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Controlling Pests and Diseases Using Mesotunnels: Understanding Organic Cucurbit Crop Growers' Preferences and Choices

Nieyan Cheng, Wendong Zhang, and Mark Gleason

Charles H. Dyson School of Applied Economics and Management SC
Johnson College of Business
College of Agriculture and Life Sciences
Cornell University, Ithaca, NY 14853-7801

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Controlling Pests and Diseases Using Mesotunnels: Understanding Organic Cucurbit Crop Growers' Preferences and Choices

Nieyan Cheng, Assistant Professor, College of Economics and Management, China University of Petroleum, cny@cup.edu.cn

Wendong Zhang*, Assistant Professor, Dyson School of Applied Economics and Management, Cornell University, wendongz@cornell.edu

Mark Gleason, Professor, Department of Plant Pathology, Iowa State University, mgleason@iastate.edu

*Corresponding Author

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Executive Summary

Consumer demand for fresh, locally grown organic produce, including cucurbits, is rising. However, organic cucurbit growers in the United States struggle to capitalize on this opportunity because of severe damage caused by pests and diseases, which collectively cost growers more than $100 million per year. Thus, a new technology, mesotunnels,[1] was introduced. Mesotunnels are medium-size tunnels–taller than low tunnels and shorter than high tunnels—made by conduits and a breathable nylon-mesh fabric to create a protective barrier between crops and the environment to guard against weather extremes (e.g., heavy rain, hail, high wind) and pest complexes (pest insects and pathogens they transmit), while increasing profitability.[2] Thus, mesotunnels provide a potential solution for managing major pests and pathogens of cucurbits and are highly amenable to integrating biologicals for further pathogen control.

A key step in evaluating the commercial viability of mesotunnels is to learn about growers' experiences and viewpoints on using row cover strategies, their willingness to adopt new approaches, and their primary ways of obtaining information about these technologies. Thus, we designed a survey targeting growers of organic cucurbit crops.

We received 337 completed surveys out of 1,057 eligible samples (a response rate of 33.7%) from January 27, 2022, to March 30, 2022 from Iowa, Kentucky, New York and the surrounding states of Illinois, Indiana, Minnesota, Missouri, Pennsylvania, Vermont, Wisconsin, Massachusetts, New Hampshire, Tennessee and Michigan. Of respondents, 90% either farmed in the past five years or will farm in the next five years. Respondents averaged 18 years of farming experience with only one respondent reporting no farming experience. Focusing on cucurbit crops, the average farmer had 13 years' experience. The average respondent farmed 100 acres for all crops; however, with small variations, only seven acres per farm, on average, were for cucurbits. The farming acres for specific varieties ranged from 0.007 (honeydew) to 4.3 (winter squash). Over 90% of respondents were in certified organic status, except growers of gourd and pumpkin.

In 2021, growers hired more paid than non-paid farmworkers. To sell their crops, nearly half of respondents marketed their products via either local farmers' markets, wholesaling, on-farm retail stands, direct sales to grocery stores, large retailers, supermarkets, grower cooperatives, or community supported agriculture (CSA) enterprises. In addition to cucurbit crops, respondents also sold a wide range of other crops (e.g., chives, garlic, leeks, etc.).

As for pest and disease management in cucurbit crop production, most respondents selected insect pressure, crop disease, weed pressure, heavy rain events, and input costs as the most concerning general threats to cucurbit crop production. Over 50% of respondents selected bacterial wilt, cucumber beetles, downy mildew, powdery mildew, and squash bugs as specific threats. To achieve their goals, producers choose different production management strategies. Sixty percent of growers considered improving yields, profitability, produce quality, soil quality, and whether pest controls are effective as top concerns. For spraying strategies, most growers (59%) used a hand-pump backpack sprayer. Half of respondents sprayed pesticides no more than three times per growing season. When asked about row covers, more than 62% of respondents said they chose to use permeable row covers for any of their cucurbit crops and 50% applied row covers to less than half of their cucurbit acres. The top two reasons for applying

[1] Details about mesotunnels can be found at https://www.cucurbit.plantpath.iastate.edu/post/whats-mesotunnel-and-whats-it-good

[2] However, mesotunnels are not a strategy to enhance earliness (they do not hold in much heat due to the mesh-type fabric covering).

row covers were to control insects and pests and protect against cold temperatures. Most respondents felt that row covers can improve yields (76%) and product quality (73%) and reduce insecticide spray frequency (66%) and vulnerability to weather (78%). The majority showed interest in continuing use of row covers.

Furthermore, while over 50% of respondents used low tunnels and high tunnels, only 14% previously used mesotunnels. More than 30% perceived mesotunnels as easy to learn, adapt and apply in their current production systems. When referring to their likelihood to adopt mesotunnels in the next five years, 40% reported they were either highly or somewhat likely to adopt while another 40% are not that likely to adopt. For those who are willing to adopt mesotunnels, 70% want to use it within next three years. Cucumber, summer squash, and watermelon are the top three varieties for which respondents are willing to use mesotunnels. Lastly, the majority of respondents perceived mesotunnels as effective on all the outcomes including maximizing marketable yield, reducing pesticide use, and controlling insect pests.

Introduction

In summer 2021, we contacted Iowa State University's Center for Survey Statistics & Methodology Survey Research Services (CSSM-SRS) to conduct a web/mail survey about the use of mesotunnels for cucurbits. The purpose of this survey was to learn about growers' experiences using row covers and their willingness to adopt mesotunnels so that we could evaluate the use of mesotunnels in the Midwestern and northeastern United States for control of pests and diseases that can occur during organic production of cucurbit crops.

Data Collection

We provided CSSM-SRS with a list of USDA Certified Organic Growers of cucurbit crops in Iowa, Kentucky, New York, Illinois, Indiana, Minnesota, Missouri, Pennsylvania, Vermont, and Wisconsin.

We used two procedures for collecting samples. First, prior to data collection we conducted a pilot study of 30 cucurbit growers via a web link to the survey in nine of our target states (we excluded Missouri due to a low sample number). We sent an invitation letter with a $1 bill as an incentive to the 30 growers on January 27, 2022. No refinements were made after our pilot study. Second, we sent the invitation letter to the 1,059 people in the main sample on February 14, 2022. These invitation letters also included a $1 bill as an incentive to complete the survey. We then sent a survey packet to 965 non-responders with deliverable addresses on March 3, 2022. The survey packets contained a cover letter, paper survey, and a postage paid return envelope. A second complete mailing of the survey was sent to 796 non-responders on March 23, 2022. There were no incentives included with the follow-up survey mailings. We sent a reminder email message to 207 non-responders with valid email addresses on March 30, 2022.

Survey Outcomes

Response Rate

We received a total of 377 completed surveys during the data collection period from January 27 through May 24, 2022—353 through mail and 24 from pilot samples. We excluded 10 responders who only answered personal information questions. In sum, the response rate was 33.8% (377/ (1089+24)). Table 1 shows the distribution of mailing samples, the number of completed surveys, response rates, pilot samples, and the total number of samples in each state. The response rate implies the existence of heterogeneity among states, where Iowa had the highest response rate while Illinois had the lowest. Wisconsin had the largest number of respondents, and Michigan and Tennessee had the smallest number of respondents.

Table 1. Number of Sampled Cases by Outcome and Response Rate per State

	Mailing					Pilot Samples	Total Number
State	Sample	Not Eligible	Eligible Sample	Completed Surveys-Mailing	Response Rate-Mailing	Completed Surveys	
Illinois	45	0	45	11	24.4%	0	11
Indiana	29	2	27	7	25.9%	0	7
Iowa	29	3	26	15	57.7%	8	23
Kentucky	27	2	25	9	36.0%	3	12
Massachusetts						3	3
Michigan						1	1
Minnesota	82	5	77	29	39.0%	0	29
Missouri	6	0	6	2	33.3%	0	2
New Hampshire						4	4
New York	247	9	238	89	37.4%	0	89
Pennsylvania	226	2	224	65	29.5%	1	66
Tennessee						1	1
Vermont	120	3	117	30	25.6%	3	33
Wisconsin	278	6	272	96	35.7%	0	96
Total	**1089**	**32**	**1057**	**353**	**33.7%**	**24**	**377**

Farmland Information

Among the 377 respondents, most operated a farm in the past five years or were willing to operate a farm in the next five years (370 and 372, respectively). Overall, respondents had an average of 18 years' farming experience with 11 years standard deviation and 50 years as maximum. Only one respondent had no farming experience. For specific crops such as acorn squash, muskmelon, and pumpkin, respondents had an average of 13 years' experience farming with 11 years standard deviation.

Respondents averaged around 100 farming acres for all crops with large variations; however, they averaged only seven mean acres for cucurbit crops. Figure 1 shows that around 30% of respondents' farms ranged from one to five acres. The remaining respondents are distributed almost equally among the remaining farm size groups (ranging from 30 to 54 acres); however, nearly two-thirds of respondents only grew cucurbit crops on less than one acre, and one-third grew cucurbits on one to five acres. Only a few respondents grew these crops on more than five acres.

When referring to the specific acres for each cucurbit crop, sample results indicate an average of 0.3 acres for slicing cucumbers and 0.11 for pickled cucumbers. For squash varieties, such as gourd, winter squash, and summer squash, the average acres were 0.04, 4.3, and 0.43, respectively. The rest, including honeydew, cantaloupe, pumpkin and watermelon, were 0.007, 0.2, 2.9, and 0.29. Over 90% of respondents for all the varieties above were in the certified organic status except gourd and pumpkin.

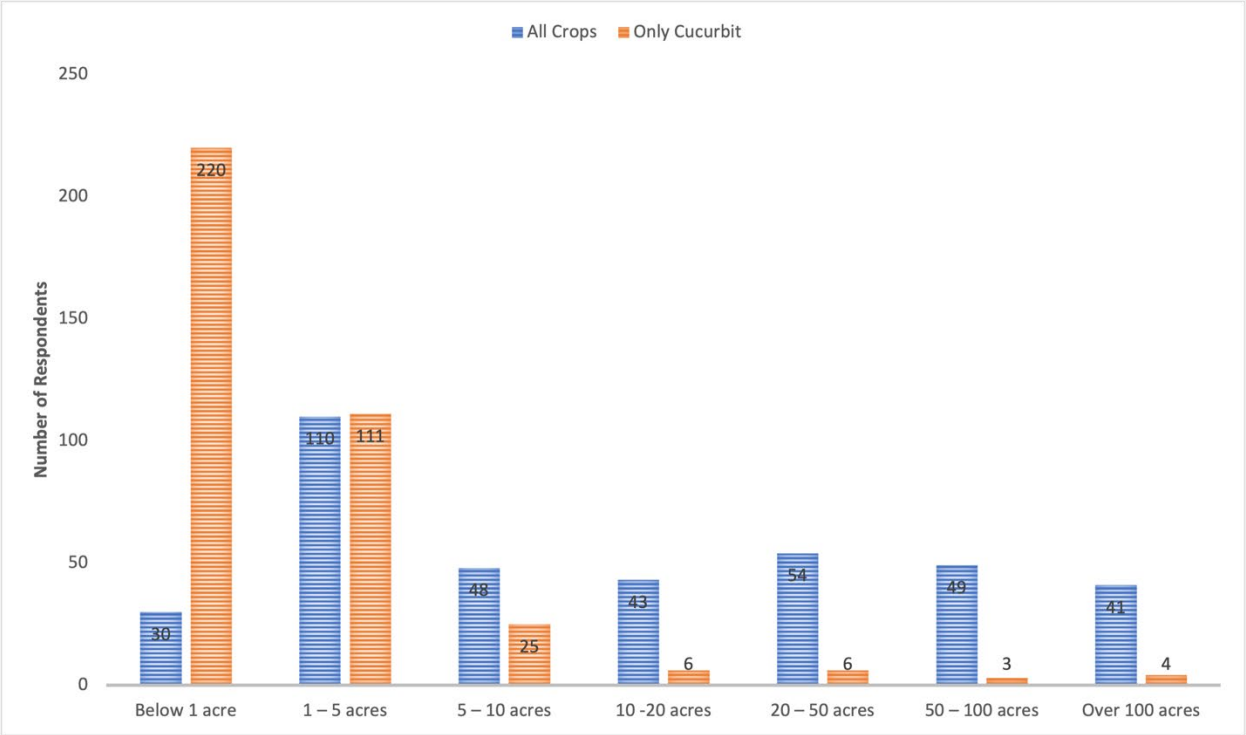

Figure 1. Number of respondents across different acreage ranges for all crops and cucurbit crops only.

Our survey also explored other aspects of respondents' farming operations. In 2021, growers hired more paid farmworkers than non-paid workers. Specifically, respondents averaged two or three paid full-time and part-time farmworkers and only one non-paid full-time or part-time farmworker.

Figure 2 depicts respondents' marketing channels and shows that over 40% of respondents chose to market their products through local farmer's markets, wholesales, sales at their own stand, and direct sales to grocery stores, large retailers, supermarkets, or grower cooperatives and community supported agriculture. Only 8% sold by production auction, and 33% chose direct sales to restaurants or caterers.

Except for cucurbit crops, respondents also grew other crops to sell, which were more than 25 diverse varieties. More than 50% grew specialty crops such as chives, garlic, leeks, onion, leafy greens (lettuce, spinach, kale), tomatoes, peppers, eggplant, potatoes, peas or snap beans, carrots, table beets, sugar beets, and sweet corn as well. In addition, 35% sold flowers and ornamental shrubs/trees. Around 25% grew small grains, wheat or oats, and apples, pears, or other tree fruits. Finally, 7% of respondents grew grapes.

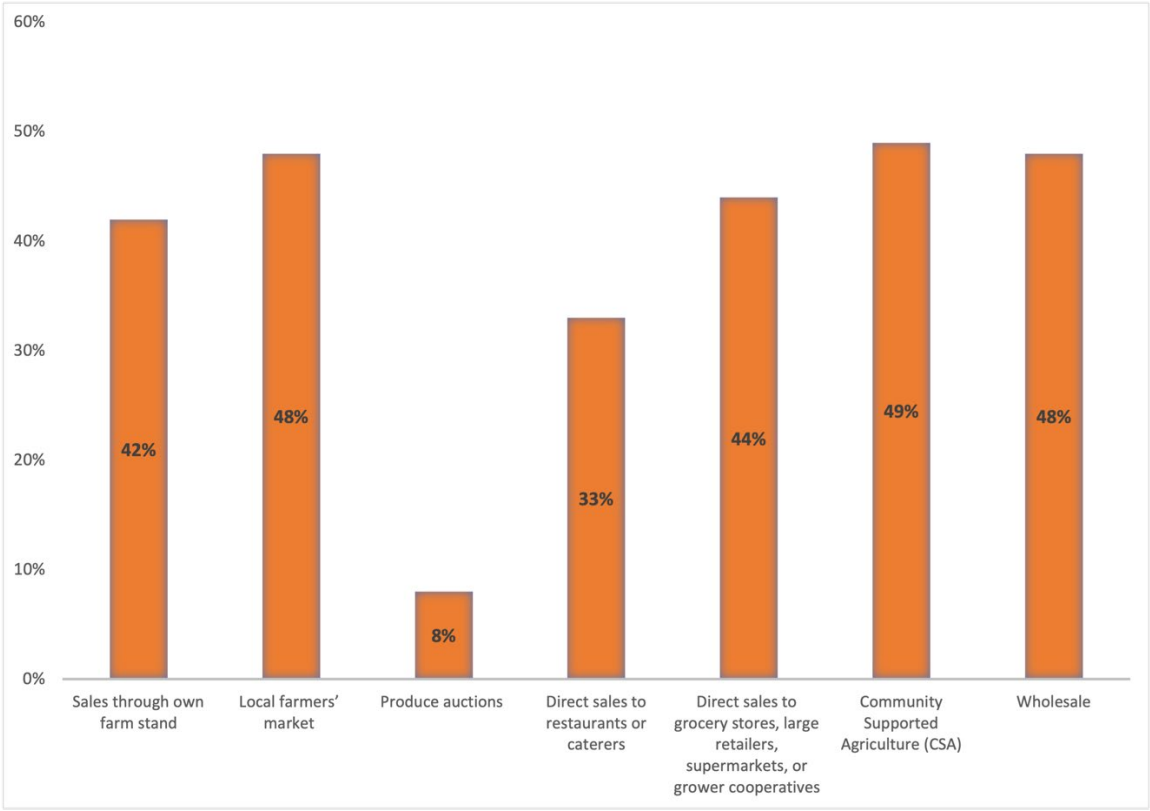

Figure 2. Marketing channels respondents use for distribution of cucurbit crops.

Pest and Disease Management in Cucurbit Crop Production

Table 2 summarizes respondents' concerns about potential threats to cucurbit crops and farm production. More than 50% respondents were very concerned, concerned or moderately concerned by 18 out of 22 threats. Specifically, insect pressure, crop disease, weed pressure, heavy rain events, and input costs were selected as the top five threats by most respondents. Moreover, over half of the growers were not concerned about accessibility to purchased pollinators, pesticide runoff and leaching to nearby waters, financial variability, and minimum wage rates.

Table 2. Respondents' Level of Concern about General Potential Threats to Crops and Farm Production

	Very Concerned	Concerned	Moderately Concerned	Not Concerned
Insect pressure	24.46	33.33	36.56	5.65
Heavy rain events	20.81	29.46	33.78	15.95
Crop disease	18.43	30.89	40.38	10.3
Weed pressure	19.68	28.57	39.35	12.4
Abundance and health of natural pollinators	19.73	26.22	27.84	26.22
Dry periods and drought	15.95	28.65	34.05	21.35
Input costs (organic fertilizers, materials, etc.)	14.91	29.27	38.21	17.62
Exceptional fluctuations of temperature	16.17	27.49	30.19	26.15
Price point of vegetables	11.89	30	36.76	21.35
High winds	15.36	26.42	35.31	22.91
Availability of organic management options for pest, weeds, and diseases	11.86	22.1	38.01	28.03
Heat stress on crops	11.35	22.43	40.27	25.95
Availability of field workers	15.63	15.9	25.61	42.86
Tractor (or machinery) breakdown or maintenance	6.76	21.89	33.24	38.11
Flooding	8.63	16.71	26.95	47.71
Organic certification procedural complexity	9.16	15.63	28.3	46.9
Soil erosion	8.38	16.22	37.84	37.57
Minimum wage rates	6.49	12.97	21.08	59.46
Pesticide runoff and leaching to nearby waters	8.15	9.24	14.67	67.93
Hail damage	4.32	11.35	36.76	47.57
Financial variability (e.g., loan availability)	4.07	10.3	23.04	62.6
Accessibility to purchased pollinators	2.2	8.52	19.51	69.78

More than 40% of respondents chose bacterial wilt, cucumber beetles, downy mildew, powdery mildew, and squash bugs as significant pest and disease management concerns (figure 3). Around 30% chose anthracnose, aphids, and squash vine borers as significant threats.

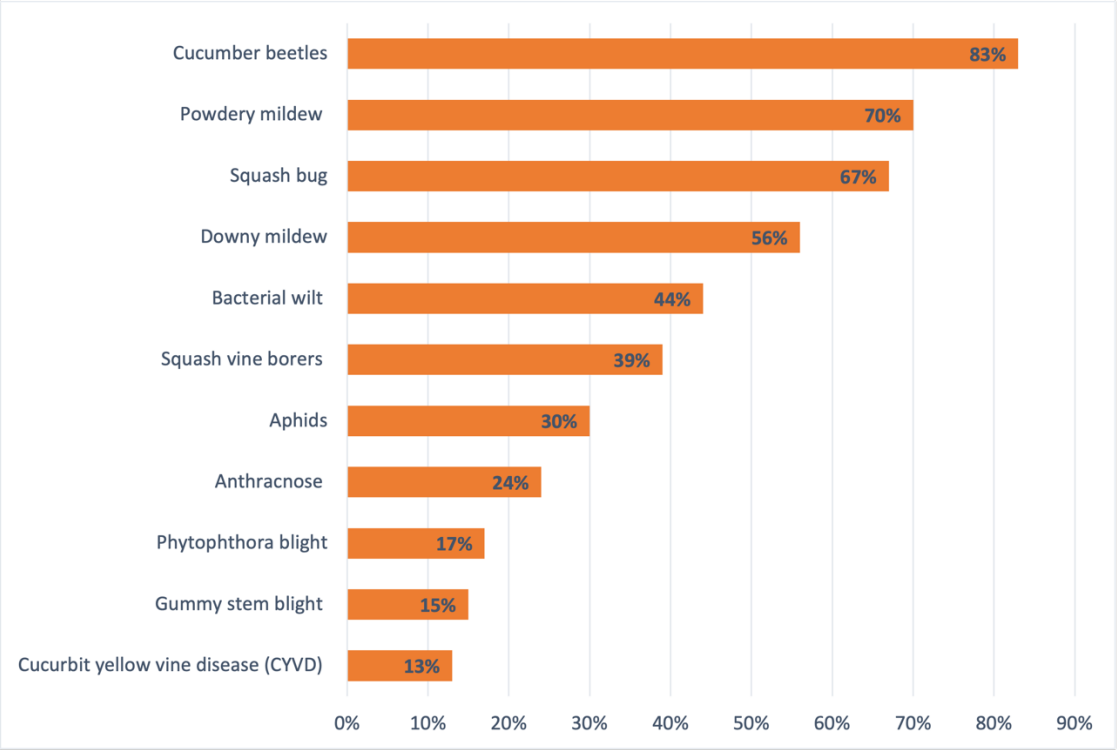

Figure 3. Percent of respondents concerned about specific threats to crops and farm production.

We also explored factors that impacted growers' choices of pest management strategies. Figure 4 shows that improving yields, profitability, produce quality, soil quality, and whether pest controls are effective are top concerns for more than 60% of growers. Around 50% of respondents also think soil erosion minimization and habitat maintenance for pollinators are top priorities. When referring to the ease and accuracy of insect pests/diseases scouting increasing, the cost of the pest management system and ease of application, around half of the respondents thought they were important considerations, but not top priorities. In contrast, only 21% of growers listed pesticide runoff or leaching as a top concern, with half regarding it as not a consideration when determining pest management strategies.

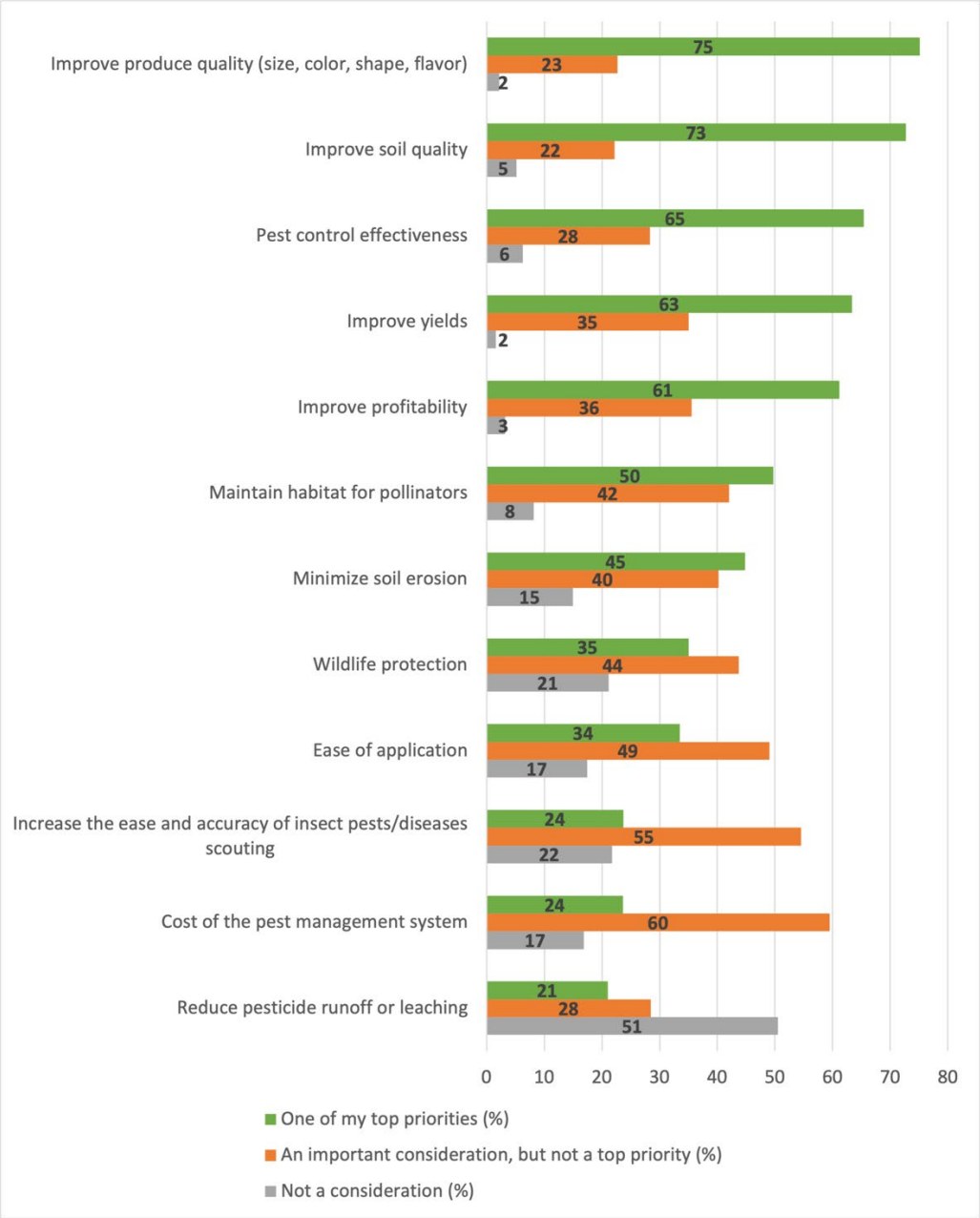

Figure 4. Factors that impact growers' choices about pest management strategies.

For spraying strategies, we explored equipment that respondents used regularly for applying pesticide sprays on cucurbit crops. As figure 5 shows, around two-thirds of respondents indicated using at least one piece of spraying equipment from our list. Most growers (59%) used a hand-pump backpack sprayer, followed by spray boom (33%), battery or motor-driven backpack sprayer (28%), airblast (7%) or hydraulic gun (1%). Furthermore, 23% of respondents used other equipment not listed here. Fifty-five respondents did not use any spray equipment.

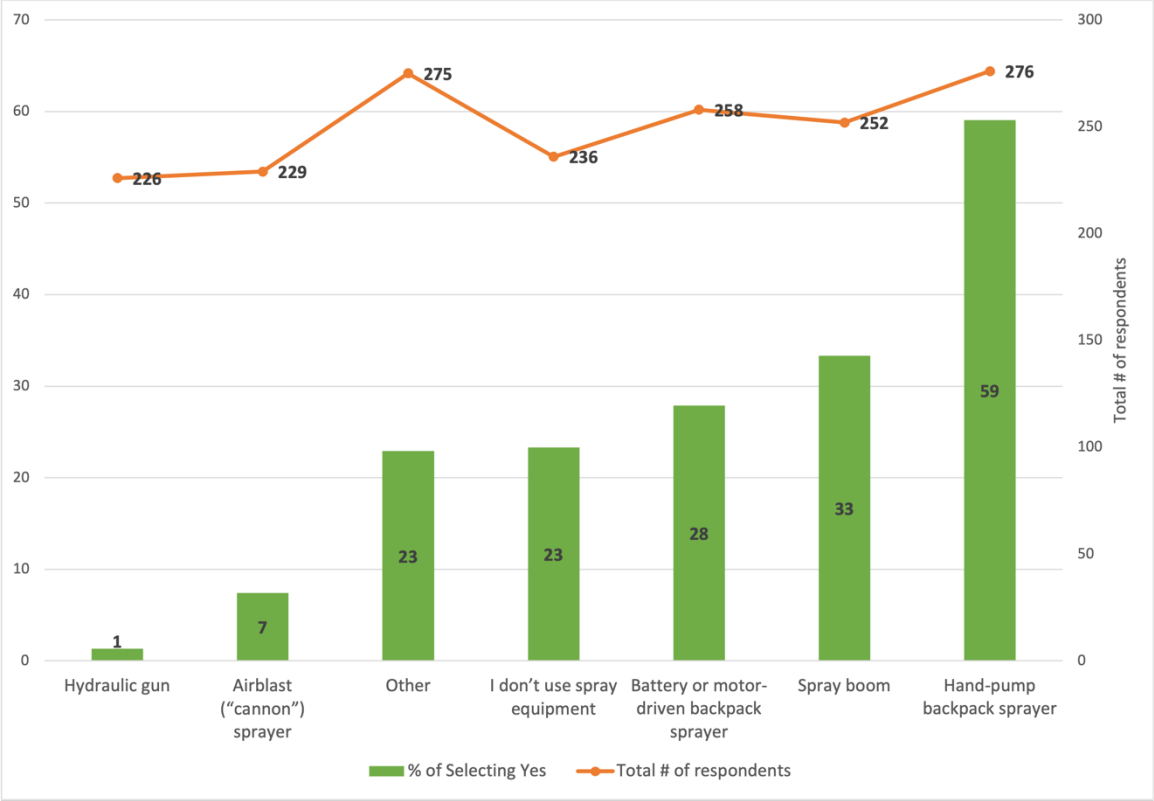

Figure 5. Response distribution and total number of respondents that regularly used pesticide spray equipment when growing cucurbit crops.

More than 40% of respondents sprayed less than three times during the entire growing season, and around 25% of respondents sprayed more than five times for their cucurbit crop with the largest acreage (table 3).

Table 3. Number of Respondents and Response Rate of Average Pesticide Spraying Frequency during the Entire Growing Season

	# of Respondents	Response Rate
One time	60	24.79%
Two times	55	22.73%
Three times	41	16.94%
Four times	24	9.92%
Five times	22	9.09%
Six times	12	4.96%
Seven times a season or more	28	11.57%
Total	**242**	**100%**

More than 62% of respondents chose to use permeable row covers (i.e., spunbond polypropylene or nylon mesh coverings) for any of their cucurbit crops. As figure 6 shows, of the total area for cucurbit production during the previous five years, 66 out of 232 (28%) used less than 10% row covers; 47 (20%) respondents applied 10%–25% row covers; 28 (12%) of them utilized 26%–50% row cover; only 21 (9%) growers chose to cover 51%–75% of their farms via row covers; 28 (12%) used 76%–99% row covers; and, 42 (18%) applied 100% row covers for their cucurbit crops.

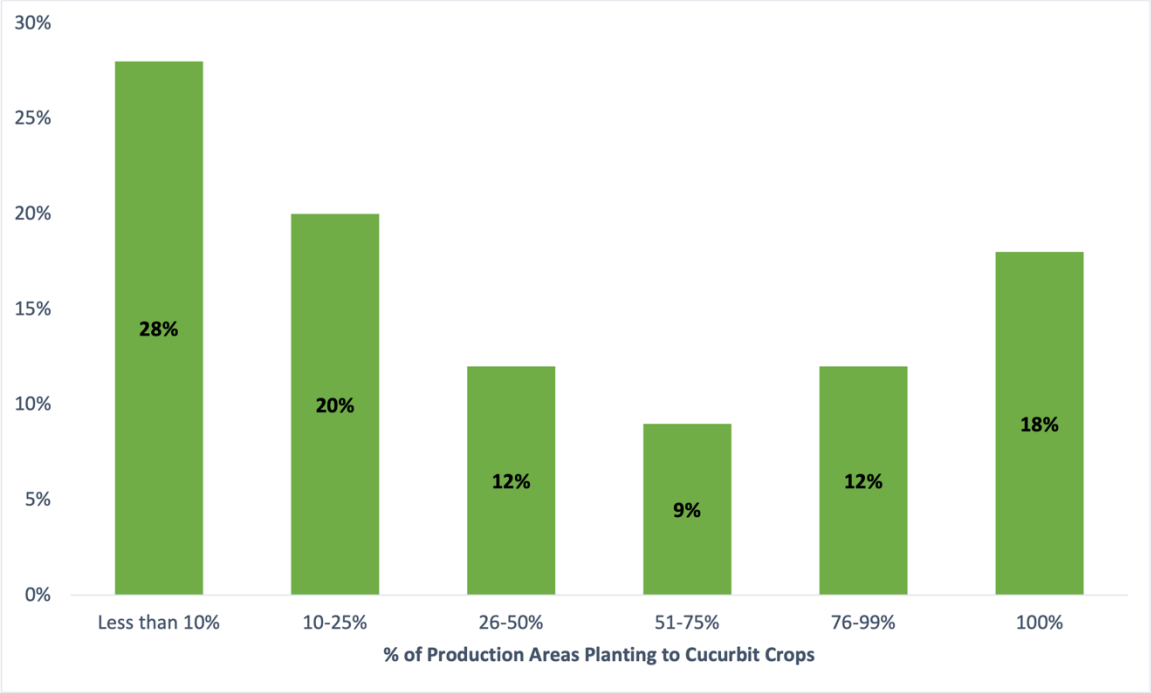

Figure 6. Range of cucurbit crop production area per farm using permeable row covers.

We also explored the reasons why growers used row covers. The top two reasons were to control insects and pests and for protection against cold temperatures, followed by extending the growing season, pesticide spraying minimization, and protecting plants from extreme weather events (figure 7).

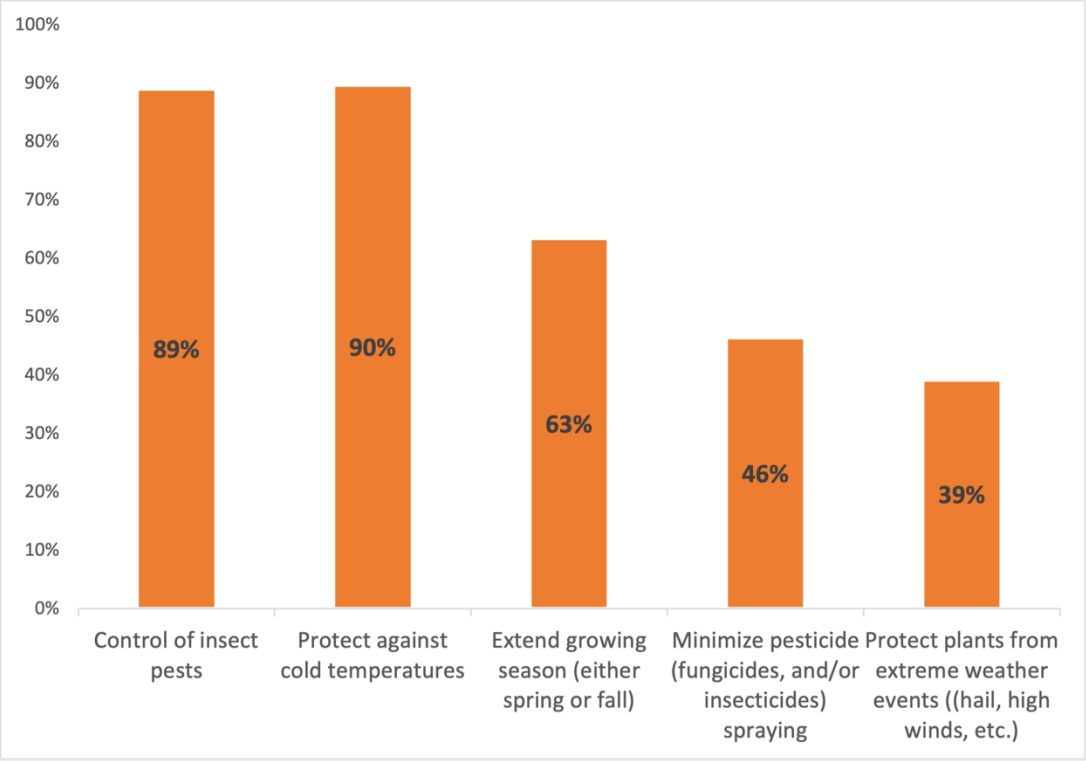

Figure 7. Reasons respondents applied row covers.

When asked about the degree of agreement with the statement, "I would like to have more options for crop disease through row cover control," most respondents (38%) neither agreed nor disagreed. However, a nearly equivalent proportion of growers (30%) wanted to have more options (table 4).

Table 4. Response Degree to which Respondents Agreed with the Statement "I would like to have more options for crop disease through row cover control."

	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree	Total #
# of respondents	18	35	143	113	59	368
Response rate	4.89%	9.51%	38.86%	30.71%	16.03%	100%

In regards to the following statements on using row covers, most respondents either strongly agreed or agreed that row covers can improve yields (76%) and product quality (73%), and reduce insecticide spray frequency (66%) and vulnerability to weather (78%). Fifty-three percent (121 out of 227) of respondents did not think row covers could reduce costs. Thirty-nine percent (90 out of 223) neither disagreed nor agreed with the statement that row covers reduce scouting time (figure 8).

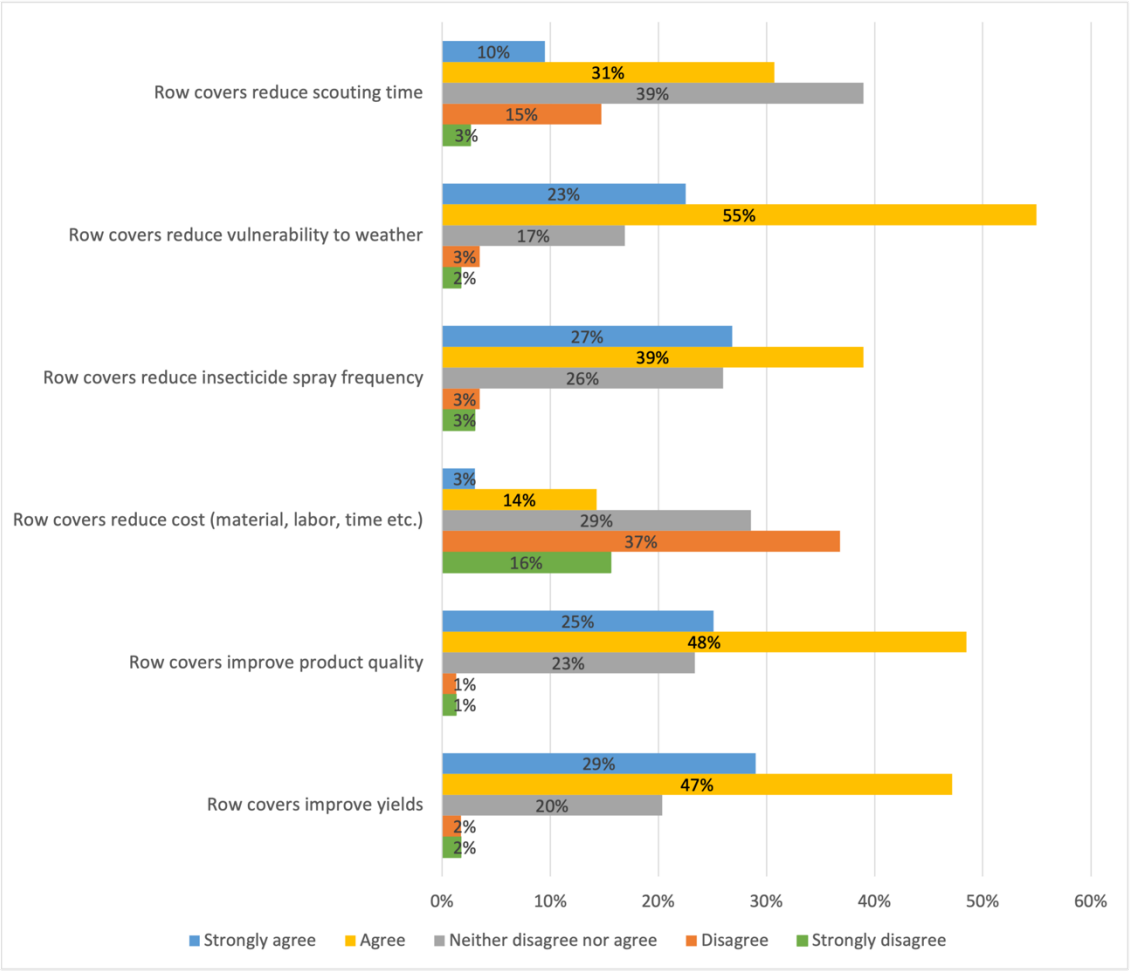

Figure 8. Degree to which respondents agreed with the outcomes of row covers.

We now explore whether growers would continue using row covers on cucurbit crops in the 2022 crop year—173 (75%) showed interest whereas 35 (15%) were not sure.

Mesotunnels in Cucurbit Crop Production

After providing information about mesotunnels, we asked respondents several questions associated with mesotunnels. First, we asked what kind of row cover systems respondents used in the past (low tunnel, mesotunnel, high tunnel). Among respondents, 186 (88%), 20 (14%), and 142 (70%) used low tunnels, mesotunnels, and high tunnels, respectively. Table 5 depicts the geographic distribution of each row cover system. These data indicate that the row cover application pattern in several states, including Wisconsin, Vermont, Pennsylvania, New York, Minnesota, and Iowa, is similar to the overall pattern. That is, the majority (over 50%) used low tunnels, followed by high tunnels and mesotunnels. Other states did not show such a pattern, possibly due to insufficient sample size.

Table 5. Respondent Rate of Row Cover Systems used Pre-survey

	Low Tunnel	Mesotunnels	High Tunnel
Illinois	2	0	3
Indiana	3	0	3
Iowa	12	4	9
Kentucky	8	1	9
Massachusetts	1	0	1
Michigan	0	0	0
Minnesota	10	0	7
Missouri	1	0	1
New Hampshire	3	0	2
New York	45	9	36
Pennsylvania	29	2	25
Tennessee	1	0	1
Vermont	23	1	19
Wisconsin	48	3	26
Total	**186**	**20**	**142**

We then asked respondents including those who only used low- and high-tunnels before to state their level of agreement with the ease of learning, adapting to, and applying mesotunnels. 68% agreed that it is easy to learn how to use mesotunnels; however, only 50% thought mesotunnels would be easy to adapt to their vegetable systems. Moreover, around 40% had no obvious inclination to the statement "It would be easy for me to become skillful at using mesotunnels" (table 6).

Table 6. Respondents' Level of Agreement with the Ease of Learning, Adapting, and Applying Mesotunnels

	Strongly Disagree (%)	Disagree (%)	Neither Disagree nor Agree (%)	Agree (%)	Strongly Agree (%)
Learning to use mesotunnels would be easy for me.	1.79	4.91	24.55	50.89	17.86
Mesotunnels would be easy to adapt to my vegetable farming system.	2.65	14.16	32.76	35.84	14.6
It would be easy for me to become skillful at using mesotunnels.	0.9	5.38	39.01	38.12	16.59

When asked about their likelihood to adopt mesotunnels in their cucurbit crop production in the next five years, overall, 84 (~37%) respondents were either highly or somewhat likely to adopt, whereas another 97 (~43%) were not likely to adopt. The rest 44 (~20%) were unsure. Table 7 shows respondent likelihood to adopt by state and indicates that New York and Wisconsin had the highest number of respondents to the question. Respondents in New York were more likely to try new technology whereas those in Wisconsin were less likely. Pennsylvania and Vermont also had more than 20 respondents and the percentage of the likely-to-adopt and unlikely-to-adopt are equivalent in those two states. Iowa, Kentucky, and Minnesota had around 10

respondents. Iowa growers expressed greater willingness to adopt mesotunnels than those in Kentucky and Minnesota. The remaining states had less than 10 respondents, thus the responses may not be representative due to insufficient sample size.

Table 7. Willingness to Adopt Mesotunnels in the Next Five Years for All Respondents

	Highly Likely to Adopt	Somewhat Likely to Adopt	Somewhat Unlikely to Adopt	Highly Unlikely to Adopt	Not Sure	Total # of Respondents
Illinois	0	1	0	0	2	**3**
Indiana	0	0	1	1	1	**3**
Iowa	3	5	3	2	1	**14**
Kentucky	1	3	2	2	2	**10**
Massachusetts	1	0	0	0	0	**1**
Minnesota	1	4	3	2	4	**14**
Missouri	0	1	0	0	0	**1**
New Hampshire	0	1	1	1	0	**3**
New York	10	13	11	14	9	**57**
Pennsylvania	3	10	11	5	9	**38**
Tennessee	0	0	1	0	0	**1**
Vermont	4	6	7	2	8	**27**
Wisconsin	3	14	19	9	8	**53**
Total	**26**	**58**	**59**	**38**	**44**	**225**

Of those were willing to adopt mesotunnels, 70% wanted to use them within next three years and half wanted to use them for cucumber, summer squash, and watermelon (table 8).

Table 8. Number of Respondents Wanting to Apply Mesotunnels to Cucurbit Crops

	Yes (%)	No (%)	Total # of Respondents
Cucumber	80	20	105
Acorn squash	28	72	82
Pumpkin	16.5	83.5	73
Muskmelon	34	66	85
Summer squash	56	44	86
Watermelon	52	48	112
Others	34	66	83

Moreover, we asked respondents to indicate their understanding of the effectiveness of mesotunnels at achieving several outcomes for their cucurbit crops, even though most of them have not adopted the technology. Most respondents thought mesotunnels were effective for all outcomes. Specifically, around half agreed that mesotunnels could maximize marketable yield, reduce pesticide use, and control insects and pests. Around one-third thought that mesotunnels could protect crops from extreme weather events and maximize profit (table 9).

Table 9. Perceived Effectiveness of Mesotunnels in Achieving Outcomes for Cucurbit Crops

	Not effective at All (%)	Moderately Effective (%)	Effective (%)	Very Effective (%)	Not Sure (%)
Maximizing marketable yield	3.13	17.55	50.16	20.38	8.78
Reducing pesticide use	7.76	13.66	42.55	27.64	8.39
Controlling insect pests	3.28	12.84	45.07	34.33	4.48
Controlling diseases	14.62	26.91	31.23	15.28	11.96
Protecting crops from extreme weather events (such as cold, high wind, and hail)	6.19	24.46	38.39	21.36	9.60
Maximizing profitability	7.48	29.25	31.97	13.95	17.35

Respondents' Background Information

We collected individual information including respondents' education levels and age. Half of respondents have a bachelor's degree or higher. The average age was 48 with a 13-year standard deviation. Moreover, 252 out of 367 (68%) were male and 105 (30%) respondents are female. There are 10 (2%) respondents that preferred not to specify.

Twenty-one percent of respondents described themselves as risk neutral either in general or when considering themselves as farmers. Twenty-three percent were risk averse; however, that declined to 13% when taking into account only respondents that were farmers. Moreover, 55% of respondents characterized themselves as risk tolerant, and 65% were willing to take risks when thinking as a farmer. Overall, respondents reported being more likely than not to take risks concerning farming activities.

Regarding information-acquisition, more than 40% of respondents preferred to get information on a specific problem related to their farming primarily through extension agents, followed by university-related websites, videos, and webinars. Podcasts and blog posts are the last two choices respondents would like to use.

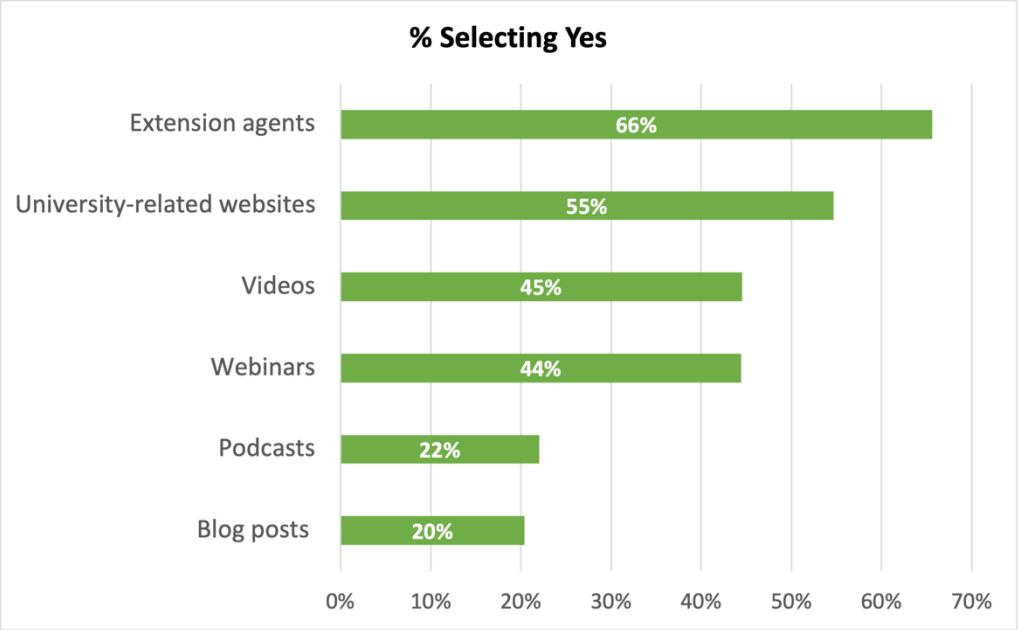

Figure 9. Channels respondents prefer to use for farming-related information.

Respondents' total farm operation annual gross income in 2021 mostly ranged from $0 to $250,000 and the remaining 17% of respondents had more than $250,000 annual gross income. Moreover, 60% of respondents did not have off-farm income sources. For those who did have off-farm sources, the average percentage of annual gross income coming from off-farm sources was around 45%.

Conclusions

This survey aims to understand the growers' use of pest and disease management tools, the crops grown, and growers' willingness to try mesotunnels in their operations in Iowa, Kentucky, and New York and the 11 surrounding states. Through both web/mail surveys, we obtained 377 eligible samples, two-thirds of which were from male respondents.

Regarding the basic farming operation information, 90% of respondents are experienced growers both in general and with cucurbit crop production. Meanwhile, cucurbit crops were not the only crops they grew—25 other crops, such as leafy greens, were also grown. Moreover, more than 90% of respondents were in certified organic status. To sell the crops, diverse marketing channels were applied, and the most frequently used were local farmers' markets, wholesaling, on-farm retail stands, direct sales to grocery stores, large retailers, supermarkets, grower cooperatives, and community supported agriculture (CSA) enterprises.

In regards to the current pest and disease management in cucurbit crop production, most respondents considered insect pressure, crop disease, weed pressure, heavy rain events and input costs as the top five general threats. As for specific pest and disease management concerns, bacterial wilt, cucumber beetles, downy mildew, powdery mildew, and squash bug were selected as the significant threats by over 50% respondents. To alleviate those concerns, multiple production strategies were applied. For spraying strategies, hand-pump backpack sprayer is respondents' major choice. Furthermore, half of respondents sprayed pesticides no more than three times per growing season. Regarding row cover systems, more than 60% of respondents chose to use permeable row covers for any of their cucurbit crops and half of them applied row covers to less than half of their cucurbit acres. For the general reasons why respondents adopted different production management strategies, we explored that 60% of growers considered improving yields, profitability, produce quality, soil quality, and whether pest controls are effective as top concerns. The top two reasons for applying row covers were to control insects and pests and protect against cold temperatures. Most respondents felt that row covers can improve yields (76%) and product quality (73%) and reduce insecticide spray frequency (66%) and vulnerability to weather (78%). The majority showed interest in continuing use of row covers.

To further understand their willingness to adopt new technology, mesotunnels, we asked respondents several questions associated with mesotunnels after providing the corresponding information. Most respondents only had experienced using low tunnels and high tunnels, only 14% previously used mesotunnels. More than 30% perceived mesotunnels as easy to learn, adapt, and apply in their current production systems. Regarding their likelihood to adopt mesotunnels in the next five years, 40% reported interest in adopting mesotunnels while another 40% are not that likely to adopt. The other 20% respondents were unsure of their preference. For those who are willing to adopt mesotunnels, 70% want to use it within next three years. Cucumber, summer squash, and watermelon are the top three varieties for which respondents are willing to use mesotunnels. Lastly, most respondents perceived mesotunnels as effective on all the outcomes including maximizing marketable yield, reducing pesticide use, and controlling insect pests no matter whether they want to adopt it or not.

OTHER A.E.M. EXTENSION BULLETINS

EB No	Title	Fee (if applicable)	Author(s)
2023-05	Controlling Pests and Diseases Using Mesotunnels: Understanding Organic Cucurbit Crop Growers' Preferences and Choices		Cheng, N.,Zhang, W.,and Gleason, M.
2023-04	2022 New York Berry Price Information		Park, K.
2023-03	Examination of Impact of Changes of Minimum Wage and Overtime Thresholds to New York State Berry Farmers		Severson, R.M., Park, K. and Gomez, M.I.
2023-02	How New York Farmers Adapt to New Farm Labor Overtime Requirements		R. Stup, E. Higgins, J. Karszes, B. Richard and C. Wolf
2023-01	Size Year Trend Analysis 2021 – New York State Dairy Farms – Selected Financial and Production Factors		Karszes, J. and Augello, L
2022-13	Specialty Mushroom Grower Survey Report		Park, K., Gabriel, S., Rangajaran, A.
2022-12	An Investigation of Marketing Channels and Suggested Methodology for Channel Assessment for Hemp Products		Leroux, M., Schmit, T., & Van, L.
2022-11	Dairy Business Summary New York State 2019		Karszes, J and Augello, L.
2022-10	Progress of the Dairy Farm Report, Selected Financial and Production Factors, New York, 2021		Karszes, J. and Augello, L.
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