MISSOURI FRUIT AND VEGETABLE PRODUCERS

Survey Report

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Background

In Missouri there is a need to bring research-based information on all aspects of Integrated Pest Management (IPM) to the state's citizens. The Lincoln University State IPM Program was established in April, 2010 in response to that need. With an emphasis on fruits and vegetables, the goal of this new program is to develop and promote affordable and environmentally compatible alternative pest management strategies to combat pests of specialty crops.

In October, 2013, the IPM Specialist at Lincoln University's Cooperative Research and Extension unit met with staff from the Assessment Resource Center (ARC) at the University of Missouri (MU) to discuss conducting a statewide survey of Missouri fruit and vegetable producers. Extension staff members were interested in getting a sense of the problems faced by commercial growers in order to better help growers with their pest management decisions.

Survey Development and Administration

Working with the IPM Specialist and his advisory committee, ARC staff developed a survey of 25 questions to investigate the farming practices of vegetable and fruit producers, including their knowledge and methods of pest management.

A purchased mailing list of Missouri fruit and vegetable producers provided 493 names and addresses. On March 17, 2014, a heads-up post card was sent by ARC to 493 growers to let them know they would soon receive a survey from Extension. Twenty-seven post cards were returned with undeliverable addresses.

From March 25, 2014 to April 4, 2014, Lincoln University Extension printed the survey and prepared and mailed the packets which consisted of the following:

1. a mailing envelope from ARC,
2. a cover letter printed at the beginning of the survey,
3. a four-page survey, and
4. a business return mailer addressed to ARC.

Data collection ended April 29, 2014. Of the 90 surveys returned, 63 provided useable data showing an approximate response rate of 14%. The 27 surveys that were returned but not used for data analysis were blank and/or from people who were not currently farming fruits or vegetables. A few of the farmers noted in comments that they were retired or that they owned a farm, but did not farm it themselves. All tracking information can be found in Table 1.

This report includes the responses from the 63 completed surveys. Although the survey was intended for commercial growers, a small group of non-commercial growers also answered the survey. Because there were few responses, the responses from these non-commercial growers were retained in the dataset. During analysis, when differences between the responses of commercial and non-commercial growers differed, results were reported by these categories separately.

Table 1: Survey Administration

Distribution	Count
Wave 1: Heads-up post card	
Sent	493
Total undeliverable post cards	27
Wave 2: Survey packet	
Sent	493
Total undeliverable packets	26
Totals	
Total undeliverable addresses	33
Total addresses receiving a packet	463
Returned surveys/notes*	90
Responses noting that survey did not apply to them*	27
Possible respondents	436
Completed surveys	63
Response rate	14.4%

*Some notes were returned and some surveys were returned blank and with notes: 15 do not grow fruits/vegetables, 7 are retired, 3 are landowner and not the farmer, 2 sold the property

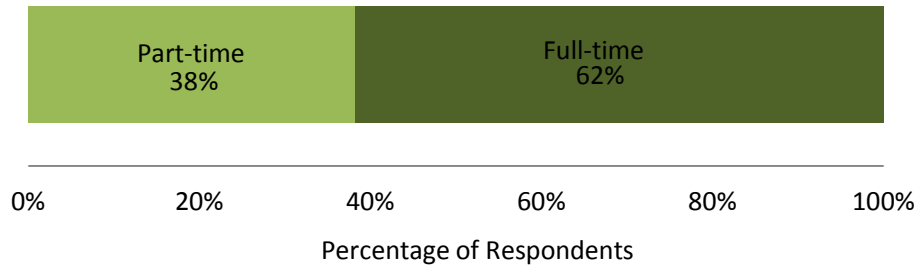
Survey Results

The survey results were calculated from the 63 respondents reporting experience farming fruits or vegetables.

Farming Practices

Of the 63 farmers surveyed, 55 identified their current amount of farming: 34 are full-time farmers and 21 are part-time farmers (Graph 1).

Graph 1: Full-time and Part-time Farming Status

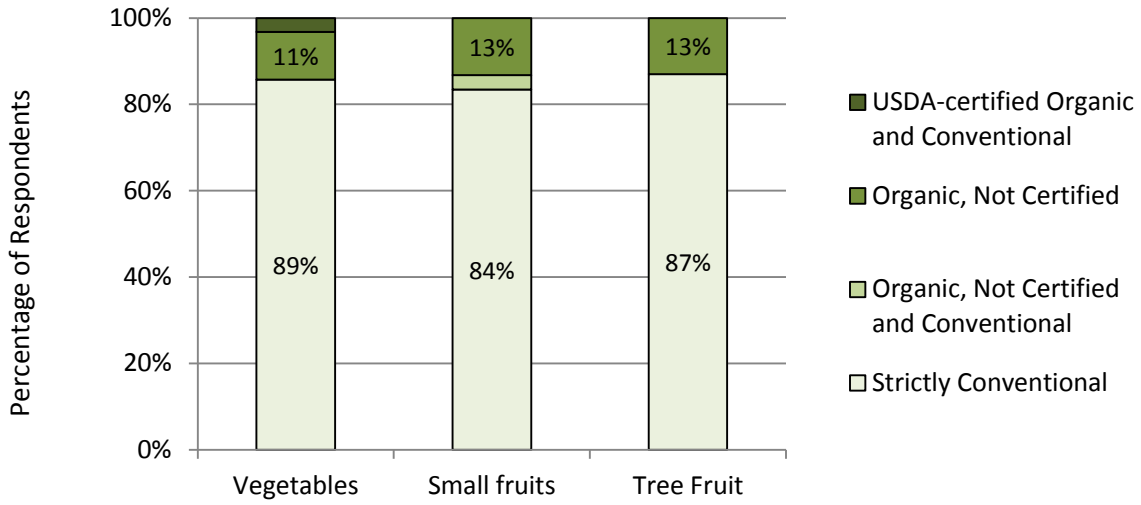


Note: 8 farmers did not respond to this question (n=55).

Farmers were asked to identify their farming practices by selecting whether they used USDA-certified organic; organic, but not certified; or strictly conventional practices for growing vegetables, small fruits,

and tree fruits. Between 84% and 89% of respondents reported using strictly conventional practices. One farmer reported being USDA-certified organic for growing vegetables.

Graph 2: Farming Practices



Note: Of the 63 people surveyed, 36 farmers reported growing practices for vegetables, 31 farmers reported growing practices for small fruits, and 15 farmers reported growing practices for tree fruits.

Of farmers surveyed, 15% of respondents reported using a high tunnel for one or more crops (Table 2). Of the nine farmers using a high tunnel, most report using it to grow tomatoes and other vegetables (Table 3).

Table 2: High Tunnel Use

	Count	Percent
Use high tunnel	9	15%
Do not use high tunnel	50	85%
Total	59	100%

Note: 3 farmers did not respond to this question.

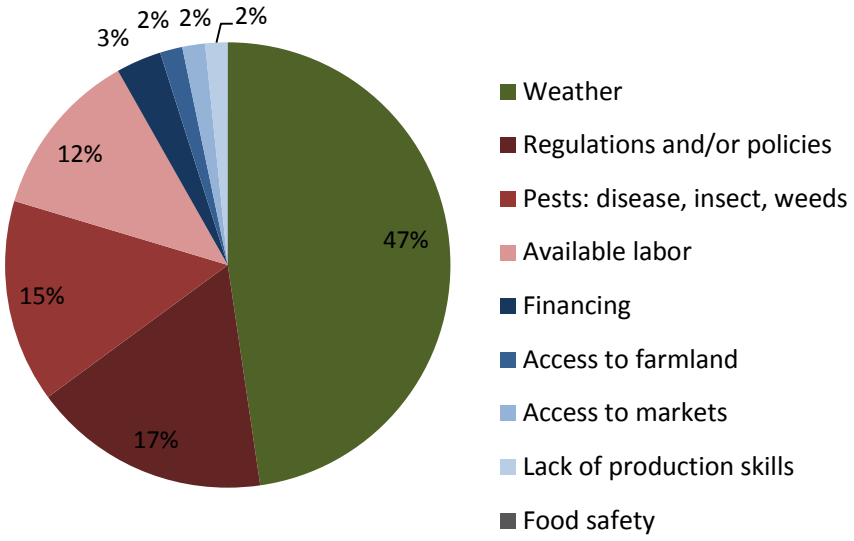
Table 3: High Tunnel Use by Produce Type

Produce Type				
Tomatoes	Other Vegetables	Small Fruits	Herbs/ Plants	Other
8	6	2	2	1
89%	67%	22%	22%	11%

Note: 9 farmers reported using a high tunnel; some farmers selected multiple produce types for which they use a high tunnel, so percentages add to more than 100%.

Farmers were asked to select the one biggest challenge on their farm from nine options. Almost half of the respondents selected weather as the biggest challenge. Regulations and/or policies, pests, and available labor were also frequently identified as the biggest challenge (Graph 3).

Graph 3: Biggest Challenge on Farms



Note: 3 farmers did not respond to this question (n=59).

Fruit Producers

Of the farmers surveyed, 47% reported growing small fruits commercially, and 19% reported growing tree fruits commercially (Table 4).

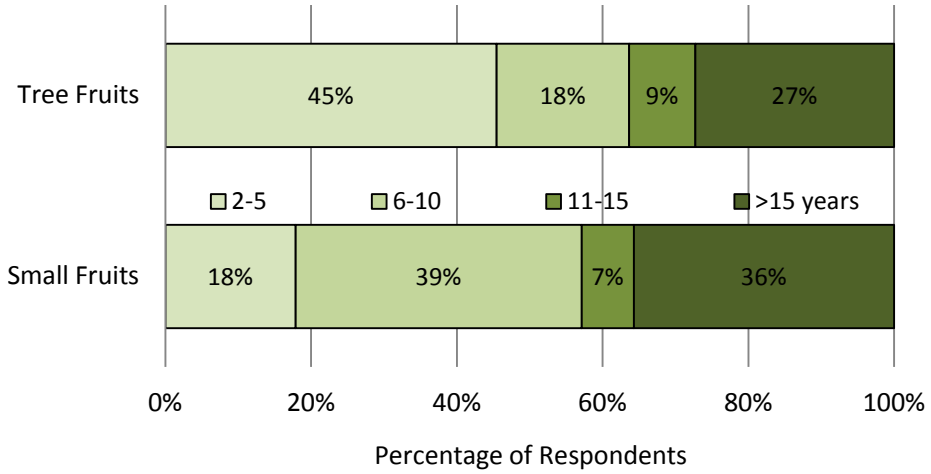
Table 4: Commercial Fruit Growers

	Produce Type	
	Small Fruits	Tree Fruits
Grow commercially	27 47%	10 19%
Do not grow commercially	31 53%	44 81%
Total	58 100%	54 100%

Note: Farmers were identified as commercial growers if they reported "yes" when asked if they grew commercially or if they reported that they have been growing "commercially/for sale" for more than one year.

Fruit growers were asked how long they had been growing fruit commercially. Of the farmers who grew small fruits commercially, 39% had been growing for six to ten years and 36% had been growing for more than fifteen years (Graph 4). Of the farmers who grew tree fruits commercially, 45% had been growing for two to five years and 27 % for more than fifteen years.

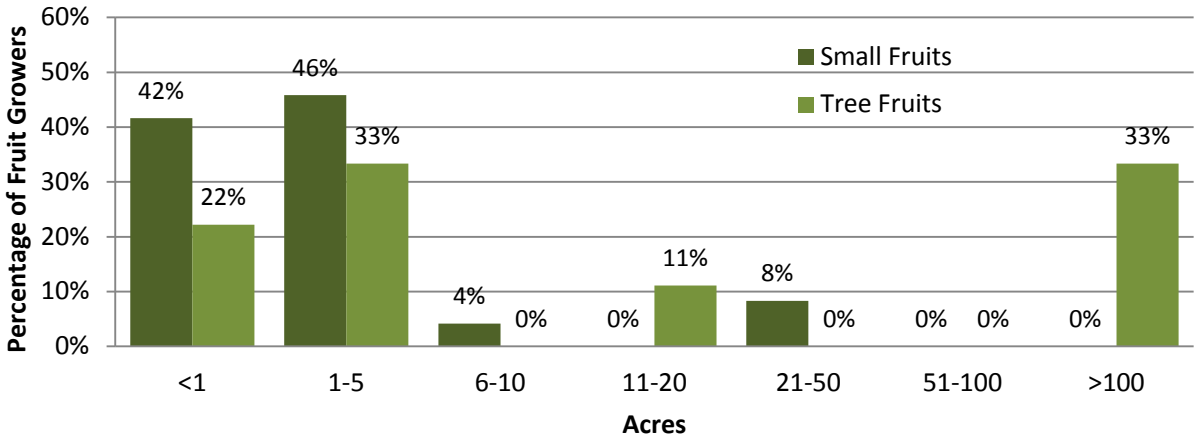
Graph 4: Years in Fruit Production



Note: 28 farmers reported number of years in production for small fruits and 11 farmers reported years in production for tree fruits.

Of the farmers who grew small fruits commercially, 88% farmed up to five acres (Graph 5). Of the farmers who grew tree fruits commercially, 55% farmed up to five acres and 33% farmed more than one hundred acres.

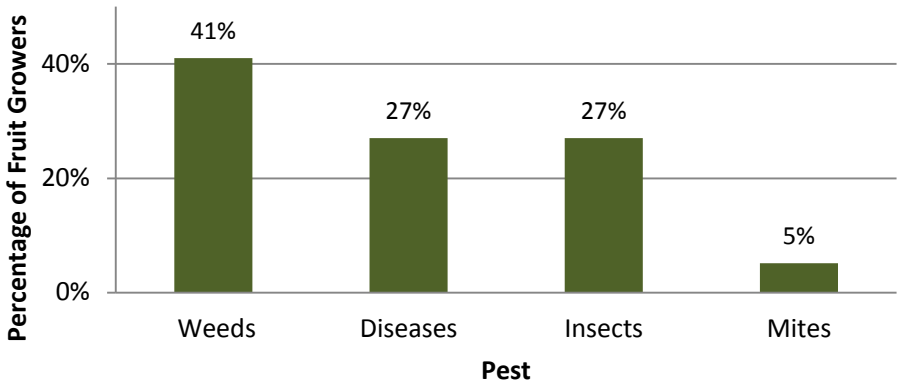
Graph 5: Acres in Fruit Production



Note: 24 farmers reported acres in production for small fruits; 9 farmers reported acres in production for tree fruits.

Farmers were asked to select all significant pests in their small-fruits production system from four choices. Of the commercial small-fruit growers, 41% selected weeds. Diseases and insects were also frequently selected as the most significant pests in their small-fruits production system (Graph 6).

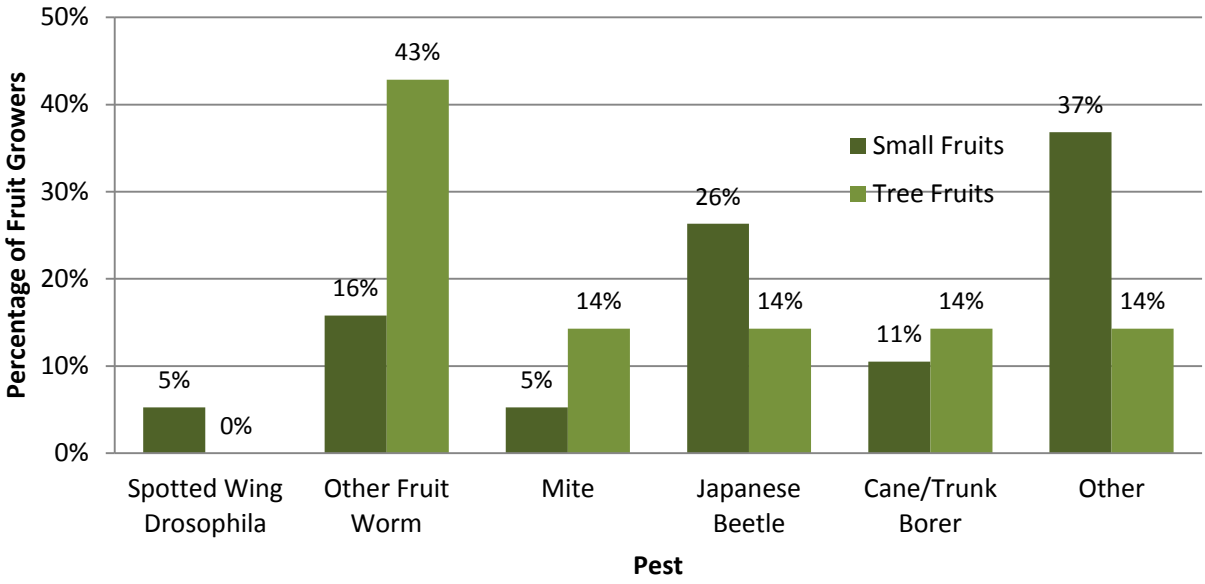
Graph 6: Significant Small Fruit Pests



Note: 26 farmers reported one or more significant small fruit pests, giving a total of 41 responses.

Growers were asked what the one most-significant insect pest in their orchard from six choices. Of the small fruit growers, 26% reported japanese beetles and 37% selected other (Graph 7). Of the tree fruit growers, 43% reported other fruit worms (not spotted wing drosophila).

Graph 7: Most Significant Insect Pest in Fruit Orchards



Note: 19 small fruit farmers and 7 tree fruit farmers responded to this question.

Within the commercial fruit growers, 78%–79% use conventional farming practices, with some using organic practices (Table 5). No surveyed fruit growers were USDA-certified organic growers.

Table 5: Farming Practices of Commercial Fruit Growers

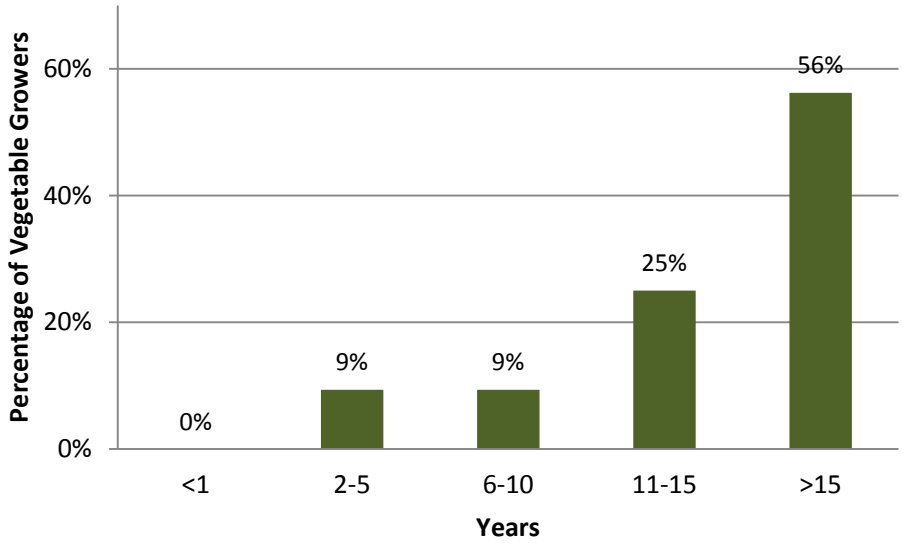
	Produce Type	
Farming Practices	Small Fruits	Tree Fruits
USDA-certified Organic	0 0%	0 0%
Organic, Not Certified	4 17%	2 22%
Strictly Conventional	19 79%	7 78%
Organic, Not Certified and Conventional	1 4%	0 0%
Total	24 100%	9 100%

Note: 4 of the 28 commercial small fruit growers and 2 of the 11 tree fruit growers did not respond to this question.

Vegetable Producers

When asked about vegetable production, 52% of the respondents reported growing vegetables commercially. Of the farmers who grow vegetables commercially, 56% have been growing vegetables for more than 15 years and 81% have been growing for more than 11 years (Graph 8).

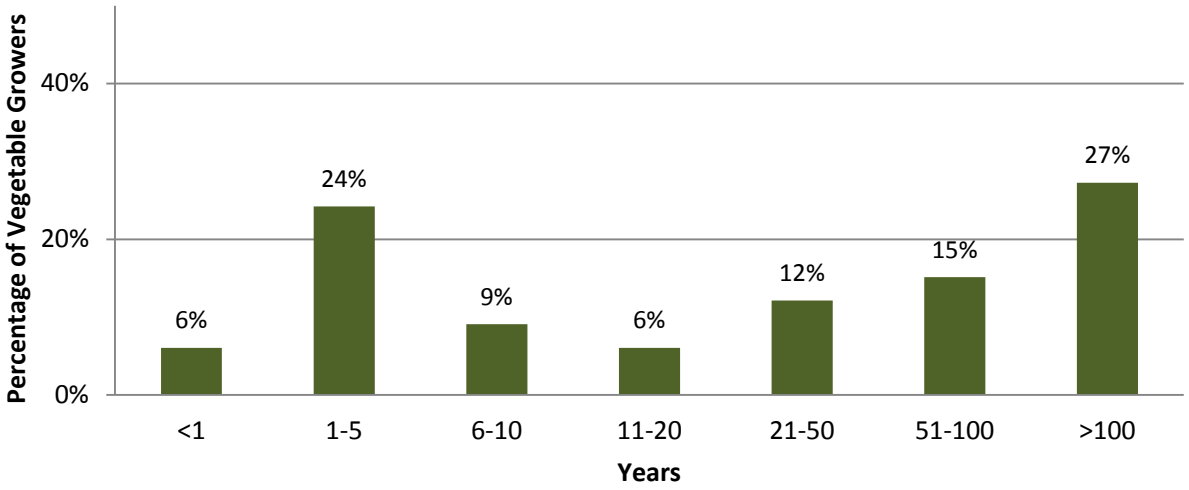
Graph 8: Years in Vegetable Production



Note: 32 of the 33 commercial vegetable growers responded to this question.

Of the farmers who grow vegetables commercially, there was a wide range of acreage used (Graph 9). A large proportion of the farmer respondents farmed either one to five acres (24%) or more than one hundred acres (27%).

Graph 9: Acres in Vegetable Production



Note: 33 of the 33 commercial vegetable growers responded to this question.

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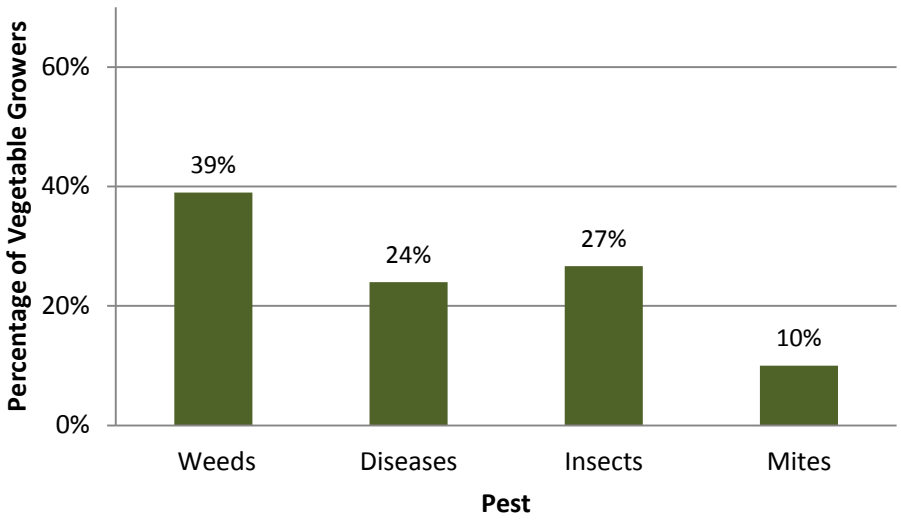
Growers were asked to select all of the most significant pests in their vegetable production from a list of four main categories. Of the vegetable growers, 39% selected weeds as a significant pest, with diseases and insects also frequently selected (Graph 10).

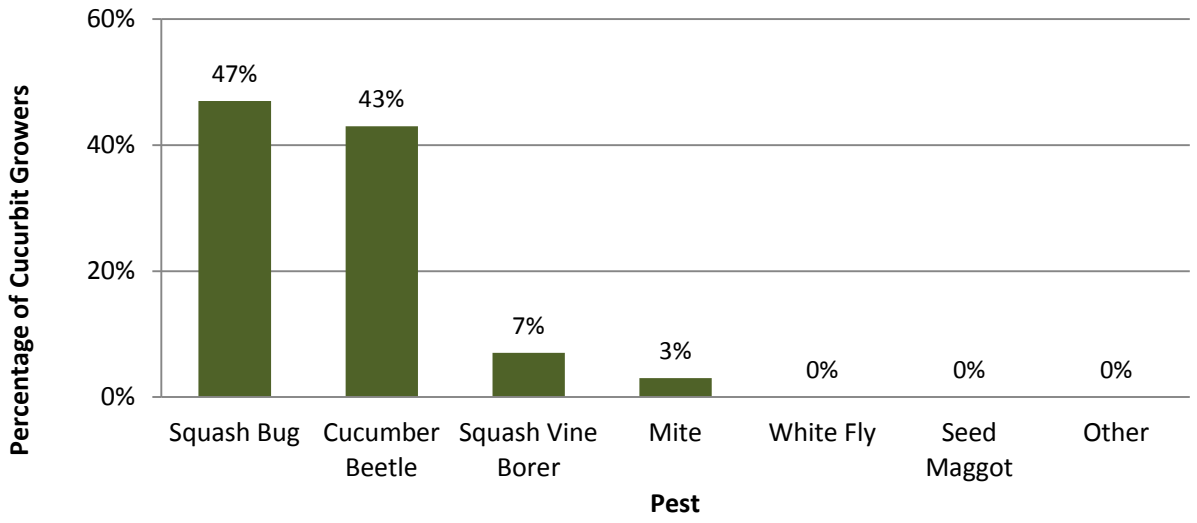
Graph 10: Significant Vegetable Pests



Note: there were 62 responses from 33 vegetable growers; some commercial vegetable growers selected multiple pests.

Of the farmers who grow vegetables, 88% report growing cucurbit crops, such as melons, cucumber, and squash. Farmers who grow cucurbit crops were asked to select the one most significant cucurbit insect pest on their farm. Of the cucurbit growers, 47% selected squash bugs and 43% selected cucumber beetles as the most significant insect pests in cucurbit production (Graph 11).

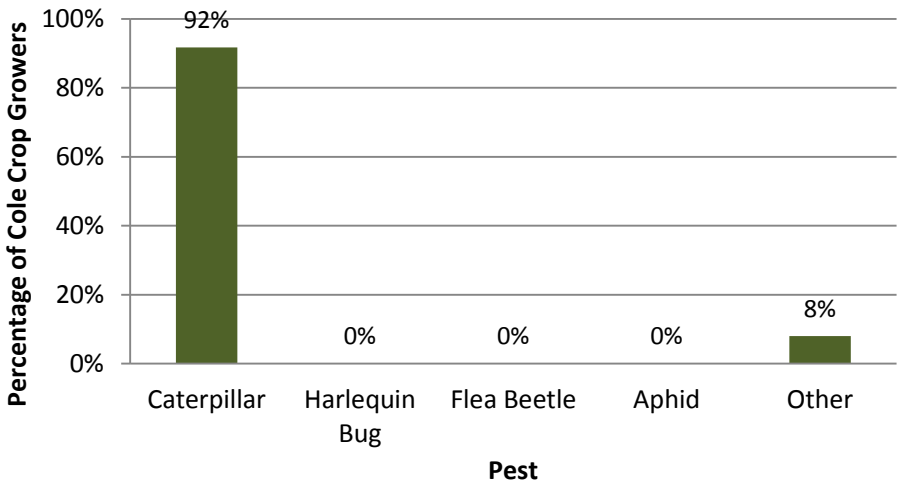
Graph 11: Most Significant Cucurbit Insect Pests



Note: 30 of the 30 cucurbit growers responded to this question.

Of the vegetables growers, 35% grow cole crops, such as broccoli and cauliflower. Farmers who grow cole crops were asked to select the one most significant cole crop insect pest on their farm. Of the cole crop growers, 92% selected caterpillars. Loopers were identified in the other category by one farmer as the most significant cole crop pest (Graph 12).

Graph 12: Most Significant Cole Crop Insect Pests

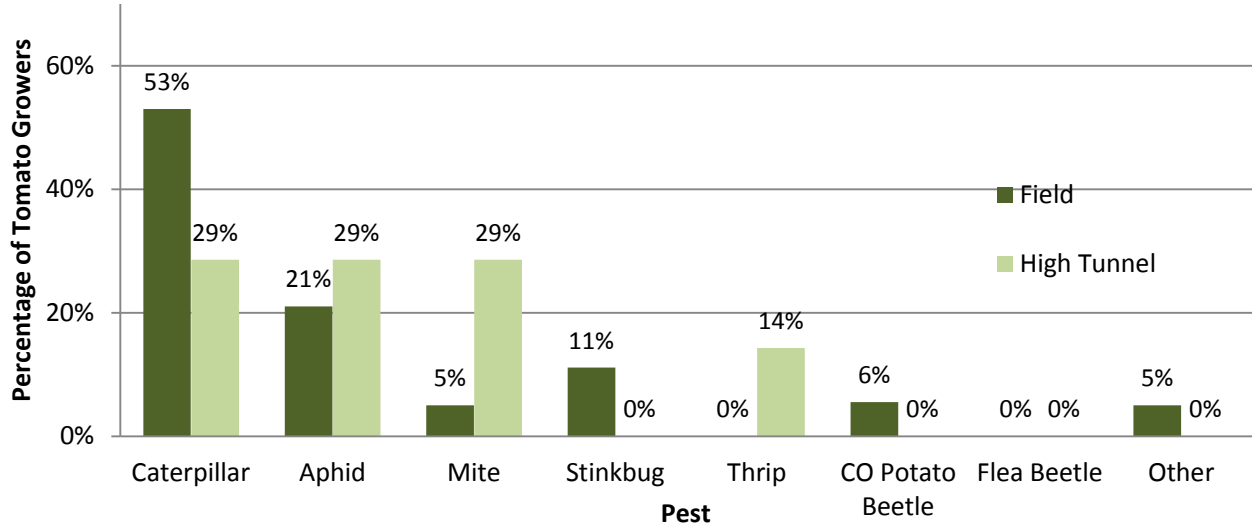


Note: 12 of the 12 cole crop growers responded to this question.

Of the vegetable farmers, 67% grow tomatoes. Most of these farmers grow tomatoes only in a field (64%), some grow only in a high tunnel (14%) and some of the farmers produce in both a field and a high tunnel (22%).

Farmers who grow tomatoes were given eight choices and asked to select the one most significant insect pest in their field or high tunnel production system. Of farmers who grow tomatoes in a field, 53% selected the category listing hornworms, fruitworms, cutworms, and other caterpillars, and 21% selected aphids as the one most significant pest. Of farmers who grow tomatoes in a high tunnel, 29% selected the category, hornworms, fruitworms, cutworms, and other caterpillars; 29% selected aphids; and 29% selected mites as the most significant pest (Graph 13).

Graph 13: Most Significant Insect Pests for Tomatoes Grown in a Field or High Tunnel



Note: 19 respondents reported pests for field-grown tomatoes and 7 reported pests for high tunnel-grown tomatoes. The farmer selecting "other" did not list the pest's group.

Pest Management Practices

Growers were asked a series of questions about their use of management practices integral to IPM, including scouting for pests, rotating pesticides, using reduced-risk pesticides, identifying pests before applying pesticides, working to improve soil fertility, and checking crops after pesticide application. For reporting, responses from commercial growers were separated from non-commercial growers in order to focus on the practices of farmers who grow fruits or vegetables commercially. Overall, commercial growers who responded report moderate or high level usage of practices consistent with IPM recommendations. Of the farmers surveyed, 66% of commercial growers scout fields on a regular interval or watch their fields closely for pests (Table 6).

Table 6: Scouting for Pests in Fields

Approach/Method	Commercial Growers	Non-commercial Growers	Total
Our fields are never scouted. We react to problems when we see them.	4 8%	4 36%	8 13%
Our fields are casually scouted. When in the fields, we keep an eye out for typical problems.	14 27%	2 18%	16 25%
Our fields are watched closely for pests. When in the fields, we inspect the crop closely and when not in the field for some time, we spend extra time examining the crop once we return to that field.	17 33%	2 18%	19 30%
Our fields are scouted on a regular interval (e.g. weekly) in an organized method.	17 33%	3 27%	20 32%
Total	52 100%	11 100%	63 100%

Note: Commercial growers were identified as farmers who reported growing small fruits, tree fruits, or vegetables commercially or reported a number of years they had been growing commercially.

In the most recent growing season, more than 67%–88% of commercial growers rotated pesticides, attempted to identify pests before selecting a pesticide, or worked to improve soil fertility (Table 7). Only 35% of respondents used reduced-risk pesticides.

Table 7: Pesticide Application Practices

	Commercial Growers				Non-commercial Growers				
In the most recent growing season, did you:	Yes	No	Some-times	Sub-total	Yes	No	Some-times	Sub-total	**Total**
Rotate pesticides?	33 67%	7 14%	8 16%	48 100%	2 20%	6 60%	2 20%	10 100%	58 100%
Use reduced-risk pesticides?	15 34%	17 39%	11 25%	43 100%	3 33%	4 44%	2 22%	9 100%	52 100%
Attempt to identify pests before selecting a pesticide?	39 81%	3 6%	5 10%	47 100%	6 55%	4 36%	1 9%	11 100%	58 100%
Work to improve soil fertility?	44 88%	3 6%	3 6%	50 100%	6 60%	4 40%	0 0%	10 100%	60 100%

Note: 11 respondents did not answer one or more of these questions. Commercial growers were identified as farmers who reported growing small fruits, tree fruits, or vegetables commercially or reported a number of years they had been growing commercially.

When asked about checking crops following pesticide application, 88% of commercial growers reported that they usually or always go back and check their crops after applying a pesticide (Table 8).

Table 8: Checking Crops Post-Pesticide Application

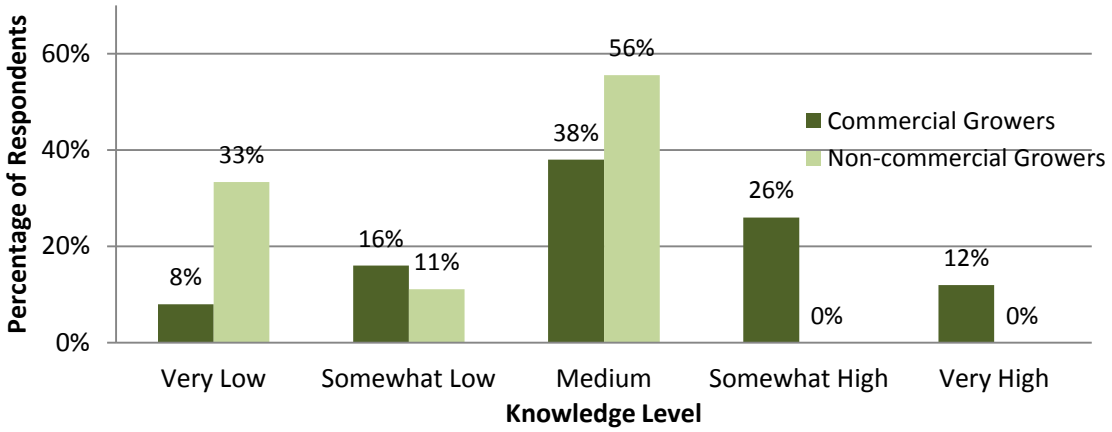
After applying a pesticide…	Commercial Growers	Non-commercial Growers	Total
I *rarely* go back to check the crop. I assume the product works like it should.	1 2%	2 20%	3 5%
I *sometimes* go back to check the crop within a few days or a week.	5 10%	0 0%	5 8%
I *usually* go back to check the crop within a few days or a week.	11 22%	4 40%	15 25%
I *always* go back to check the crop within a few days or a week.	33 66%	4 40%	37 62%
Total	50 100%	10 100%	60 100%

Note: Two commercial growers and one non-commercial grower did not respond to this question. Commercial growers were identified as farmers who reported growing small fruits, tree fruits, or vegetables commercially or reported a number of years they had been growing commercially

Pest Management Knowledge

Growers were asked to rate their knowledge of IPM using a five-point rating scale. Of the commercial growers, 38% reported a Medium level of knowledge (Graph 14) and 38% reported a Somewhat High or Very High level. No non-commercial growers reported a knowledge level above Medium.

Graph 14: General Knowledge of IPM



Note: 50 commercial growers and 9 non-commercial growers responded to this question (n=59).

In order to calculate a mean score, answers were scored as Very Low = 1, Somewhat Low = 2, Medium = 3, Somewhat High = 4, and Very High = 5. Means were calculated and overall, respondents showed a medium level of knowledge of IPM overall (3.0) (Table 9). When means were calculated by type of grower, the commercial growers reported a higher average level of knowledge, just above medium (3.2), than the non-commercial growers who reported a somewhat low level of knowledge (2.2).

Table 9: General Knowledge of IPM

	Mean	Count
Grow commercially	3.2	50 85%
Do not grow commercially	2.2	9 15%
Total Overall	3.0	50 100%

Farmers were given a list of eleven IPM topics and asked to rate their knowledge of each one. Answers were scored as Very Low = 1, Somewhat Low = 2, Medium = 3, Somewhat High = 4, and Very High = 5. Mean scores were calculated to determine the level of knowledge reported by respondents for each IPM topic. The overall average score for all Integrated Pest Management techniques was 3.1, or medium knowledge (Table 10).

The respondents rated *Understanding pesticide labels* as the topic in which they had the greatest knowledge, with an average of somewhat high knowledge (mean score of 3.8). *Weed identification* and *understanding insect/disease/weed resistance to insecticides/fungicides/herbicides* were the topics that respondents reported having between medium and somewhat high knowledge (mean score of 3.6). The topics with levels of knowledge averaging between very low and somewhat low were *using natural enemies of insect pests for biological contro*l (mean of 2.4) and l*earning how to provide habitat for beneficial insects including native pollinators* (mean of 2.5).

Table 10 shows the mean score for non-commercial and commercial growers for each topic and is sorted from the highest to lowest mean score for all growers. The commercial growers had an overall higher knowledge level of all topics, with a mean score range of 2.4–4.0 (Table 10), compared with non-commercial growers, with a knowledge level mean score of 1.7–3.2.

Table 10: Knowledge of IPM Topics

IPM Topic	Average Knowledge Level		
	Non-commercial Growers	Commercial Growers	All Growers
Understanding pesticide labels	2.7	4.0	3.8
Weed identification	3.1	3.7	3.6
Understanding insect/disease/weed resistance to insecticides/fungicides/herbicides	2.8	3.7	3.6
Insect pest identification	2.7	3.4	3.3
Cultural practices including crop rotation, sanitation, and trap crops	2.9	3.3	3.2
Using cover crops to enhance soil health, minimize erosion, smother weeds and as soil bio-fumigants	3.2	3.1	3.2
Establishing economic thresholds (level of the pest at which control measures need to be implemented to prevent economic injury to the crop)	2.4	3.1	2.9
Disease identification	2.1	3.1	2.9
Insect pest monitoring and sampling methods	2.3	3.0	2.9
Learning how to provide habitat for beneficial insects including native pollinators	1.7	2.6	2.5
Using the natural enemies of the insect pests (parasites, predators) for biological control	2.0	2.4	2.4

Note: 9 respondents did not rate their knowledge on at least one topic (n=63). 10-11 non-commercial growers rated every topic and 44-48 commercial growers rated every topic. The average knowledge level has a possible range of 1 (Very Low) to 5 (Very High).

Looking Forward

In addition to learning more about sources of information and pest management practices used by Missouri vegetable growers, the Lincoln University IPM program was also interested in identifying issues of concern for local growers and preferences for outreach activities. This section provides insights into these areas that may help guide future programming.

Pest Management Information

Growers were given eleven IPM topics and asked which of the topics they would like to learn more about. Thirty-two percent of the surveyed farmers reported being interested in learning more about at least one IPM topic, with some farmers reporting an interest in learning more about all eleven topics (Table 11). The topic of interest to most farmers was *Disease identification*. Respondents showed some level of interest in all topics. There was not a notable difference between commercial and non-commercial growers, so data are presented for the combined group of respondents.

Table 11: Interest in Learning More about IPM Topics

IPM Topic	Count
Disease identification	14
Learning how to provide habitat for beneficial insects including native pollinators	11
Insect pest identification	10
Using the natural enemies of the insect pests (parasites, predators) for biological control	9
Insect pest monitoring and sampling methods	9
Weed identification	8
Using cover crops to enhance soil health, minimize erosion, smother weeds and as soil bio-fumigants	6
Cultural practices including crop rotation, sanitation, and trap crops	6
Establishing economic thresholds (level of the pest at which control measures need to be implemented to prevent economic injury to the crop)	5
Understanding insect/disease/weed resistance to insecticides/fungicides/herbicides	5
Understanding pesticide labels	4

Note: 20 respondents selected at least one topic that they would like to learn more about (n=63).

Growers were given a list of five resources and asked from which source they would most prefer to receive IPM information from extension and research personnel. Overall, 46% of respondents reported that they would prefer information in print, with 33% of farmers preferring a combination of print and electronic information (Table 12).

Table 12: Preferred Source of IPM Information

Method	Count	Percent
In print (paper)	28	46%
Electronic (website, PDF, etc.)	1	2%
Any combination of print and electronic	20	33%
Face-to-face on your farm	6	10%
At field days and/or workshops	6	10%
Total	61	100%

Note: 2 respondents did not answer this question (n=63).