



# Level of Adoption of IPM in New York Greenhouses

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# Level of Adoption of IPM Practices in New York Greenhouses

**F**loriculture is an important and growing industry that contributes to the local economy and enhances community quality of life. The floriculture industry in New York ranked 6th among the states with production sales in the year 2000 of \$316.4 million. Greenhouse area increased 16.9% from 1999 to 26.2 million square feet in 2000 (2002 Outlook Handbook, Chapter 11, W. L. Uva). The greenhouse operations produce a wide variety of crops, including bedding plants, flowering potted plants, cut flowers, vegetable transplants, and herbs.

Among the many challenges faced by New York growers are high costs of heating and labor, and management of diseases and insects. Education by the New York State Integrated Pest Management Program in partnership with Cornell Cooperative Extension began more than 20 years ago to provide

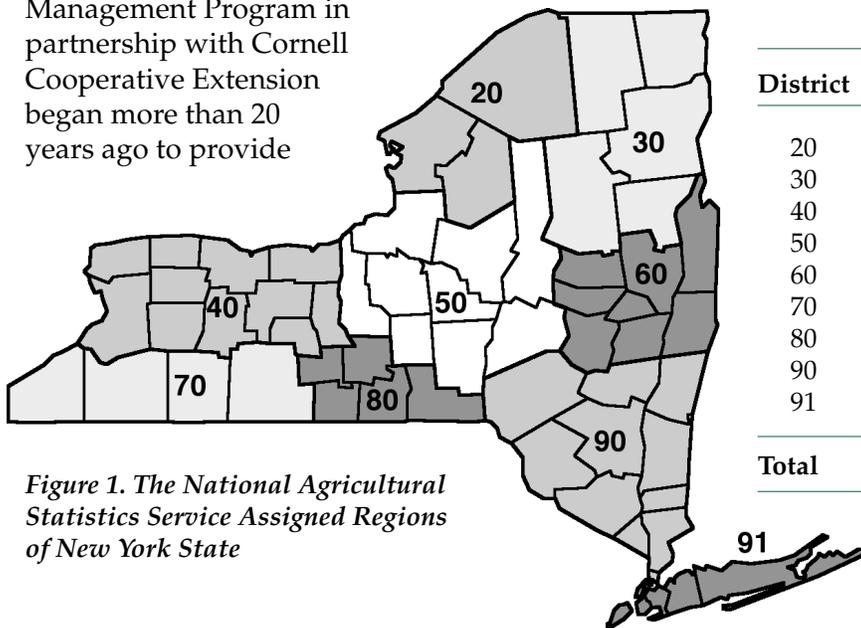


Figure 1. The National Agricultural Statistics Service Assigned Regions of New York State

educational assistance. Growers also take advantage of programs such as the Ohio Short Course and the New England Greenhouse Conference.

The NYS IPM Program and the New York Agricultural Statistics Service conducted a survey of registered greenhouse operators in 2000. The objectives of the survey were to evaluate progress in the implementation of greenhouse IPM, to determine

any regional strengths and weaknesses, and to compare the implementation of IPM practices adopted by different sized operations. The survey instrument was written with the advice of S. Keating and B. Blackson of the New York State Agricultural Statistics Service, Albany. The IPM survey was mailed Jan. 6, 2000 by the NYS Department of Agriculture and Markets along with the annual floriculture survey. Out of 875 surveys mailed, 247 growers sent the completed survey back voluntarily. NASS conducted follow-ups by telephone (170) and personal interview (90), achieving balance in sampling the nine districts in the state and the different sized operations. A total of 507 responses were tabulated.

TABLE 1. Response Summary

District	Mail	Phone	Interview	Total Reports
20	3	7	5	15
30	7	4	5	16
40	54	32	22	108
50	28	28	7	63
60	36	25	17	78
70	15	9	2	26
80	14	12	4	30
90	49	25	14	88
91	41	28	14	83
<b>Total</b>	<b>247</b>	<b>170</b>	<b>90</b>	<b>507</b>

TABLE 2. Total Protected and Covered Growing Area of Respondent Firms

	Number of Firms	Percent
Less than 10,000 ft <sup>2</sup>	206	41
10,000 to 43,560 ft <sup>2</sup>	226	45
Greater than 1 acre	75	14
<b>Total</b>	<b>507</b>	<b>100</b>

**TABLE 3. Crops Grown by the Respondents to the Survey**

	Number of Firms	Square Footage	Average Square Footage
Bedding plants (flowers)	433	8,864,193	20,472
Vegetable transplants	292	6,094,358	20,871
Herbaceous perennials	214	2,432,407	11,366
Lilies or other bulbs	112	378,851	3,383
Poinsettia	140	3,308,947	23,635
Chrysanthemum (indoors)	75	683,067	9,108
Chrysanthemum (outdoors)	196	4,817,099	24,577
Other flowering potted plants	199	2,646,602	13,300
Foliage plants	94	275,534	2,931
Herbs	161	232,145	1,442
Greenhouse vegetables	37	143,071	3,867
Cut flowers (indoors)	29	558,441	19,257
Cut flowers (outdoors)	52	3,759,664	72,301

## The Diversity of IPM Adoption Levels

The results of the survey indicate that all respondents employ some IPM practices and a majority would appreciate an opportunity to learn more. Advanced IPM practices, such as the use of microbials and beneficials for insect management, hiring a professional scout, and monitoring electrical conductivity of nutrient solutions, are routine in some operations. Almost all operations remove weeds from their greenhouses during the crop season, but a few do not. Only about one third of growers keep written records of scouting data. Management practices were assigned points that reflected degree of IPM adoption and allowed us to graph the IPM adoption continuum (the number of growers at each level of implementation). Survey questions focused on practices affecting pest management, including sanitation, cultural practices, basic IPM elements, disease management, and insect management. The survey point system, questions, and answers are described in detail in the last section of this report.

### Preseason sanitation practices

Growers generally take the opportunity to clean up

between crops. About two-thirds of growers allow a one-month fallow period. 90% of growers surveyed remove all organic debris, and 97% start their crops in a weed-free greenhouse.

### Recording cultural practices

Horticultural practices are critical to the management of diseases and arthropod pests. Recording information such as changes in environment and nutrient solution allows the grower to develop the site history and to communicate with employees, consultants, and educators. Life cycles and reproductive rates fluctuate according to the environment, and keeping track of pest life stages can help to determine spray frequencies and timing the release of predators. About 40% of growers record maximum/minimum temperatures. Monitoring water quality is extremely important, since municipal and well water can change pH and alkalinity during the summer. About 40% of growers monitor pH; only 27% monitor electrical conductivity (EC), the saltiness of water and nutrient solutions.

### Basic IPM practices

The basic elements of IPM include scouting, record keeping, weed management, correct pest identification, and sprayer calibration. Most

**TABLE 4. Greenhouse IPM Practices, Average Score by Questionnaire Subject and Region**

Survey Subject	Max. Score	Average Score by Region									State Average
		20	30	40	50	60	70	80	90	91	
Sanitation	16	12.0	10.4	10.8	11.0	11.3	10.4	10.0	9.8	10.6	10.7
Culture	10	3.5	3.3	2.3	2.4	2.6	1.7	3.0	2.3	2.1	3.1
Basic IPM	18	10.2	9.4	9.4	9.9	9.6	9.8	9.1	9.8	9.6	9.6
Disease mgmt	11	6.9	5.8	6.5	6.4	6.4	6.6	6.2	6.3	6.6	6.5
Insect mgmt	15	7.4	8.5	7.1	7.1	8.0	7.2	7.0	7.6	7.5	7.5
<b>Total</b>	<b>70</b>	<b>39.9</b>	<b>37.3</b>	<b>36.1</b>	<b>36.8</b>	<b>37.8</b>	<b>35.6</b>	<b>35.4</b>	<b>35.9</b>	<b>36.5</b>	<b>36.6</b>

greenhouses are scouted regularly: 88% of growers scout weekly or more often. Most greenhouse operators scout themselves (81%). Designated employees (9.5%), the person watering (6.1%), and professional scouts (2.2%) monitor in the other operations. Scouting has an impact on decision making: 40% of growers always base their management tactics on scouting results, and another 25% sometimes do. The remaining 35% of growers are not basing their sprays on actual observed pest populations. We hope to work with this group in the future to explain the advantages associated with scouting. Without scouting records, growers lose the opportunity to communicate easily with employees and to predict future pest outbreaks based on experience. Weeds harbor insects and disease beneath the benches. 96% of growers reported that they weed during crop production. 48% of growers sent pest samples to Cornell Cooperative Extension or to clinics for identification. 48% calibrated their sprayers at least once per year; the others need training about effective application.

### Disease management

Most growers demonstrated awareness of the principles of disease management: 94% inspect new shipments of plants and 98% remove infected leaves and flowers during the growing season. About 48% remove diseased prunings in a covered garbage can; we should teach the other growers about dispersing fungal spores while moving debris through the greenhouse. Half of the responding growers ventilate based on temperature; 45% manage humidity. 70% disinfect their cutting tools.

### Insect management

Of the 68% of growers who use yellow or blue sticky cards, about 29% change the cards weekly. Microbial products are being used for insect control by 38% of growers. About 13% are releasing predators or parasites for biological control. 97% identify insects before making a pesticide application.

## The IPM Continuum for Five Subject Areas

The concept of an IPM continuum is based on an increased knowledge base over time as growers accumulate experience. The reliance on pesticides to solve crop problems will decrease when growers understand pest biology and pest prevention. Instead of calendar-based applications, they will monitor pest levels and spray at the most effective time. The survey responses for basic IPM and insect

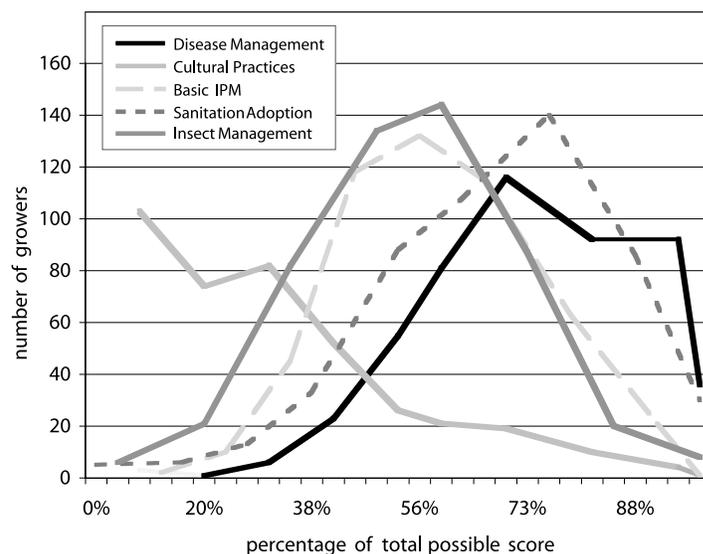


Figure 2. The IPM Continuum for Five Subject Areas

management appear as a normal distribution curve, with most growers' scores clustering around 55% of total possible points (Figure 2). Disease management and preseason sanitation peaked to the right, suggesting greater adoption of these practices. The lowest scores are observed in recording cultural practices, suggesting that this area offers the greatest opportunity for teaching. The relevance of fertility, water quality, and environmental parameters to pest population biology and disease progression can be illustrated with specific examples. Hands-on training can increase familiarity with equipment and promote wise selection of monitoring instruments.

## IPM Adoption in Greenhouse Operations of the New York Regions

There is a trend of stronger IPM implementation at larger operations, perhaps because it makes sense in larger companies to define the role of IPM scout or pest manager and focus more dollars on education and resources. This is particularly evident in the graphs of cultural practices and of basic IPM (Figure 3). The trend for better IPM adoption in larger businesses is not so strong in sanitation, insect, and disease management. Surprisingly, the level of IPM adoption across the state clusters around the state average, with no particular region displaying a prominent lack of IPM adoption. On Long Island (Region 91), the larger operations scored higher in all five aspects of IPM. In central New York (Region 50), the larger operations scored higher than the smaller operations in four out of five aspects. These results combined suggest that we should focus on trying to meet the needs of operations with fewer resources, but should not ignore any regions of the state.

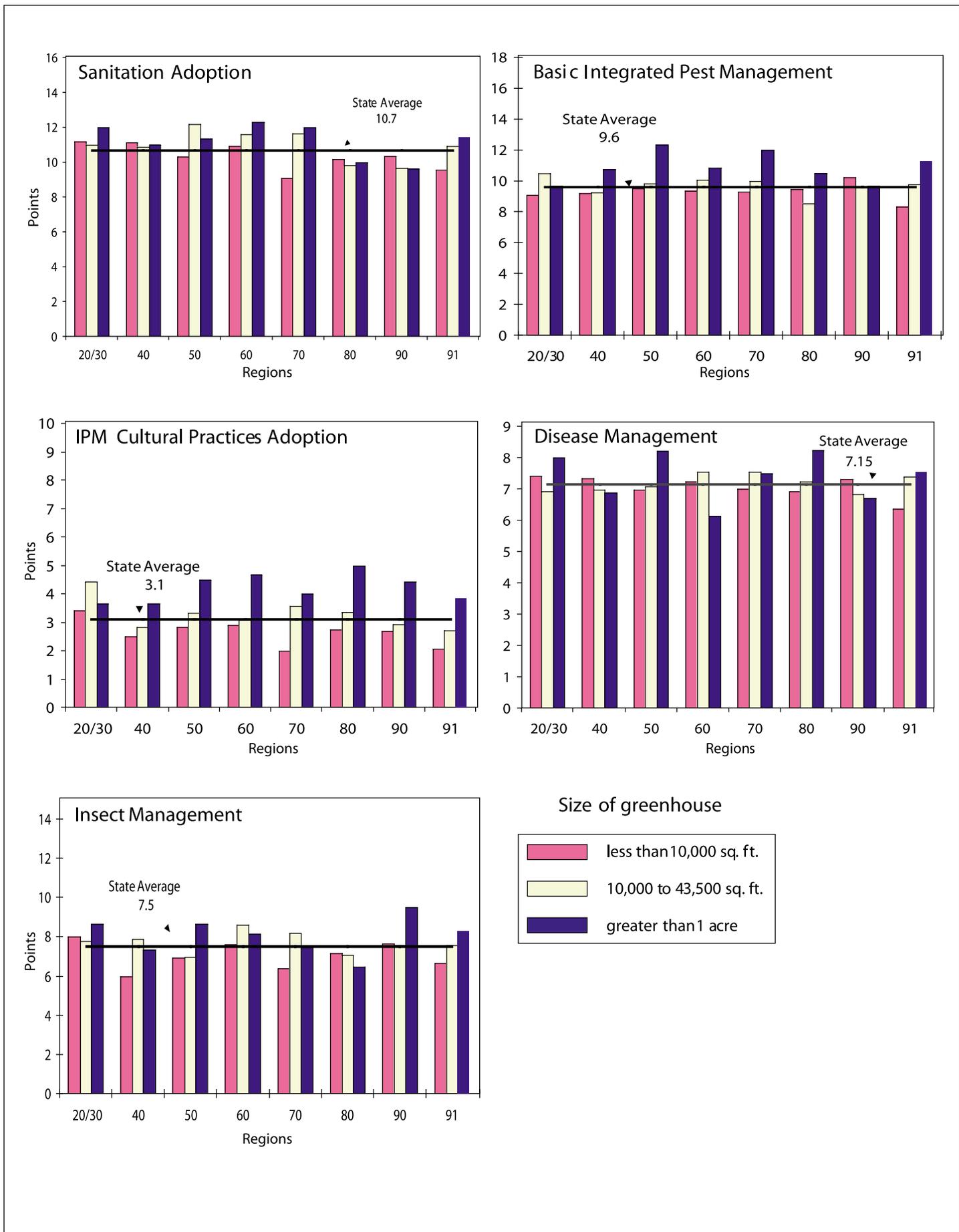


Figure 3. Scores for IPM Practices, by Region and Size of Operation.

## Survey Questions and Answers on Greenhouse IPM Practices

The statisticians at the New York Agricultural Statistics Service analyzed the results of the survey in a report that included for each question the number of respondents who did not answer, as well as those who answered yes or no. A copy of that report is available on request. In the following report, “number of growers” represents the number of growers who gave a particular response to or answered “yes” to the question; “percent” is the “number of growers” written as a percentage of the total number of respondents (507).

The point system parallels that used in the development of the elements of vegetable production IPM for the purposes of IPM labeling (<http://www.nysipm.cornell.edu/elements/index.html>. see greenhouse tomato elements). Individual practices were assigned points to give credit for activities that have the potential to reduce pest populations or symptom development, thereby reducing reliance on pesticides.

### Preseason sanitation practices. Maximum 16 points

	number of growers	percent
<i>Which of the following are your customary practices?</i>		
disinfect used pots and flats (2 points)	278	54.8
use only new pots, flats (2 points)	265	52.3
remove all organic debris from greenhouse floor, benches (2 points)	451	90.0
treat floors, walls, benches with disinfectant (2 points) (such as GreenShield, Physan 20, ZeroTol)	306	60.3
disinfect irrigation system (2 points)	127	25.0
allow a fallow period (of at least one month) (2 points)	337	66.5
remove weeds from greenhouse (2 points)	490	96.6
remove weeds around greenhouse exterior (2 points)	441	87.0

### Routine cultural practices. Maximum 10 points

	number of growers	percent
<i>Do you keep records of fertilizer product, frequency, and rate?</i> (1 point)	292	57.6
<i>Do you keep records of maximum and minimum temperatures? If yes, how often?</i>		
weekly (1 point)	41	8.1
daily (2 points)	128	25.2
other (1 point)	38	7.5
<i>Do you keep records of water test results?</i> (for carbonates, pH) (1 point)	205	40.4
<i>Do you keep records of electrical conductivity (EC) of water or nutrient solution? If yes, how often?</i>		
annually (1 point)	37	7.3
monthly (2 points)	25	4.9
weekly (3 points)	44	8.7
other (1 point)	31	6.1

*Do you keep records of foliage analysis results? If yes, how often?*

annually (1 point)	54	10.1
monthly (2 points)	25	4.9
more frequently (3 points)	24	4.7

**Basic Integrated Pest Management.** Maximum 18 points

	number of growers	percent
<i>Do you remove weeds during the growing season?</i> (2 points)	489	96.4
<i>Do you scout regularly for insects and diseases? If yes, how often?</i>		
monthly (1 point)	26	5.1
every two weeks (2 points)	28	5.5
weekly (3 points)	222	43.8
more frequently (4 points)	225	44.4
<i>Who does the scouting?</i>		
I do it myself (2 points)	411	81.1
a designated employee scouts (2 points)	48	9.5
the person who waters (1 points)	31	6.1
a professional consultant (3 points)	11	2.2
<i>Do you record scouting results?</i> (1 point)	161	31.8
<i>Do you base pest management tactics, including chemical sprays, on scouting records? If yes, how often?</i>		
sometimes (1 point)	126	24.9
always (2 points)	201	39.6
<i>Do you use last year's records to predict problems?</i> (1 point)	189	37.3
<i>Do you use cooperative extension or diagnostic labs to diagnose your pest problems? If yes, how many times in the past year (1999)?</i>		
one to three (1 point)	202	39.8
4 or more (2 points)	40	7.9
<i>Do you calibrate your sprayers? If yes, how often?</i>		
Less often than annually (1 point)	46	9.1
annually (2 points)	159	31.4
monthly (3 points)	50	9.9
more often than monthly (4 points)	34	6.7

**Disease management.** Maximum 11 points

	number of growers	percent
<i>Do you inspect plants upon arrival for signs of infection?</i> (1 point)	476	93.9
<i>Do you remove diseased leaves and flowers periodically to reduce infection?</i> (1 point)	498	98.2
<i>Where are diseased plant prunings discarded for short-term disposal?</i>		
on the floor (0 points)	12	2.4
in an open bucket (1 point)	242	47.7
in a covered garbage can (2 points)	245	48.3

<b><i>Where are diseased plant prunings discarded for long-term disposal?</i></b>		
in a compost pile far from any intake vents (1 point)	256	50.5
buried (1 point)	38	7.5
municipal garbage (1 point)	205	40.4
<b><i>How frequently is the air exchanged with outside air?</i></b>		
whenever the greenhouse is too hot (1 point)	255	50.3
when my glasses fog up (1 point)	5	1.0
when the humidity reaches a specific level (2 points)	52	10.2
<b><i>Do you disinfect cutting tools? (1 point)</i></b>	355	70.0
<b><i>When do you apply fungicides/bactericides?</i></b>		
before I see symptoms (0 points)	190	37.5
whenever I see symptoms (1 point)	234	46.1
on a calendar basis (0 points)	30	5.9
after obtaining lab diagnosis (2 points)	4	0.8

**Insect management.** Maximum 15 points

	number of growers	percent
<b><i>Do you use yellow (or blue) sticky cards to monitor insect pests?</i></b> (1 point)	346	68.2
<b><i>If yes, How often do you replace them?</i></b>		
every 6 months (0 points)	42	8.3
monthly (1 point)	159	31.4
weekly (3 points)	127	25.0
more often than weekly (4 points)	18	3.6
<b><i>Do you use a microbial product for insect control ? (1 point)</i></b>	192	37.9
<b><i>If yes, which of the following:</i></b>		
NaturalisO or BotaniGard (beneficial fungus)	125	24.7
Gnatrol (beneficial bacteria)	117	23.1
Nemasys or ScanMask (beneficial nematodes)	29	5.7
<b><i>Do you use beneficial predators or parasites for biological control? (1 point)</i></b>	65	12.8
<b><i>If yes, how often:</i></b>		
weekly (2 points)	17	3.4
monthly (2 points)	15	3.0
three to four times a year (2 points)	12	2.4
twice a year (0 points)	8	1.6
once a year (0 points)	13	2.6
<b><i>Do you identify insects before applying pesticide?</i></b> (1 point)	491	96.8
<b><i>If yes, how often:</i></b>		
sometimes (0 points)	30	5.9
usually (2 points)	66	13.0
always (3 points)	395	77.9
<b><i>Would you like to learn more about integrated pest management?</i></b> (2 points)	335	66.0