agar plate; the plates were scored as percent of the total number of seeds exhibiting yellow bacterial colonies or fungi with the morphology characteristic of *Alternaria*. At the time of this report, isolates were being transferred to new plates or grown on for identification to species by either sporulation or Biolog testing.

1) c and d. BioComp compost was purchased from Penn State Seed Co. for use at the Harrington greenhouse in comparison with their standard peat/lite mixes. At Harrington's, 12 flats of 72 transplants were grown: Cut and Come Again (6), and Envy (6). At the Taylor Greenhouse, Roxanne McCoy's 10 flats of 288 plants of Benary Giants were produced in standard grower mix using PlantShield.

2) Karen Hall observed conditions at the Taylor Greenhouse, and Jana observed the results at Roxanne McCoy's cut flower operation. Nellie Call scouted at Harrington's greenhouse, and also in her field of cut flowers. Observations were made during transplant production, at the time of field planting, and later at time to harvest flowers. Fungicides (Pencozeb and Warrior) were applied 7/10/02 and 7/27/02 at Nellie's when it was necessary to treat for tarnished plant bug.

3) Cultural practices in the greenhouses were observed.

4) Photographs were taken in the greenhouse and field. Follow up experiments will be done in a greenhouse at the Geneva Experiment Station to test microbials and other new products as seed treatments and preventives.

Results and Discussion

The zinnia seeds as they came out of the packets carried so many microorganisms that it wasn't possible to count the pathogens. The 20 min Clorox treatment acted like surface sterilization, so that *Alternaria*-like, *Fusarium*-like, and *Xanthomonas*-like colonies could be isolated. The hot water treatment (52C for 20 min) essentially cleaned the seeds, killing bacteria and fungi. This is a different result from the Riverhead Lab last year, when the hot water treatment killed fungi but not bacteria. It suggests that slight differences in methods could produce clean seeds reliably. The detailed methods for the heat treatment utilized by the two laboratories will be compared before giving any recommendations to growers. As in last year's trial, Ruffles was the least contaminated seed variety (Table 1).

Table 1. Zinnia Seed Contamination and Disinfection, Plant Disease Clinic, Ithaca

Zinnia seed variety	Control, not treated	20% Clorox 20 min			52° C 20 min		
		% A	% F	% X	% A	% F	% X
Benary Giant	many organisms*	64%	12%	12%	*	*	2%
Cut and Come Again	many organisms	32%	12%	16%	0	0	0
Envy	many organisms	34%	12%	24%	0	0	0
Magnificent Mixture	many organisms	44%	12%	12%	0	0	0
Ruffles	many organisms	16%	12%	12%	0	0	0
State Fair	many organisms	56%	2%	18%	0	0	0

A= *Alternaria*-like
F=*Fusarium*-like
X= *Xanthomonas*-like
**Fusarium, Aspergillus, Rhizopus* and others

Seed treatments at the IPM House and effects on germination

Are the seed treatments cost-effective for growers? Seed treatment that increases the quality of seedlings and field cut flowers substantially could be cost-effective, but only if that value is worth the time and trouble and loss in germination.

Seeds were sown at the commercial greenhouse to observe the effects of hot water and Clorox seed treatments on two zinnia varieties. Half of the seeds were planted in active compost and half in standard mix, in 72 plug trays, two seeds per plug. Twelve flats of zinnias were planted, without replication of treatments. The germination of Cut and Come Again was adversely affected by hot water treatment for 20 minutes, but not of the Envy seeds (which have a lower germination rate and more disease). The Clorox treatment for 20 minutes did not reduce germination of either variety. It might have increased the germination of Envy seeds. Some of the foliar disease observed was due to Botrytis, and is not considered to be seed-borne. Also, seedlings may have succumbed to root rot so that germination losses observed might not be due to the seed treatments.

Table 2. Effects of seed treatment on germination and disease observed at transplant

Zinnia variety	Germinated seeds	Diseased seedlings
Cut and Come Again		
control, compost	93%	1%
control, soil mix	87%	0
hot water 52°C, compost	64%	0
hot water 52°C, soil mix	69%	13%
Clorox, compost	91%	1%
Clorox, soil mix	85%	2%
Envy		
control, compost	58%	16%
control, soil mix	59%	25%
hot water 52°C, compost	58%	2%
hot water 52°C, soil mix	53%	7%
Clorox, compost	68%	0
Clorox, soil mix	62%	36%

Zinnia samples sent to the Plant Diagnostic clinic in 2002 were infected with *Alternaria, Xanthomonas, Botrytis, Fusarium,* and *Rhizoctonia.*

Leaf Spot Diseases in the Greenhouse and Field

At Roxanne's cut flower operation, the first set of transplants suffered frost damage; the second planting did not have foliar disease problems in the field. Her main pests are weeds and deer.

At Harrington's Greenhouse, zinnia seeds were planted later, in standard soil mix with no microbial or fungicide treatments. There was less time and opportunity for diseases to spread than last year. Plants were generally healthier, with differences between varieties as noted at transplanting on May 30, 2002:

Table 3. Disease rating of transplants from Harrington's Greenhouse (Nellie Call)

Zinnia variety	diseased seedlings	dead or too diseased to plant
Benary Giants (mix)	85%	15%
Benary Giants (colors)	78%	13%
Envy	100%	33%
Oklahoma	90%	10%
Ruffles	50%	11%

A second planting of Ruffles was after the cool spring weather and the heavy rush in the greenhouse. These transplants did not have any disease symptoms.

The differences in the transplants between varieties seemed to even out during the first part of the season when the plants were actively growing. Leaf spots showed up when growth slowed in late August, diagnosed as Alternaria. Envy was the most diseased, Ruffles the least diseased.

Powdery mildew first appeared 8/02/02 on Envy, then on the other varieties a few days later. By 9/04/02 powdery mildew was beginning to spread up towards the flower heads. It was worse in zinnias planted in the lower part of the field where air movement was blocked by a Canna lily windbreak.

Cultural Practices

Potential greenhouse conditions that might lead to greater disease include high humidity, crowding as seedlings grow larger, baskets suspended over the benches, watering late in the day, over or under fertilization, and presence of other crops in the greenhouse with leaf spot diseases. Cultural practices that may reduce the amount of disease include using preventive treatments such as ActinoIron, Mycostop or SoilGard in the mix, PlantShield drenches, or active composts. In the last two years we learned that planting early was not a good gamble; disease incidence on transplants is worse when they are held too long in the greenhouse. Early frosts damaged seedlings in the field. It appears that the single most valuable change in practices might be to plant seeds late, when the greenhouse is less crowded and ventilation is better.

Evaluation

Isolated yellow bacterial colonies were tested with a Biolog kit at Riverhead after inoculation on healthy zinnia seedlings and recovery of yellow colonies. They did not fit the profile for *Xanthomonas*, but we are still isolating yellow bacteria from zinnia seeds and testing them. The results of this project will be presented in a talk on cut flower IPM. This winter we will work on developing detailed strategies for zinnia leaf spot diseases that could benefit almost all of the cut flower and bedding plant growers in New York and the Northeast. Photographs and results of this project will be incorporated in a presentation at the New York State Vegetable Growers Conference in Syracuse, Feb. 2003, Cut Flower IPM: Key Pests and Strategies.

References

R. K. Horst, 1979. Westcott's Plant Disease Handbook, 4th Edition. Van Nostrand Reinhold.
H. Dillard, 1999. New York State Vegetable Project Reports Relating to IPM, 1999
Also see: Managing bacterial diseases of pepper and tomato.
http://www.nysipm.cornell.edu/publications/bacterial_dse.html
D. L. Stider. 1979. Methods to eradicate *Xanthomonas* on zinnia seed. Plant Disease Reporter 63:873-876.