MSU IPM Programming Evaluation Focus Group Discussions with Technical Consultants and Survey of Growers

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Executive Summary

This report details the findings of a three-part series of evaluations of the Michigan State University (MSU) Integrated Pest Management (IPM) Program, consisting of a survey of growers and focus group discussions with specialty crop and row crop consultants. The project started with a survey of growers to assess the degree of adoption of key IPM practices and sources of information concerning such practices. The focus group discussions where used to gauge the effectiveness of such programs to grower financial outcomes, assess the barriers to adoption, and assess the overall impact on pesticide applications.

A mail survey of Michigan growers was conducted with an initial mailing date of February 18, 2014 and a second mailing on March 10, 2014. The survey was administered by the Michigan regional office of the USDA National Agricultural Statistics Services (NASS). A sample size of 3,550 was selected, equally distributed across five commodity classes. Growers were assigned to commodity class based on responses in the 2002 Census of Agriculture, modified by post-census surveys. Survey administers attempted to contact those that did not return a survey after the second mailing by phone.

The first focus group discussion with specialty crop consultants took place at the 2013 Great Lakes Fruit, Vegetable and Farm Market Expo. The second and third focus groups occurred at general regional meetings of field crop consultants in Edmore, MI, on July 10, 2015, and in Centreville, MI, on December 18, 2015.

While difficult to summarize the findings of the comprehensive assessment, a few key findings are worth highlighting. First, growers respond to prescriptive practices that benefit their bottom-line. If there is not a clear channel from practice to outcome, growers become less inclined (in general) to invest in the practice. This leaves a great deal of space for exploring how IPM practices lead to financial and yield outcomes. Second, while growers are aware of biological implications of practices, their knowledge may be best expressed in their general attitudes toward pest management, but likely do not factor directly in their decision-making process. That is, those who perceive wide spectrum pesticides as harmful and wish to minimize environmental harm likely act out of instinct to minimize environmental impacts without directly attributing that thought to the actual decision. Third, while few consensus impacts were reached, it appeared that some practices give rise to improved grower outcomes and reduced pesticide use. Scouting for threats appears to be the practice most likely to impact pesticide use and growers' bottom line. It is also the practice most readily adopted by growers, especially specialty crop growers.

This report summarizes with key areas where the MSU IPM Program may experience significant impact. However, as evident in the discussion groups and via the survey, there are likely few growers not impacted directly or indirectly by the MSU IPM Program and associated research.

Introduction

This program evaluation project set out to understand how MSU Extension IPM programming impacts Michigan's agricultural producers. The effort is fairly modest in linking expected practices and associated impacts with extent of adoption. For this, a two-part project was developed. One part set out to estimate how particular practices impact growers in terms of yield and production costs. This part engages field technicians to estimate the association of practices and outcomes. To facilitate different crops, two sets of focus group discussions were pursued. One targeted specialty crops while the other targeted row crops. The focus group instrument is provided in the Appendix of this report. The second part is to assess the extent to which practices are adopted by growers. This part engages growers directly with a short survey of practices, the extent of participation in such practices and the source of information growers received about those practices. The survey is reproduced in the Appendix of this report.

The following report details the findings of the survey of growers and the focus group discussions. The first section discusses the findings of the survey of growers and establishes the level of adoption of key practices and sources of information growers use to obtain IPM information. The next section covers the findings of the focus group discussions with specialty crop consultants. The third section discusses the findings of focus group discussions with row crop specialists. The final section summarizes the findings and amalgamate some key findings.

1. IPM Survey of Growers

A mail survey of Michigan growers was conducted with an initial mailing date of February 18, 2014, and a second mailing on March 10, 2014. The survey was administered by the Michigan regional office of the USDA National Agricultural Statistics Services (NASS). A sample size of 3,550 was selected, equally distributed across five commodity classes. Growers were assigned to commodity class based on responses in the 2002 Census of Agriculture, modified by post-census surveys. Survey administers attempted to contact those that did not return a survey after the second mailing by phone.

Table 1 below shows the breakout of total number of operators in each commodity class (N), number sampled (n) and the representative weights that would be assigned to each response had all surveys been returned completed. Table 1 also shows survey responses by commodity class. In total, 1,600 of the 3,350 sampled completed a survey for a response rate of 48 percent. Most responded via mail (1,152), though several completed the survey via phone (448).

		Sample			Returns			
	Description	**N**	**n**	**Initial weight**	**n (mail)**	**n (phone)**	**n**	**Rate**
1	Row/grain	14,062	670	20.988	180	111	291	43%
2	Vegetable	1,601	670	2.390	193	90	283	42%
3	Berry/fruit	1,634	670	2.439	287	91	378	56%
4	Christmas Tree/nursery	1,346	670	2.009	248	80	328	49%
5	Floriculture	1,077	670	1.607	244	76	320	48%
	Total	**19,720**	**3,350**		**1,152**	**448**	**1,600**	**48%**

Table 1: Michigan Sample

Respondents were asked to provide total number of acres of commodities they produce and the number of square feet of greenhouses. The sums of these are provided in Table 2 by commodity. In this, the number of acres surveyed represents the coverage of the survey responses.

Commodity	**Acres**
Corn	104,598
Soybeans	61,634
Other field crops	43,253
Berries	4,872
Nursery	3,778
Vegetables	311,128
Fruit	26,571
Christmas Trees	15,016
Greenhouses*	337

Table 2: Acreage of Responses

** converted from square total feet*

Responses were scaled to be representative of the larger population of commodity growers. Sample weights indicate the number of responses each response represents. By multiplying each response by the weight, the sum of responses will total 19,720, which, according to the Michigan regional office of NASS, is the total number of growers engaged in the targeted commodities. Table 3 shows the total number of growers by commodity, the sample size of completed surveys and the resulting weights applied to responses.

		N	**n**	**wt**
1	Row/grain	14,062	291	48.323
2	Vegetable	1,601	283	5.657
3	Berry/fruit	1,634	378	4.323
4	Christmas Tree/nursery	1,346	328	4.104
5	Floriculture	1,077	320	3.366
	Total	19,720	1,600	

Table 3: Survey Sample Weights

Several qualifying questions were asked of respondents. These Yes/No questions also determined subsequent questions on the survey. First, respondents were asked if they have attended an education session entailing IPM within the last 12 months (Figure 1). About 11 percent of respondents did not respond. Responses are broken out between Extension and non-Extension education sessions. Of those that did respond, 22 percent indicated they have participated in an Extension educational session, while 20 percent indicated they attended a non-Extension session.

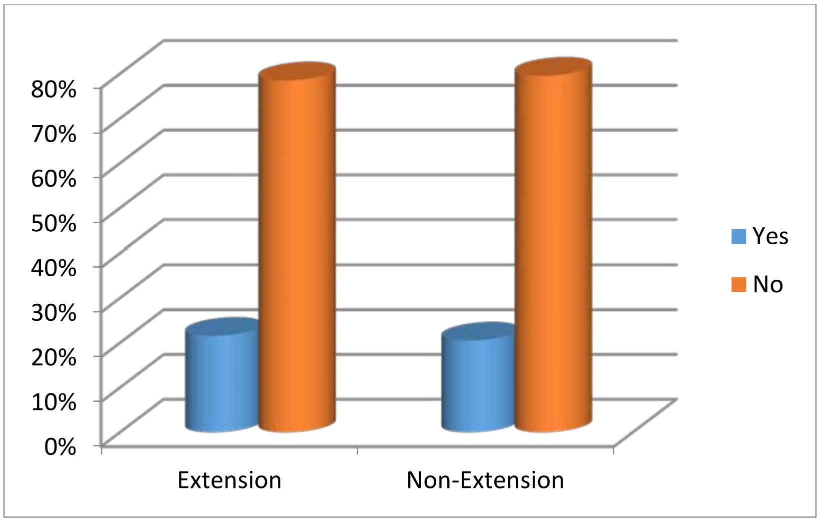

Figure 1: Have you attended an education session that included IPM within the last 12 months?

The responses in Figure 1 varies by commodity group, as shown in Figure 2 which shows the percent responding yes to the question, “Have you attended an education session that included IPM within the last 12 months?” As evident in Figure 2, Extension programming appears modestly more common across most commodity groups. However, both Extension-based and non-Extension based training is most common for berry and fruit producers. Once compared to adoption, it is clear that training is closely related to rates of utilization of IPM practices. However, the largest disconnect appears to be associated with floriculture producers.

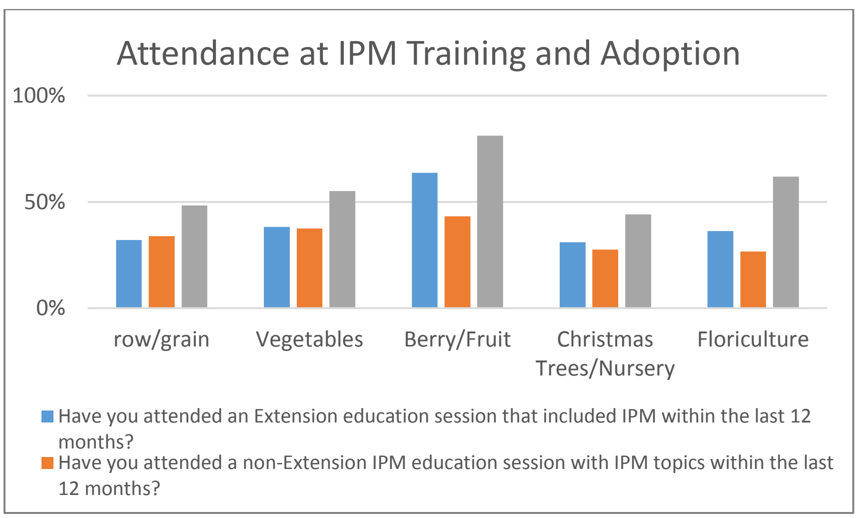

Figure 2: IPM training by commodity group within the last 12 months.

As the survey targeted those that have adopted IPM, we asked respondents to indicate whether they practice IPM. About 10 percent did not respond to this question. Of those that did, 58 percent indicated they have adopted IPM practices (Figure 3). This reduced the total number of respondents proceeding to the remainder questions by 42 percent, and all remaining responses only include those selecting “Yes” on this question.

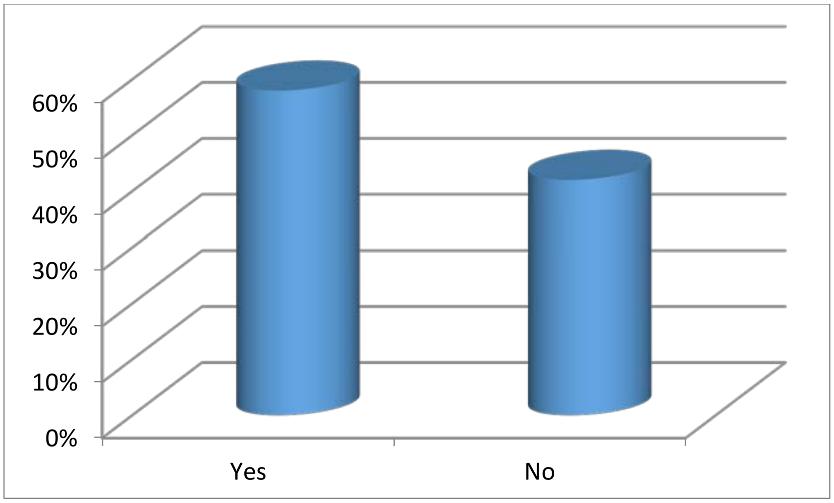

Figure 3: Do you routinely utilize Integrated Pest Management (IPM) practices on your farm operation?

A quick note on how responders view IPM may be warranted here, as we anticipate one's understanding of IPM practices may be subjective and impact survey outcomes. While the survey request included a cover letter stating the survey objectives around IPM practices, we believe that the gradual introduction of IPM practices into conventional farming practices may result in negative bias in responses to this question. That is, many growers may not identify their current practices as being in the family of IPM practices even though such practices are consistent with IPM systems.

Those that indicated adopting IPM practices were asked to check off practices they have adopted. Categories are ordered from highest adoption rate to lowest in Table 4 below. Scouting ranks as the most adopted practices, both for injurious pests and beneficial insects. This is followed by only treating crops when economic thresholds are reached and considering biological impacts when choosing pesticides. The least common practices included supporting beneficial insect habitats and accessing MSU IPM print or online resources for reference.

Practices	Yes
Scouting for damaging insects and diseases	96.0%
Scouting for beneficial insects	85.8%
Only treating for pests when the economic threshold is reached, as applicable	76.6%
Considering biological impacts when choosing pesticides	75.1%
Selecting pest-resistant varieties or cultivars	69.1%
Referencing weather models to make management decisions (e.g., Enviro-weather)	63.0%
Using sanitation practices (removing inoculum, sterilizing or cleaning implements, etc.)	56.0%
Protecting native pollinators (mowing before spraying, spraying at night, etc.)	51.1%
Supporting beneficial insect habitat to promote pest control via natural enemies	46.0%
Accessing MSU IPM print or online resources for reference	36.6%

Table 4: Which of the following IPM practices or resources do you routinely use on your farm operation?

We next asked respondents to rate the importance of several sources of information they use in their IPM decisions (Table 5). The results are shown in Table 6. Field technicians (including fieldmen, chemical representatives and seed dealers) and MSU Extension personnel rated highest. Fewer growers turn to private crop consultants and Michigan's Agricultural Assurance Program was also low in importance. Respondents were encouraged to add their own resource. In Table 5, scores represent average response on a three-point scale where three implies more important.

Sources of information	Essential	Important	Not Important	Score
Field man, chemical, or seed dealer representative	32%	55%	14%	2.18
MSU Extension programming or personnel	27%	60%	13%	2.14
MSU Extension print or internet material	27%	53%	21%	2.06
Trade journals	13%	68%	19%	1.95
Grower, commodity or industry group	10%	64%	26%	1.84
Neighbor	8%	65%	27%	1.81
Natural Resources Conservation Service (NRCS) programs	12%	53%	35%	1.78
Private crop consultant (not associated with a chemical dealer)	18%	41%	41%	1.77
Participating in the Michigan Agricultural Environmental Assurance Program (MAEAP)	11%	43%	45%	1.66

Table 5. How important was each source of information in your decision to adopt IPM practices?

Figure 4 breaks out Table 5 for key sources of information. As evident, most berry and fruit producers indicated that MSU Extension personnel and print material were essential for the operations. Other operations rate them high as well. Concerning crop consultants, it appears berry, fruit and floriculture producers are less apt to enlist their services, while relying more on fieldmen for IPM information.

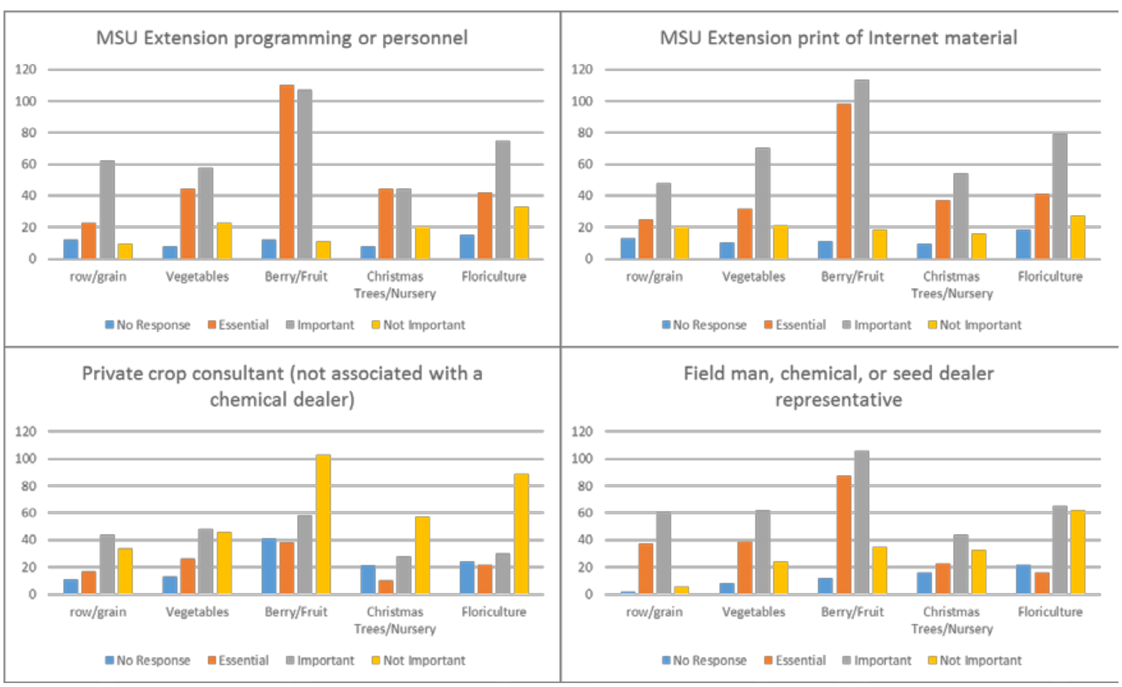

Figure 4: Importance of Key Sources of IPM Information
Based on unweighted counts

Most respondents feel that adoption of IPM practices have not reduced their use of pesticides. However, of those that indicated a change in pesticide usage, more respondents perceived declines in pesticide use than increases. As shown in Figure 5, about 46 percent indicated no change in pesticide use associated with IPM practices, while 40 percent perceived a decline and 14 percent perceived increased usage.

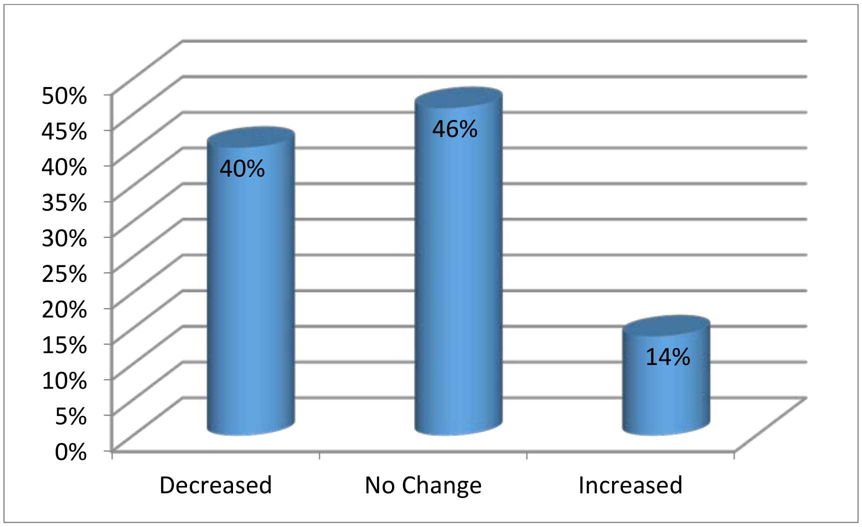

Figure 5. Has your use of IPM resources or practices increased, decreased, or not affected the amount of pesticides you apply on average?

Next, we asked a series of questions about the operational impacts of adopting IPM practices. These considerations include impacts on ability to protect crops, yield and crop quality. As shown in Table 6, there is near universal agreement that IPM practices facilitate grower's ability to protect their crops with 92 percent of those responding indicated the positive. The level of affirmation declines to 73 percent on impact to yields. Hence, while fewer saw positive yield outcomes associated with IPM practices, a significant majority see positive yield outcomes. Finally, we asked if growers saw crop quality impacts associated with IPM practices. About 84 percent perceived positive quality impacts associated with IPM practices. Of those that indicated an improvement, most did not tie the quality outcomes to changes in prices they receive. However, about 40 percent perceived some positive impact on prices their commodities command.

Survey question	Yes	No
Has your use of IPM practices or resources helped protect your crop?	92%	8%
Has your use of IPM practices or resources increased yield?	73%	27%
Has your use of IPM practices or resources increased crop quality?	84%	16%
If yes, has the crop quality improvement increased prices?	40%	60%

Table 6. How has adopting IPM impacted operations?

Another barrier is the perception that IPM practices may reduce yields, though it is an empirical question whether a particular farm may have in fact greater profits from reduced costs associated with IPM practices. Caswell et al.[1] analyzed the claim that adoption of IPM practices will result in a decrease in pesticide or fertilizer use, finding modest reduction in chemical loadings with no yield decreases (but in some cases increases) in the five case adopter farms they examined. Miller[2] found that use of the Michigan Enviro-weather system decreases the use of pesticides and has a positive impact on environmental outcomes based on grower responses.

Synthesis of Grower Survey Findings

While rates of adoption of IPM practices have room to grow, it is evident that most growers who have adopted IPM practices perceived a reduction in pesticide applications. There also exists a near universal perception of those adopting IPM practices that they are better able to protect their crops, and a significant proportion see such practices positively impacting crop yields and crop quality. However, much fewer saw improved crop quality bring about higher market prices of the crops they sell.

When referencing sources of information, most respondents did not see any one source as essential for their operations. That is, with so many sources of information, no one source stands out. This is most likely a reflection of the new information-driven economy. with so many sources of information, delivery becomes relatively more important in terms of capturing growers' attention. Those venues and messages most in line with growers are more likely to reach their targets. Based on responses, MSU Extension programming and personnel and MSU Extension print are more important for berry and fruit producers than for other commodity producers. This relates both success in reaching these growers and opportunities for fine-tuning messages and venues of messages for other commodity producers.

2. Specialty Crop Focus Group Discussions with Chemical Representatives and Scouts

We started the focus group discussions around general topics concerning IPM practices, sources of grower information, and the roles of chemical representatives, scouts, and chemical companies. Chemical representatives (sometimes referred as fieldmen) and scouts are individuals that are trained and practiced in pest and crop management and are routinely consulted by growers. The focus group discussion took place at the 2013 Great Lakes Fruit, Vegetable and Farm Market Expo. Lunch was provided. In total, six consultants participated in this focus group discussion, covering most of Michigan's Lower Peninsula and with broad coverage of fruit and vegetable production, including greenhouses.

Findings

Chemical representatives and scouts largely rely on Extension IPM programing to keep them up-to-date with latest threats and to fill gaps in their knowledge. While Extension IPM is not the sole source of information they draw from, nor is it the primary source in some cases, the information they receive from

[1] Caswell, M., Fuglie, K. O., Ingram, C., Jans, S., & Kascak, C. (2001). Adoption of agricultural production practices: lessons learned from the US Department of Agriculture Area Studies Project: United States Department of Agriculture, Economic Research Service.

[2] Miller, S. R. (2015). Economic and Environmental Impacts of Enviroweather. East Lansing, MI, Michigan State University.

Extension IPM is specific to grower threats as they happen, and this information is directly actionable. The immediacy of Extension IPM information is of particular value to chemical representatives and scouts. They largely keep up-to-date on current threats and gain information on pest management news and technologies by attending weekly Extension meetings across the state. Through these interactive meetings, they view themselves as an essential resource for Extension IPM programming by reporting conditions and providing first-responder information on pest conditions to Extension educators. To this extent, the association is complementary.

Growers largely stay up-to-date with pest management information through four channels: technical consultants, MSU Extension, other growers, and retailers. They also receive information directly from chemical companies and representatives. Growers remain in touch with Extension IPM programing through weekly meetings and through word of mouth on topics covered during these meetings. Growers often find information from chemical companies and retailers, and largely back that information up with advice from chemical representatives or scouts. That is, marketing material generated from chemical companies and distributors often promote their products as meeting certain grower needs, and growers often call on chemical representatives and scouts to verify such claims. Chemical representatives and scouts expressed concern about claims of innovations made by chemical companies. From their experience, these claims, while not incorrect, often are not as revolutionary as claimed by their representatives and print material. Rather, the "latest and greatest" products are mostly repackaging of existing active ingredients. Confusion is facilitated by product names and labels that are not always clear to growers. Chemical representatives and scouts familiar with active ingredients and their effects help growers decide on what regiment will meet grower needs – helping them through the complex task of designing a pest management regiment. They work with growers to develop management regiment recommendations that growers may or may not adopt. Alternatively, chemical companies and retailers largely sell pesticides, not regiments. But regiments are necessary to get the most beneficial impact of pesticide usage and expenses as they are designed to take advantage of timing, synergies across pesticides, and other considerations for effectively managing the dynamic sphere of agricultural pest management.

Conventional pest management calls for calendar-based timing of pesticide applications. Calendar-based methods are best suited for broad-spectrum pesticides that destroy pathogens and beneficial insects regardless of their threat. These applications are then repeated on a fixed schedule to assure effective suppression of pests. However, EPA regulations have consistently sought to restrict the use of such broad-spectrum pesticides because pest management regiments using them tend to call for applications regardless of the presence or absence threat of pests. Such indiscriminant applications encourage resistance development in targeted pests, making future control efforts more difficult. In addition, such regiments often result in the destruction or suppression of beneficial organisms. Modern pesticide management techniques focus on using targeted pesticides with limited ancillary impacts on non-targeted organisms and are most cost-effective when applied to fields meeting economic thresholds of infestation.

Growers are less apt to design or time their applications. To a large extent, they are likely to reference neighbors' activities and check with their chemical representative to ask if it's time to apply. Chemical representatives and scouts feel that growers are increasingly less inclined to develop their own pest management regiment, as the learning curve for understanding active ingredients, best practices, and managing localized pests is getting increasingly steep. Technological advances in pesticides and pest management practices commands greater technological skills of growers in a similar way that technological advances in automobiles have reduced the number of backyard auto mechanics who service their own vehicles. However, chemical representatives and scouts classified two types of growers: Newer growers, that have an interest in staying on top of developments, and older growers, acclimated to timed applications and who have failed to keep up with changes in pest management practices. Both represent opportunities for IPM education programs, as younger, technology-savvy growers are more open to keeping up with the latest advances in environmentally-friendly pest management, while those adopting customary practices affords the greatest opportunities for impact.

Chemical representatives and scouts suggest that grower's interest in IPM and pest management options is generally high. Much of the interest in gaining new information is associated with changes in technology that have driven a high pace of change in pest management options. This has not only opened new opportunities for growers, but also generated a great deal of confusion. Growing complexity of modern pest management is a primary factor contributing to a growing trend in scouting and outsourcing pest management. This complexity impacts the two grower types differently. Those seeking to stay on top of and manage technological advances in pest management must invest considerable time and effort in learning about pesticide active ingredients, their interactions with other pesticides and in developing effective pest management regimes that meet their specific needs. Those who seek to minimize the impact of technological change on current practices are probably most vulnerable to technological change and most likely to seek outside assistance. Traditional methods of pest management may not only be less profitable for growers, but may also breach regulatory standards, which do evolve with technological innovations.

When asked what motivates grower's choice of pest management regime, chemical representatives and scouts feel growers are less inclined to seek out pest management regiments to meet their customer's demand (or consumer demand in general) than they are to effectively manage the labyrinth of information necessary to effectively manage pests. In this, pesticide labels are seen as sufficient in meeting regulatory mandates for pest management and food safety issues, but not necessarily for designing effective management protocols. This is not to say that consumer demand is not having an impact on pest management practices, as retailers are adding to pest management mandates. However, such mandates are mostly directed at food safety concerns, and for most growers, this has not been a source of pressure for modifying pest management practices.

Many growers select not to manage their own IPM practices because of the complexity associated with modern agrichemicals. In the past, growers could apply pesticides on a calendar basis. These broad-spectrum pesticides would eradicate fields of most pathogens and insects, including desirable ones, and have potential environmental implications. As an alternative, agrichemical companies have actively pursued development of more targeted pesticides with fewer undesirable incidental outcomes. These targeted pesticides require more complex management efforts. Complexity associated with more targeted pesticides and mixing pesticides with added food safety issues have reduced grower capacity to manage the pest management function.

Resistance management is challenging for growers and a key contribution of chemical representatives and scouts. While growers may view resistance management as a second-order concern, chemical representatives and scouts routinely consider resistance management when developing pest management plans. Growers are more inclined to see a pest problem and attempt to minimize the immediate risk posed by the pest, while chemical representatives and scouts may be more apt to recognize the broader concern of environmental impacts and resistance. Their failure to manage resistance has greater implications on their future ability to prescribe spray regiments.

Type of commodity has direct bearing on grower's choice of pest management regiments. Foremost, different commodities have different pest management requirements and options. Specialty crop growers may have fewer options for managing pests than row crop growers and may be required to juggle multiple pesticide applications with varying label instructions. Row crop growers are less apt to apply IPM practices as they generally make fewer pest application trips through the field. In contrast, specialty crop growers are more apt to modify planned sprays to meet immerging threats, as they are making the trip down the field anyway. When possible, they simply add another pesticide to the existing tank mix.

Maybe the most prevalent obstacle to grower's willingness to adopt new practices is the time-cost of doing so. Time-costs may take two forms: (1 The time required to learn about the new practices, including time necessary to assess its relevance to the grower's operations, and (2 the time to implement once adopted. Arguably, it may be the prior time commitment that is most influential to grower's decision to implement a new IPM practice. Time, like any commodity of value, is discounted over time. That is, growers view time today as more valuable than the same amount of time in the future — much as individuals value a dollar today more than a dollar a year from now. But this is not to suggest the operational time commitment of implementing a new practice is not relevant to the grower decision. Growers may over-estimate the time necessary to actually undertake some practices, as they perceive the practice from the bottom of the learning curve. The implementation time-costs include the time necessary to implement the new practice once adopted. To this extent, implementation time-costs compete with other operational time requirements of operating the farm. Those practices requiring the least operational time-costs may appear more attractive than those with higher time commitments. Growers must anticipate the true time-costs of adopting new practices against benefits, and the decision to adopt is easier where the benefits far exceed the two time-costs associated with adopting the practice.

Fuel prices are taken into consideration if the practice requires additional fuel uses. Hence, IPM efforts that increase fuel uses, primarily diesel fuel, face greater resistance when fuel prices are high. On this flip-side, this suggests that IPM practices that reduce fuel uses may be more attractive when fuel prices are high. As the general consensus is that motor fuel prices will continue to trend up,[3] those practices that can reduce fuel usage have a comparable advantage in terms of being adopted than that increasing fuel usage.

We briefly discussed funding opportunities for growers wishing to adopt IPM practices. This discussion is by no means conclusive, and a comprehensive look into funding opportunities is beyond the scope of this

[3] Since this focus group discussion, fuel prices have reversed.

study. Regardless, only Environmental Quality Incentives Program (EQIP) funding was discussed as a cost-share opportunity for growers. One participant noted that early adopters have already taken advantage of EQIP incentives to implement IPM practices. These growers no longer qualify for current EQIP incentives. In general, chemical representatives and scouts see that most cost-share opportunities have been exhausted.

We asked chemical representatives and scouts to provide their perspective on the degree of influence several groups have on growers' decisions to adopt IPM practices, without discussion. For each group, respondents selected on paper the degree to which they feel that group influences growers' IPM decisions on a scale from 1 to 3 representing none, moderate or significant, respectively. The tallied responses are shown below in Table 1. In Table 1, the higher the degree of influence score, the more influence. Technical consultants, including private crop consultants and fieldmen, ranked highest in terms of influence. This is followed by MSU material provided in print or in person. Michigan Agricultural Environmental Assurance Program (MAEAP) and chemical or seed dealers and representatives also had significant influence on growers. The remainder is mostly considered moderate influencers and includes commodity groups, National Resources Conservation Service (NRCS), trade journals and neighbors. It may be of interest that NRCS, which provides incentives for growers to adopt IPM practices through EQIP, is rated as a moderate rather than significant influencer. This may be, as discussed above, that most growers no longer qualify for EQIP incentives.

Table 1: Primary Influencers Affecting One's Adoption of IPM

Influencer	Degree of influence (1-3)*
Private crop consultant	3.0
Fieldman (includes chem/seed rep, industry rep)	3.0
MSU Extension print or internet	2.8
MSU Extension programing or personnel	2.7
MAEAP	2.6
Chemical or seed dealer/rep	2.6
Grower/commodity/industry group	2.3
NRCS	2.2
Trade journals	2.1
Neighbors	1.9

* *1=No influence, 2=moderate influence, 3=significant influence*

Finally, we asked participants to discuss their experience with MSU Extension. It appeared that chemical representatives and scouts directly observed recent changes in Extension and made mention of the lack of fruit representation in the west side of the state. They expressed gratitude that their new Extension educator is doing a great job in her year and a half at the job, and see great improvement in the delivery of up-to-date information relevant to pest management.

Next, we asked chemical representatives and scouts to generate a list of IPM practices they see and recommend to growers. We compared this list to an existing list of practices that we particularly sought input about. The two lists of practices mostly overlapped, though chemical representatives and scouts identified resistance management as a key IPM activity, where the focus group discussion did not. IPM practices we considered in this focus group are shown in the Appendix.

For each IPM activity, chemical representatives and scouts were asked to discuss barriers to adopting the practice, alternative practices foregone, effect of practice on crop outcomes, costs of implementing the practice and finally, how widely they see the practice being adopted. In addition to participating in the discussion, chemical representatives and scouts were asked to complete forms for quantifying their perceptions. They were further encouraged to provide comments in writing and identify commodities they considered when discussing the practice.

Scouting for insects and diseases

The first practice discussed was scouting for insects and disease. Chemical representatives and scouts noted that this core IPM practice posits moderate barriers to adoption. A principle barrier is the time-cost of adopting this practice and the high cost of hiring out scouting effort. Second, is the reliability of the scouting effort in assessing the true threat of potential pest damage. Scouting for insects and disease is more complex than simply identifying insects, but growers must also be able to gauge the potential damage such pests pose. As such, growers who wish to scout themselves exhibit uncertainty about their ability to effectively perform the scouting function. The ability to master the craft of effective scouting is difficult, and scouting businesses relay concerns about finding qualified individuals for employment. Alternatively, growers can turn the scouting activity over to third-party scouts with training and experience in assessing impeding threats. Scouting done correctly can be very costly to implement, but scouting done poorly can be costly in results. Scouting is time consuming and it can be expensive to hire a scout. However, third-party scouts may not only be more proficient at identifying threats, in many cases, they can also effectively perform the scouting operation with reduced time. Hence, many growers adopting scouting practices will hire third-party scouts, benefiting from their experience and efficiencies in effectively monitoring for pest pressures.

Scouting for pests precludes the timed or calendar-based application of pesticides. Abandoning timed sprays either requires a greater time commitment from growers or the expense of hiring a scout to identify when and what pesticide application is warranted. Hence, adopting scouting practices generally adds costs to production. However, scouting for pests may posit significant savings in costs of active ingredients if scouting results in fewer or more effective pesticide applications. There's significant uncertainty whether the potential savings exceed the additional costs and expected returns are likely to vary depending on commodities and circumstances. For example, scouting may not decrease the number of sprays applied, but may save active ingredients mixed in the spray tank in orchards that receive regular sprays. In contrast, scouting may actually reduce the number of sprays for row crops if scouting indicates no or little threat. Furthermore, there is no guarantee that scouting reduces applied active ingredients. If pest pressures are high, scouting can result in greater use of pesticides. Though one would anticipate that is to the benefit of resulting crop yields and quality.

All participating chemical representatives and scouts expressed certainty that scouting generates positive impacts on yields. In effect, they anticipated growers adopting this practice can expect yield outputs to increase in value of between 10 and 25 percent over conventional practices. However, they also anticipate that along with this is additional costs of production of up to 10 percent. However, expectations of impacts differ for different commodities. For example, tree fruit and tree nut growers can expect the largest yield impacts while row crops will likely experience the lowest productivity impacts. Chemical representatives and scouts also indicated that adoption of insect and disease scouting is widespread. Adoption for tree fruit and greenhouses is highest, while that for row crops is lower, but may still exceed 50 percent.

Scouting for beneficial insects

Scouting for beneficials posit similar challenges as scouting for injurious insects and disease. Growers, if aware of this practice, view scouting for beneficials as of secondary importance to the threat of injurious organisms. That is, growers see injurious organisms as a direct threat and view protecting beneficials of second-order importance. Furthermore, existing sprays often kill off beneficial insect populations before the grower can take note of them, and growers may have a hard time distinguishing beneficial insects from injurious ones. Therefore, there is limited penetration of this practice in non-greenhouse farms. However, greenhouse operators are more likely to scout for beneficial insects and protect them than non-greenhouse operators, even though they are equally likely to view the simple presence of injurious organisms as posing a significant enough threat to warrant pesticide application in the absence of concern of the beneficials.

Growers adopting this practice do not necessarily have to abandon other practices. Principally, timed sprays do not take into consideration beneficials that would be impacted with the sprays. However, scouting is a time consuming process that may supplant other activities. Those scouting for insects and disease are in a better position to also adopt scouting for beneficials. However, it is questionable as to whether the presence of beneficials will impact grower pesticide application decisions when threats are present. For growers, the threat of injury outweighs the cost-savings of delaying pesticide applications in hopes that beneficial insects can contain the threat. Those seeking to protect beneficials in the presence of injurious organisms will likely seek label content for guidance or postpone application of pesticides until pest pressure hits their economic threshold.

In total, chemical representatives and scouts indicated that scouting for beneficial insects likely results in little change in grower productivity, and may increase or decrease the costs of production. While they suggest that costs of scouting may be offset with fewer sprays, they did not reach consensus in this conjecture as some saw the costs of scouting exceeding potential savings through reduced pesticide use. Similarly, some see adoption rates as exceeding 50 percent, but others anticipated lower rates of adoption, below 20 percent. This largely reflects differences across production methods with greenhouse growers showing a greater willingness to adopt scouting for beneficial insects.

Referencing weather modeling to make management decisions

Referencing weather modeling for pest management decisions appears to be more common with chemical representatives and scouts than with growers. One participant suggested that MSU's Enviro-weather website and associated weather models may be one of the most important functions of MSU Extension. Many growers rely on weather modeling indirectly through the advice provided by chemical representatives and scouts. However, as discussed above, there are two types of growers, and those more inclined to keep up with technology are more apt to reference weather models and more likely to be familiar and have access to computers or handheld devices necessary to get access to these models.

Both chemical representatives and scouts concur that Enviro-weather weather data and associated models are vital to their decision-making process when advising growers. In this, participants highlighted that both the weather data and the pest pressure models are fully utilized. However, several caveats were offered. Primarily, weather stations a distance away can generate in-actionable results and that the only way to be assured of models' recommendations is if the weather station is located on the property. Hence, close proximity to weather stations is ideal. Other weather stations may exist, but non-Enviro-weather stations lack the benefits of the management models built into Enviro-weather weather stations, which chemical representatives and scouts indicated were vital resources of pest management planning. Chemical representatives and scouts also mentioned they are encouraging weather station producers to partner with MSU for developing non-Enviro-weather stations with models.

Growers may also reference Enviro-weather data and models, but this requires grower access to internet and a level of sophistication necessary to properly interpret outcomes. Once again, growers largely fall into two categories: those that seek to be on top of the technical details and resources for precision farming (most associated with younger growers), and those that seek to remain current on conditions. The prior is more likely to engage all the resources provided by weather data and models while the latter are more likely to apply heuristic rules over the more technically comprehensive tools available.

Timed applications are most susceptible to being abandoned when adopting this practice. Abandoning timed applications can increase the precision of spray applications by timing them with weather events and proclivity of pest threats. This may also reduce or increase the number of sprays that one may apply over a season, depending on how weather conditions play out with existing pest management practices.

Growers adopting this practice should experience an increase in yields and generally no substantial change in production costs. However, if a grower were to purchase their own weather station to work with existing or their own custom weather model, they would have to cover the additional cost. Row crops possibly have the lowest return to yields (negligible), while vegetable and tree fruit growers can generally expect yield hikes of around 10 percent. Overall, it appears that chemical representatives and scouts see overall high rates of adopting this practice of about 75 percent. This includes direct adoption of growers and indirect adoption through third-party advisers.

Only treating for pest when the economic threshold is reached, as applicable

Chemical representatives and scouts suggest that economic thresholds may be less relevant than what they can be. They point out that economic thresholds were established 20 to 30 years ago and may be less relevant today. Because of this, the delineation of economic thresholds is somewhat blurred and subject to grower discretion. Chemical representatives and scouts made examples of times when communicating levels below economic thresholds to growers who proceeded with sprays against their recommendation. That is, growers mostly have a hair-trigger response on the presence of injurious organisms, or that growers exhibit lower thresholds than those recommended by Extension and the literature. Furthermore, there is reason to believe that row crop growers are less likely to abandon timed intervals for sprays than specialty crop growers, because specialty crop growers are more likely to have opportunities for applying pesticides than row crop growers. Specialty crop growers have very regular spray applications related to and not related to pest management. For them, adding pesticide to the spray tank is a marginal process.

Growers adopting this practice necessarily have to abandon the practice of calendar-based applications. Maybe the most significant challenge to adopting economic thresholds is the tenuous nature of one's own interpretation of what the threshold should be. To this extent, published thresholds, seen as behind the times, are not a sufficient reference for growers. Hence, there is no effective definition of what the economic thresholds are. Growers then define their own thresholds and these may be subject to interpretation. Thus, chemical representatives and scouts describe the term "calibrating the scouts" to denote the effort one has to make to be able to get scouts and growers in agreement for adopting economic thresholds.

While chemical representatives and scouts suggest that barriers to adopting this practice are moderate, the barriers are largely soft barriers in that greater information, or greater willingness, may illicit greater response of growers than that of other practices that require capital investment or surmounting a steep learning curve. Regardless, those currently scouting for pests are better prepared to add this practice to their existing pest management regiment, as timed applications take no or limited consideration of current pest pressures. Furthermore, chemical representatives and scouts are largely undecided as to whether adopting this practice will impact yields, though they nearly universally see this as providing no cost-saving opportunity. Delaying pesticide sprays until an economic threshold is established has the potential of resulting in pest damage to fields, thus reducing output. But it also has the potential to stave off damage to native pollinators and beneficial insects. While delaying sprays may generate cost-savings in reduced sprays, this practice has the potential to increase operating costs, especially in added time costs in assessing the level of threat. Because of this, it is likely that adopting this practice will not impact yields, but has the potential to modestly decrease costs of production.

Supporting beneficial insect habitat to promote pest control via natural enemies

The primary barrier to adopting this practice in fields is lack of evidence of its efficacy. Chemical representatives and scouts described this practice as having a feel-good factor with no evidence of beneficial outcomes. As pesticide use generates inhospitable environments for many organisms, the use of chemical pesticides inherently contraindicates supporting beneficial insect habitat.

However, two classes of growers are largely attuned to this practice if not adopting this practice outright. Greenhouse growers, where the minutia of growing conditions is under control of the operation, are likely to adopt some form of this practice. Organic growers inherently generate hospitable habitat for beneficials, but this can also generate the same for injurious organisms. Regardless, organic growers have some degree of control in fields for discerning the extent to which beneficial and injurious organisms benefit from habitability. As organic growers have access to fewer tools for managing pests, even marginal contributions to pest management may have a significant impact on their bottom line.

In the minimum, pesticide use must be reduced or modified to adopt this practice. It is conceivable that conservation reserve land or buffer strips near fields can serve as hospitable space for beneficial mobile organisms. But this posits the potential of losing productive fields, and it is not certain whether productivity gains from beneficials habituating in these buffers can offset the loss of output. As the benefits of supporting beneficial insect habitat are uncertain, growers likely view this practice with skepticism.

Chemical representatives and scouts largely see few examples of this practice in organic fields and limited examples in greenhouse environments. While nearly absent in conventional IPM practices, the rate of adoption in organic farming may be around 10 percent of growers and may be as high as 25 percent in greenhouse environments. However, adoption of this practice is likely to result in little to no impact on costs or yields. If any, it may posit modest increases in cost with no to little increase in yield outcomes.

Selecting pest-resistant varieties or cultivars

Market demand is a primary barrier to grower adoption of this practice. In this, market demand for varieties and cultivars is a much larger factor in growers' decisions. An example is apple varieties that are less susceptible to common pest pressures but have low market demand or commands lower market prices. Furthermore, pest-resistant cultivars with lower yields may be overlooked vis-à-vis other varieties growers seek to maximize their returns. In total, growers need substantiated full costs and revenue estimates of pest-resistant cultivars compared to others for making viable planting decisions. Here, information may be the key resource for grower adoption. Finally, limited availability of consumer-supported varieties limit the number of cultivars growers can safely adopt. This is especially so for specialty crops, including vegetables, and fruit.

By limiting production to pest-resistant varieties or cultivars, growers have a potential to reduce their overall financial outcomes. This is not universal as resistant varieties and cultivars may also generate off-setting savings in reduced pesticide and application costs. Market conditions mostly favor this practice for row crops where hybrid lines are more accepted by consumers. Resistant specialty crop varieties, though, have limited penetration, quite possibly due to lack of consumer willingness to accept hybrid varieties. The delineation is not limited to fresh vegetables and table fruits, though the impact may be greatest for those commodities.

Chemical representatives and scouts anticipate this practice comes with significant, market-based barriers to adoption. However, they were not so certain about the potential impact to grower yields. Most uncertain is for specialty crops where pest-resistant cultivars are limited. However, row crop growers adopting this practice can anticipate positive yield impacts of up to 10 percent. Furthermore, they anticipate that this is a costly practice to adopt with cost of production increasing by up to 10 percent across all commodities. Despite this, they see moderate rates of adoption. Though varied by respondent, they estimate adoption rates of about 40 percent.

Using sanitation practices

Time is the primary obstacle to adopting this practice. Steam cleaning or power washing implements between field runs can create logistical bottlenecks for growers, especially if the implement is required for several different applications or is traversed through fields with known injurious organisms. Lack of grower information does not appear to be a significant obstacle for growers, but rather the lack of efficacy in light of the time-costs of adoption. Beyond time costs, growers adopting this practice also must contend with energy and water costs and in some cases the costs of chemical cleaners.

Chemical representatives and scouts suggest that barriers to adopting this practice are significant and that lack of a direct link between this practice and outcomes is a significant barrier to grower adoption. Adoption varies by commodity and growers are more likely to adopt this practice on a need basis. For example, they are more likely to clean their implements when there exists a known threat capable of being spread to other fields. Overall chemical representatives and scouts anticipate that about one-third of growers adopt some form of sanitation practice. They anticipate those that do adopt this practice are likely to experience modest positive impacts on yields and slight increase in production costs. These estimates are largely consistent across commodities.

Protecting native pollinators

This widespread practice may have significant barriers that temper outcomes. The primary barriers to adopting this practice are timing and weather. Time can be a limiting factor in two ways. First, the threat from the presence of pests can forego considerations of protecting native pollinators if it is not routinely a source of consideration. But this is not to suggest that growers otherwise routinely apply pesticides when pollinators are present. Second, and more importantly, weather often dictates the timing of applications of pesticides. Certain pollinators are more active at particular times of day, but rain events can require sprays before or after rain events and must be timed to the weather event. Growers can forgo certain pesticide applications not tied to weather events, but for growers attempting to time sprays with weather events, may face a lose-lose option.

Practices potentially abandoned by adopting this practice include abandoning potentially effective sprays on injurious organisms for the protection of native pollinators. This has the potential to reduce yields. However, the resulting access to pollinators has the opposite effect of potentially increasing yields or in the extreme case, saving the need to rent pollinators. Of course when pollinators are rented, there may be additional cost considerations to spraying on pollinators, and many growers wishing to increase the certainty of pollination simply rent bee hives, reducing reliance on native pollinators. Hence, for these growers, the benefit of the added costs of protecting native pollinators may not be sufficient to supplant the need to rent commercial pollinators.

This practice is largely aligned with protecting beneficial insects in that pesticide sprays often have the undesirable outcome of reducing non-targeted organisms. Chemical representatives and scouts differ in their opinion on the significance of the barrier for growers to adopt this practice, though most suggest there is a moderate barrier. Where protecting native pollinators is adopted, growers can be expected to see higher yields according to chemical representatives and scouts, but this gain depends on commodities grown. Row crops stand to receive negligible boost in yields, while vegetable and fruit/nut growers may expect to see gains of up to 10 percent. However, all growers are expected to incur additional costs in protecting native pollinators of up to 10 percent. While costs and returns, especially for non-row crops, move in similar manner, chemical representatives and scouts see that the practice of protecting native pollinators is widespread, especially for specialty crop growers. They estimate about an 80 percent adoption rate of these growers.

Accessing MSU IPM print or online resources for reference

MSU Extension has long been a source of information for Michigan agricultural producers. It is therefore natural to consider the extent to which growers access information provided by MSU Extension in print and online form. Chemical representatives and scouts suggest growers get access to MSU IPM information through two channels – directly and indirectly through chemical representatives, scouts and others. Participants did not indicate a relative importance of one channel versus the other.

Direct channels to MSU IPM information can be gained with internet access, by direct contact at grower or MSU events or through mediums where MSU Extension bulletins are provided. Growers with internet access have extensive access to such material. Through MSU Extension events, all growers have some capacity to access MSU IPM print material. In essence, few barriers appear for growers to get direct access to such material.

Chemical representatives and scouts have similar access to such material and are likely to keep on top of the latest IPM information. These individuals use such information in their recommendations and when designing pest management regimes. Thus, MSU IPM print and online material is readily delivered indirectly to growers utilizing technical consultants for pest management.

Chemical representatives and scouts suggest it may be extremely difficult to quantify the impact of MSU IPM print and online resources on grower output and costs of production. While none suggested referencing such material will decrease yield, their best estimates suggest modest to large impacts on grower's ability to generate high yields. Using their estimates, we anticipate a small increase of up to 10 percent yield gains. Only one participant suggested MSU IPM material may lead to costs impacts, and this was only for row crops. Otherwise, all were in agreement that referencing MSU IPM material is likely to lead to little or no grower cost-savings.

Using biocontrols for insect pest management in greenhouses

Biocontrols, in practice, are largely confined to greenhouse operations and organic farms in Michigan. Though biocontrols can compete with chemical pesticides, chemical representatives and scouts largely see them as unequal substitutes. Where used when chemical options are restricted, they can be effective in controlling injurious insects and diseases, and they are most competitive in greenhouse operations.

Pesticide applications compete with biocontrols in greenhouses. Hence, for greenhouse growers this can be a mutually exclusive set of options. Greenhouse growers strive to develop a controlled environment and have the potential capacity to capitalize on biocontrols where field crops cannot. To that extent, greenhouse growers can benefit from biocontrols where such would be less effective in field crops, and more likely to adopt than field crop growers. Greenhouse growers find synergies in biocontrols and beneficial insects, as biocontrols can be less toxic to beneficial organisms. To that extent, biocontrols are generally not compatible with chemical controls, requiring growers to select one or the other approach to pest management.

Chemical representatives and scouts see the costs of biocontrols as posing a significant barrier to adoption. While we were not able to quantify the expected impact of biocontrols on greenhouse yields, it was suggested that this practice has a potential to increase costs of production.

Purchasing disease-free or virus-free planting stock whenever possible

Chemical representatives and scouts were in agreement that disease- or virus-free seed and stocks are implied at the time of purchase and those suppliers who fail to provide disease- or virus-free planting stock would have difficulty finding customers. Most providers certify their seeds and planting stock to meet this practice. As such, there exists virtually no barrier to adopting this option. While there are grades of disease- and virus-free certifications, it appears those certified are not exceptionally differentiated from common sources.

As this practice is essentially implied when purchasing seed and stocks, no estimates were made on this practice's impact on yields and costs.

Using in-house ELISA test kit for rapid disease identification

Chemical representatives and scouts in our focus group were not universally aware of in-house ELISA kits. Those who did discuss this practice suggested that in-house ELISA kits are most common in greenhouse environments, and few expected its use on field crops. Scouts spoke highly of using ELISA kit for scouting disease and indicated cost is not a factor in using the kit. In effect, in-house ELISA kits are cost-effective alternatives to submitting samples to labs for analysis. They also have the added benefit of producing results in a timelier fashion than submitting samples, where lab times can be prohibitive for timely interventions. Those using in-house ELISA kits generally abandon submission of samples to labs. However, since lab times can take one to two weeks for a response, the availability of in-house kits may also supplant doing no disease testing at all. In effect, the availability of in-house ELISA kits encourages the practice of testing for disease.

While chemical representatives and scouts familiar with the use of in-house ELISA kits view their use favorably, it appears that direct adoption by growers may be limited, though indirect adoption through technical consultants may be more common. Unfortunately, we were not able to quantify the rate of adoption, nor the potential impact to production or costs.

Synthesis of Specialty Crop Consultant Discussions

Several topic areas were covered in this focus group discussion, starting with a broad discussion of how information about IPM practices is conveyed to growers. While growers receive information about pest management through several channels, the channels and information sought may be largely influenced by the nature of the grower. Some growers prefer to be up-to-date on technical operations of the farm, while others are more apt to hire pest management expertise. Regardless, information about pest threats and pest management is readily sought across all groups of growers.

Growers are largely seeking information about practices with known outcomes. To this extent, information growers are gaining can sometimes be nebulous. Labels, while sufficient for regulatory purposes, cannot recommend effective spray regiments which take into account the system of threats, weather, and mix of pesticides. Written recommended spray regiments are often not universally applicable. In short, growers largely seek outside support in sorting through the confusion. Chemical representatives and scouts in this focus group suggest that pest management information is essential to growers and growers are interested in receiving relevant information with benchmarks of effectiveness against a broad spectrum of options. Before adopting new practices, growers want to know the bottom line of the practice in terms of risks, costs, and outcomes.

Several IPM practices were discussed during the focus group discussion. A common concern across all practices is the time-costs required to implement the practice. Most practices discussed required either operational time costs to implement or time costs associated with mastering the practice. While not all practices require the same time-costs to implement, it appears relevant for all practices and posits significant barriers to adopting IPM practices.

Uncertainty appears to be a barrier for many practices. Uncertainty is largely a function of information, but may arise through random processes (unanticipated changes in markets, weather, field conditions, etc.). However, uncertainty through lack of relevant information can largely be controlled with pointed, relevant and timely information – information largely gleaned and trusted from technical consultants. Maybe one of the most challenging aspect of uncertainty is the timely release of information. For chemical representatives and scouts, timeliness of information is gained through interacting with MSU Extension programs and personnel.

3. Row Crop Focus Group Discussions with Chemical Representatives and Scouts

Two focus group discussions were held for row crop specialists. The first was held on July 10, 2015 in Edmore, MI. The second was held on December 18, 2015 in the St. Joseph County Extension offices in Centreville, MI. Both focus group discussions took place during ongoing round table discussions that bring crop consultants together to discuss current issues around pest management in their respective regions. The two groups differed in the frequency of their meetings, in the kinds of crops they interact with, and by the geography and geographic considerations they address. The Edmore round table was made up of 11 individuals, and monthly meetings were well established. These consultants were well acquainted, centered on potato crops and covered a substantial share of total crop acres in the surrounding area. The Centreville round table met less regularly and participants were less acquainted with others in the room. There were five individuals in the discussion, including two Extension educators, where specialty was with seed corn and commercial corn on irrigated soils.

Findings

We started the focus group discussions around general topics concerning IPM practices, sources of grower information, and the roles of chemical representatives, scouts, chemical companies and information sources. Chemical representatives (sometimes referred as fieldmen) and scouts are individuals that are trained and practiced in pest and crop management and are routinely consulted by growers or hired to manage pests. Increasingly, growers appear to be willing to custom-hire out such management functions due partially to the progressively intricate challenges of modern agricultural pest management. Besides hired scouts, the information sources that growers turn to are varied and may entail a combination of retail representatives, agri-chemical producers, neighbors, trade journals, MSU Extension, and any web-sourced literature the grower may deem as reliable.

The discussion started by talking about the channels by which growers receive information about IPM practices. Discussants noted that the grower has to be considered when answering this question, as small producers are less likely to rely on a crop consultant than large producers, and some commodity growers rely more heavily on consultants than others. The consultants feel that information about IPM practices are largely conveyed through consultants and that small producers are likely to adopt their own form of IPM practices. For those not working with consultants, and even some that do, the discussants feel that growers largely get information from a wide variety of sources that may include direct consumption of MSU Extension bulletins, bulletins from other university Extension services, trade publications, vendors, technical consultants, neighbors and others. That is, growers generally obtain information from where they can get it.

The sources of information growers reference and the information technical consultants provide largely overlap. Technical consultants are aggregating information and keeping abreast of emerging issues, products and practices. From the conversation, growers may be able to extract more actionable information through discussions with consultants than through most other sources. To that extent, consultants are a store of up-to-date information and experiences and can quickly conclude with actionable prescriptions for both overt management issues and complex ones. However, for some pest pressures, especially those calling for herbicide use, products and practices are much more linear and growers can turn to the retailer or label for actionable intelligence. That is, the channel by which growers seek information largely depends on the question and one's own capacity for addressing the issue. When outside of the grower's expertise, the interviewed consultants conjectured that they are the first source for growers, and often serve to validate retailers' claims.

We then asked respondents to suggest what information sources are commonly used. Once again, the perception was that credible resources are referenced regardless of the source. Generally, MSU Extension is viewed as an important source of information for growers and consultants, but with caveats. First, the research and the reporting coming out of MSU Extension is not readily applicable to grower needs, but rather written to a level of sophistication that benefits experts in the field of pest management. With this frame of reference, consultants are the effective audience of MSU Extension material. Practicing farmers may not have the requisite knowledge of the jargon used in these reports and must navigate through multiple resources including attempts to comprehend the available research reports, labels, and chemical representatives and seed companies who may have a vested interest in the product used. Seed corn growers largely trust their seed companies, while commercial corn growers rely on third-party information and retailers. When considering the role of labels, discussants suggest that they are viewed as useful. However, labels lack the robust consideration of real-life situations that may entail multiple pest targets, mixed ingredients and other issues that make it difficult to establish a plan based on pesticide labels alone.

One discussant went so far to point out that most attendees at commodity conferences, like the Ag Expo, are the consultants, not the producers, because small producers are too busy farming and large producers expect the consultants to attend and implement innovations learned through their consultancy services. Hence, large producers indirectly gain from such events as if they actually attended themselves.

Next, we asked participants to consider the trends in pest management practices that may be impacting grower's demand for IPM education programs. The discussants abruptly stated that the primary driver of any grower's willingness to adopt new practices is profits. While growers may be interested in hearing what others are doing and what innovations researchers are uncovering, in the end they will gauge these against their practices and assess what may or may not work in their operations toward maintaining or increasing profitability. This is not to suggest that only profits are considered, but rather growers consider a balance of long-run considerations with profitable choices today in assessing future practices.

When probing deeper, the concept of what constitutes IPM becomes somewhat murky. Many of the practices one may classify as an IPM practice is normal operations to more progressive growers. For less progressive farmers, elements of IPM practices may already be put into place simply based on the economics of the practice. That is, like with specialty crop growers, there are those growers who tend to by younger and better educated that have adopted IPM practices as the norm and those that refer to time-honored traditional methods that favor wide-spectrum, timed sprays. Hence, the question is not always whether to adopt or not adopt an IPM practice, but rather the degree to which one adopts a practice. For example, with cultivation, the practice of no-till farming was once uniquely different from conventional tillage. Now most farmers practice a hybrid approach with elements of both. Similar integration of conventional practices with IPM practices have created ranges of adoption where it is not sufficient to suggest a grower has adopted a practice, but rather the extent to which the practice has been adopted.

Growers are largely driven by common issues in pursuing IPM. This includes profitability and the need and desire to limit grower's ecological footprint. There may exist many reasons to limit pesticide applications that were not directly mentioned in the focus group conversations, including the desire to do no harm, the need to conform with GAAMPS, and environmental regulation, and real differences may exist between the needs of specialty crop and row crop growers. For example, specialty crop growers may be more apt to adopt the spectrum of the practices commonly espoused by IPM programs. However, row crop growers are more likely to adopt a subset of practices deemed most relevant for their commodities. For example, high value commodities like potatoes and many specialty crops command a higher level of grower input in the production process. Such commodities also command greater pesticide expenditures. That is the need to minimizing the maximum loss of crop failure is greater the higher the value the commodity commands. Hence, growers have a stake in managing inputs efficiently, and this is where IPM practices become relatively more important.

Scouting for insects, diseases and weeds

The first specific practice we discussed was scouting for insects, disease and weeds. The consultants expressed a wide range of concern about the claim that one adopts scouting as a practice, noting the wide range of commitment and effort that is encompassed in this statement. Scouting may entail simply driving down the road and looking, as many agreed was often called scouting. They both derided and defended the effectiveness of this level of engagement in scouting. In the most grievous fields and the most opportune locations of visual evidence, such a system works, but in most cases, time and effort is required to accurately assess pest pressures. Smaller farmers are less apt to implement scouting because of the time costs. It becomes an issue of selecting priorities under limited time resource. For larger operations, constraints on resources are mitigated by outsourcing this effort to consultants.

The discussants suggested that the metric used to determine whether a grower adopts this practice as well as any other is if it affords positive net returns. Accordingly, scouting is a relatively low cost endeavor, whether hired out or undertaken by the grower, but it can vary depending on the crop and existing practices. For seed corn, where someone is generally in the field weekly, scouting is mostly second nature. However, motivation to take on scouting may be questionable. The expected returns to scouting for insects and disease are not significant and often not measurable. For corn and other grain crops, scouting may be more a way to anticipate seasonal outcomes than for timing sprays. In many cases, scouting will not provide a positive return because once the damage is visible, it is too late. While newer, high-clearance sprayers (and possibly chemigation) afford growers greater responsiveness to pest pressures, pest management of grain crops mostly relies on cultural practices around rotation and tillage. This does not suggest that growers do not respond to pest pressures, as those that do have scouts tend to have timely applications of insecticides. However, those that do not may be inclined to follow their neighbor's lead. Such responsive sprays are commonly called "revenge sprays" and are usually too late to be cost-effective.

In general, the costs of adopting scouting are about 1-2percent of overall production costs. While it is a minor cost to growers, it is easy to overlook the importance of this effort. The grower does not always recognize the foregone opportunity costs of not scouting. For example, if the grower scouts all year and does not find anything significant to manage, they may choose not to scout the next year. However, the practice can be hugely impactful, but only within a probabilistic sense. Not unlike a lottery, the expected payoff is low, but in the off-chance that scouting results in mitigating huge losses, the gains more than make up for the costs. One's willingness to adopt scouting may also be driven by superficial considerations. The scouting effort may be more common for weed management than insects and disease. This is because weed pressure may be more evident to neighbors than insect and disease pressures, and the presence of weeds may be perceived by the field owner as an indicator of poor management. Growers may be more responsive to weeds obstructing the healthy appearance of their fields than the concern of aphids on own fields infecting neighbors' fields.

The participants expressed some additional considerations. First, scouting can become habitual for growers if they stick to it. This may be particularly important for growers not relying on technical consultants who periodically advise on field conditions. If growers recognize the benefit they are likely to continue the practice, but without such recognition they are more likely to taper off on this practice. For consultants, technology is making it easier to convey benefits of scouting. In real time, consultants can email and timestamp pictures of field conditions and reports. By communicating the benefits, they can encourage client-growers to continue scouting efforts.

Those who make pesticide applications based on a calendar schedule may also benefit from scouting. For them, scouting will inform modifying application schedules to account for the lessor or greater pest pressures present and mixtures. The act of scouting also builds a level of expertise that contributes to more effective pest management decisions in the future. The outcome is difficult to measure and easy to overlook, but as the discussants proclaim, better growers are better informed.

The consultants also exhibited frustration in their role as scouts, noting it makes little sense to spend significant time scouting for pests and diseases if the grower does not heed the scout's recommendation. The discussants expressed a greater willingness to invest significant time scouting for those growers who are more apt to act on the additional information. In their roles as scouts, the discussants nearly unanimously agreed that threshold data is lacking, and for scouting to be effective it should be tied to reliable and up-to-date thresholds. We cover this more in a later section.

Referencing weather modeling to make management decisions

Discussants suggest that outside of consultants and those who have placed weather stations on the farm, or are neighbors to those with a weather station, weather modeling is uncommon. This is despite the web-presence of systems like MSU Enviro-weather, which uses regional weather stations along with weather models to help inform pest pressures and risks associated with pest pressures. One of the primary obstacles to using weather models is that once the weather model determines a threat exists, it is often too late to respond. There are two primary lags to responding to pest and disease pressure. The first is the time required to identify the pressure. This is where weather modeling can be a substitute or complement to scouting activity. Weather modeling has the potential to decrease the recognition time. However, discussants contend that even this is not sufficient to overcome a second lag, an implementation lag. Once the pressure is recognized, this response time lag is due to the time required to arrange for custom application and other time costs to respond to the new pressures. This lag appears to be a substantial obstacle to timely mitigating pest pressures. There could also be a third source of lag, the decision lag that occurs while one forms the choice of approach to suppressing the pressure. Therefore, while weather models may expedite the time required to identify risks, it falls short of facilitating sufficiently timely response to new pest pressures. This is a key obstacle to adopting weather modelling for management decisions. Others include understanding how to use such models and access to relevant weather data. To this extent, users perceive that weather stations need to be co-located with fields to be effective, and that a station outside of the immediate field has limited merit to the pest pressures an individual grower experiences. As an alternate consideration, growers rely on experience in making pest management decisions based on best weather data. For many growers, such information informs the chemical application rates, not the decision to apply.

Weather station statistics are only as useful as they are relevant to field weather and soil conditions. Rainfall and soil temperatures can vary significantly over short distances from the station. One commenter noted that the soil condition around a nearby station is poorly maintained and populated with weeds, making soil temperature assessments questionable. However, the discussants generally contend that rainfall data are most accurate in the springtime when showers are more geographically uniform. The accuracy degrades through to July, where pop-up showers tend to make pockets of micro-weather events that can lead to misleading measurements if the station is not in near proximity to the target field. While weather stations are useful in determining when to plant, weather data is largely not a good predictor of corn pests.

The discussants suggested that the value of weather stations and models differs by commodities. For example, corn growers may use weather models a bit differently than tree fruit growers, but view it as an important resource. For corn growers, critical time seasons are the spring at planting and the fall near harvest. Where tree fruit growers refer to weather models to predict pest pressures, corn growers are more interested in soil temperatures at planting and moisture and frost near harvest. They may also turn to weather models and stations to help predict crop growth stages and rainfall. One Centreville participant indicated he refers to a weather station to test accuracy of rain prediction provided by newscasters and meteorologists. The convenience of remote access to such stations is a benefit. Another participant noted using rain prediction to determine nitrogen leaching and help time nitrogen applications.

One consultant pointed out that a key benefit of the weather models is developing the structure or framework for managing pests. It is less effective as an early warning system in practice. In practice, interpreting the weather condition's impact on optimal practices is too complicated to be captured by a simple model. It requires experience and acumen on the behalf of the manager or consultant. He went further to note that he listens to the weather report in the morning and forms a decision with other factors to reach a more optimal decision rule than the weather models attempt to reach.

Only treating for pests when the economic threshold is reached, as applicable

The issue of economic thresholds was a big topic for discussants and one where they see a distinct role for MSU Extension. Perceptions differed between the Edmore discussants and the Centreville discussants, where the prior felt current MSU Extension thresholds are out of date while the prior viewed them as representative but with limited uses. The Edmore discussants lamented on having access only to dated economic threshold numbers. Since economic thresholds change with the prices of commodities and pesticides, they need to be continually updated. The Centreville discussants focused on the challenge of using thresholds when multiple pests are present. For them, the single pest thresholds do not hold when other pests are present. More so, the discussants concede they have little guidance they can follow when more than one pest is present. Both groups suggest that they apply experience and judgement over existing thresholds in light of these limitations.

The Edmore group was very vocal in the call for updateable thresholds that respond to changes in commodity and pesticide costs. They see the lack of updates as a direct hindrance to adopting this practice. They envisioned a web application that allows users to quickly look up current and up-to-date threshold figures. They largely view this as low-hanging fruit for MSU Extension, as the economic thresholds largely vary only with prices. However, accommodating multi-pest thresholds will be more difficult.

Further topics were discussed. For the participants, the value of economic thresholds in decision-making rests in the value of the final crop. When corn prices are low, economic thresholds are more meaningful than when prices are high. That is because the perceived loss due to crop failure of high-priced commodities commands a different response than that of a low-valued crop. When prices are high, growers insert their own values for economic thresholds. For irrigated soybeans and seed corn, crop values tend to be higher, invoking growers to use their own thresholds based on their tolerance for risk.

When pressed a bit further on the contribution of economic threshold values pose to growers, respondents did not suggest a direct link. Rather the economic thresholds provide benchmarks that growers can work with in interpreting their own threshold values. He concedes that economic thresholds are probably less used by growers and more so by consultants. To that extent, growers rely on consultants in determining management decisions.

Supporting beneficial insect habitat to promote pest control via natural enemies

There was light discussion on this topic, as discussants view this largely within the domain of organic growers. While some discussants indicated working with organic growers, most appeared to have limited experience in this area. Of non-organic growers, considering beneficials depends on the commodity grown, such that the contribution of the beneficials to outcome appears to be the driving consideration. If no direct link exists to outcomes, growers are likely to place less emphasis on protecting beneficial insects and habitat. For most row crops, such consideration is negligible. In Centreville, discussants noted that growers value their neighbors and their use of beneficials. However, as most corn fields are surrounded by similar fields, pollinators are not common issues. They suggested it is safe to assume growers communicate with neighbors about rented pollinators and protecting those pollinators.

Selecting pest-resistant varieties or cultivars

Only Centreville discussants were asked to respond to the practice of selecting pest-resistant seeds. For seed corn growers, the choice of pest-resistant varieties is implied by the seed corn they are growing. When under contract, as they usually are, the natural resistance attributes are less of a decision choice. However, commercial corn growers selecting pest-resistant varieties is seen as an important decision. Good producers select varieties that work best for their own farm. This statement, in itself, may suggest non-resistant varieties may be selected if the grower finds to lower seed price worthwhile in light of added costs of pesticides, if applicable. With lower corn prices, it appears that growers have shifted somewhat away from traited corn to Roundup Ready or non-GMO hybrid varieties to reduce seed costs. This trend may be partially exacerbated by the gradual rootworm adaptation to Bt-resistant varieties, where rootworm threats pose a significant challenge to corn over corn growers.

Growers largely turn to outside information when considering variety options outside of their conventional choice. If faced with a need to explore options, they turn to seed representatives, retailers, and Extension educators for advice. Some of the younger farmers may be more open to social media sources for advice. However, different varieties have different market traits that may impact marketability. Producers may take on small trials for seed, but the consultants see this taking place in the field less often.

Accessing MSU IPM print or online resources for reference

The sixth practice we considered was that of referencing MSU IPM print or online material. The discussants feel that weed control and issues around carryover may be the primary information growers are seeking in MSU IPM print material. Potatoes were specifically mentioned, where pest pressures are forcing growers to seek new acres to plant. However, for the most part, row crop growers are much more likely to turn to seed companies and retailers for solutions than are specialty crop growers. Hence, we should expect row crop growers to be less likely to directly seek out MSU IPM print material and more likely to consume such material indirectly through seed company and retailer representatives. The consultants largely saw the material coming out of MSU as being beneficial to their work, but largely could not speculate the extent to which growers actually utilize them. From the discussant's perception, seed company and retail representatives do not readily refer to MSU IPM print material, but rather turn to weed guidebooks and available products for controlling weeds, and refer to internal data for other pests.

Using seeds treated to specific pest and disease needs

Quite a bit of discussion was rendered when talking about growers' practices around treated seeds. For corn growers, an issue with adoption is whether the seed retailer can provide seed treatments or not. Where treated seeds for the specific pest or disease need are available, the discussants largely suggested that treating corn seeds is common and provides obvious advantages. The same cannot be suggested of soybeans, as the relative merit of current treatments is up for discussion. Using treated seeds may be most beneficial when planting in early season where pest pressures may be greatest. Using treated seeds can be a very flexible option for growers, as growers can select whether to purchase treated seeds for specific fields and what treatments to apply.

When asked if using treated seeds can reduce pesticide applications relative to non-treated seeds, the discussants indicated some skepticism that a spray can be supplanted, but did indicate that it frees the grower to apply more targeted pesticide sprays. Rather than applying broad spectrum pesticides, the treated seeds may be effective at reducing parts of the spectrum, such that only specific pests remain. Equally, it may be difficult to assess the impact that pre-treated seeds have on the number of sprays and total active ingredient applied throughout the growing season. Several other factors contribute that cannot be controlled for, including environmental and pest pressures present in any given year. There's a significant amount of time between planting and harvesting that may change environmental conditions and pest pressures. Much like a flu shot, treatment may not be aligned with the actual pressure realized during the growing season.

While lower dose and targeted pesticides may have environmental positive implications over broad spectrum sprays, we wanted to know whether such have cost considerations. To this extent, the discussants largely deferred to, "It depends." More targeted pesticides tend to command higher prices for growers, but more so, producers generally apply a cocktail of pesticides to make up a spectrum that meets their needs. Treated seeds may afford an opportunity to leave out one of those products in the cocktail.

Synthesis of Field Crop Consultant Discussions

We ended both focus group discussions on broad considerations of the role of Extension in promoting IPM practices, and how MSU IPM Program and general programming can better meet growers' needs. Throughout much of the discussion around row crops, discussions tended to de-emphasize the role of IPM practices. Several reasons exist. First, practices under the umbrella of IPM practices that were once considered progressive are more mainstream now – eroding the brand of IPM. Additionally, row crop production differs significantly from specialty crop and tree fruit production where IPM practices have more relevance. Growers are largely driven by common issues in pursuing IPM. This includes profitability and the need and desire to limit grower's ecological footprint. There may exist many reasons to limit pesticide applications that were not considered during the conversation, including the desire to do no harm, the need to conform with GAAMPS, and environmental regulation. Specialty crop growers may be more apt to adopt the spectrum of the practices commonly espoused by IPM programs. However, row crop growers are more likely to adopt a subset of practices deemed most relevant for their commodities. For example, high value commodities like potatoes and many specialty crops command a higher level of grower input in the production process. Such commodities also command greater pesticide expenditures. Hence, growers have a vested interest in managing inputs efficiently, and this is where IPM practices become relatively more important.

However, the row crop focus group discussants were adamant that new challenges continue to present themselves requiring innovative solutions with an eye toward minimizing unintended consequences. For growers to be viable requires some judicious uses of costly pesticides and ineffective uses can be both financially and environmentally catastrophic.

However, the discussants also warned that MSU Extension's direct influence on individual growers is waning, as growers turn to chemical representatives, seed companies and consultants for technical advice. The dominant factor contributing to this is that MSU Extension bulletins are largely too technical for most growers, and growers rely on others to put such information into practice. To put such research into practice, growers are looking for a prescription of steps to take rather than a research report in technical detail. In addition, the steps outlined in many bulletins are not feasible in practice. That is, the research may document an arduous management scheme that may not be feasible for a time- and labor-strapped operation. Implementation time should be minimal to encourage adoption.

Hence, the discussants see their role as consultants as a form of filter from MSU Extension and MSU research. They filter out all the superfluous information in such reports to get to the actionable prescription, though they view MSU Extension as a key resource for meeting client needs. In this, communications between consultants and the IPM Program is and should be reciprocal, where consultants are instrumental in verifying MSU Extension reports. Through MSU Extension bulletins and research, they sketch out a profile of new products, combined with other information, to develop a set of recommendations for growers that may entail using multiple resources. They also regularly look outside the state for information coming from other university research programs, trade journals and from the chemical industry.

We asked if the consultants had any thoughts on the cost-share opportunities for growers to adopt new IPM practices. While the topic quickly turned away from cost-share opportunities, some comments suggested that if more cost-share options were available and relevant to row crop growers, it would help growers in adopting IPM practices. Specifically, the discussants recognized there are tools available for adoption, and that cost-sharing will help in the adoption of those tools. However, examples of tools that should be considered for cost-share options were not explored. The area where the discussants saw a weakness in grower practices was outside of IPM practices, but rather around nitrogen management. Specifically, nitrogen management of irrigated cornfields appears to lack proper modeling for effective management. Here, existing nitrogen recommendations do not take into account different soil types. Further complicating the management role is the interaction of soil nitrogen content and water, where irrigation is commonly part of the management mix in southwest Michigan. The discussants also reinforced their concern around modeling disease pressures from gray leaf and northern leaf blight, noting successful use of modeling potato and fruit diseases.

The last topic covered in the discussion was whether the discussants had any advice for MSU Extension around pest management. We asked respondents to indicate what they would like to see come out of the MSU IPM Program. Many suggestions followed along pest modeling or providing better access to tracking existing research undertaken at MSU. Specifically adding models or tracking data for moth flight. They related information delivery they would like to see to what Enviro-weather generates, where a database is available online for individuals to reference. That is, a one-stop resource for all pest management research and resources is desired.

Maybe the most problematic area for growers, and one where participants saw a direct opportunity for MSU Extension, is in developing an easy to interpret star rating system of pesticides. In this, the discussants focused on the lack of farm-useable information on pesticide efficacy toward particular pest pressures, where labels do not impart information on effectiveness and chemical representatives may not be viewed as impartial. A simple four- or five-star rating system would be an ideal resource for those growers who do not routinely have access to independent consultants and do not possess the technical skills to wade through technical bulletins.

When asked if they are satisfied with the services and products MSU Extension is providing, they resoundingly responded in the affirmative. This should be interpreted within the scope of technical expertise the consultants represent, as they also indicated earlier in the conversation that MSU Extension publications may be overly academic for grower's use. They specifically mentioned Lyndon Kelley's irrigation work and presentations as a key example of a well-received MSU Extension program. They further appreciated that the MSU IPM Program is inquisitive about program outcomes, as exemplified in this focus group discussion. They like to know that tax dollars are being used effectively and that industry input is being sought to build efficiency in program outcomes.

Evaluation Conclusions

This analysis of the MSU IPM Program was to assess the delivery and performance of the MSU IPM Program and to identify strengths and weaknesses in program outcomes. Significant intelligence was generated on grower's existing practices through a short survey of growers and on the potential impacts and barriers to adopting IPM practices through interviews with fieldmen and technical consultants. As grower practices around pest management span many distinct practices and as many of these practices have become routine for many growers, it is difficult to succinctly characterize program outcomes.

Some observations are evident from this effort. First, growers are more apt to adopt those practices with clear and observable channels to improved bottom lines. That is, practices where technical consultants saw significant potential impacts to yields, crop quality and net financial returns were more aligned with the practices routinely cited by growers. This mostly includes scouting for insects and diseases and treating based on threat. While abandoning timed application for scouting may reduce pesticide use, it may also increase pesticide use in the presence of threats. It may be interesting to note that growers may not withhold treatment until economic thresholds are reached for multiple reasons. The primary reason is that growers may not trust existing economic thresholds that are not up-to-date. Rather, they establish their own economic thresholds and act accordingly. Technical consultants suggested the MSU IPM Program develop new, dynamic economic threshold models that allow the user to input updated control costs and product revenues. This avoids the static nature of existing economic thresholds. Alternatively, MSU IPM can develop programs to help growers be more effective in their own personal threshold assessments. The expected social return of pursuing the prior will depend on grower's willingness to reference such models, while the latter participates in training programs and employs such training in decision-making. As the consultants suggested that grower's personal economic thresholds may differ significantly, shoring up grower's knowledge around threat levels may have significant impacts on future application rates.

Those that indicated they scout for pests tended to scout for beneficial insects as well. That is, the cost of the scouting effort does not appear to increase much by adding effort to identify beneficial insects at the same time. However, grower response to the presence of beneficials is questionable. Technical consultants largely saw the presence of beneficials as being of secondary importance to the presence of threats. To this extent, the presence of a threat trumps the potential benefits of beneficial insects. Programming that targets the relative contributions of beneficials may help to elucidate the value beneficial insects can make to grower's bottom line.

The notion that growers should purchase disease- or virus-free planting stock should be self-evident. However, grower's ability to discern the true nature of planting stock is limited. Mostly, growers must rely on the reputation of suppliers with the expectation that reputation is a good indicator of performance. To a certain extent, the same can be claimed on the selection of pest-resistant varieties. Depending on the commodity, growers may have limited ability to select cultivars or varieties with preferable pest resistance. This may be especially true for tree fruit, where consumer preferences largely dictate commodity demands. Outside of tree-fruit, buyers may have restrictions on varieties. Where markets do not influence variety selection, growers routinely attempt to manage pest and environmental pressures with optimal varieties. Here, growers turn to their suppliers for technical information on variety characteristics.

Many of the practices, while a good idea on the surface, may not be considered by growers in practice. Consider for instance grower's recognition of biological impacts of treatments. In general, consultants perceive and growers responded that though they recognize the biological impacts of treatments, it is not evident that this has a direct impact at the point of decision, but rather has an overarching impact on one's attitudes toward pest management.

Grower responses to referencing MSU IPM print or online material and referencing weather models may under-represent the true impact of these sources of IPM management. Only about a third of the grower survey respondents indicated they reference MSU IPM print material. This was lower for row crops than specialty crops. While this indicates room for MSU IPM Program improvements, discussions with consultants assured that many receive the benefit of MSU IPM programming indirectly through their dealers or technical consultants. A similar assessment was made of referencing Enviro-weather models, where consultants routinely turn for up-to-date environmental conditions. Furthermore, as it is quite evident from the grower survey responses, many sources of IPM information is available, and no single source stands out as essential to many growers except for technical consultants. That is, the MSU IPM Program and MSU Extension, competes with and compliments many information providers. A key issue for the MSU IPM Program becomes how it will differentiate itself from these other sources. That is, the MSU IPM Program should assess whether it can provide information or delivery of that information in ways other sources do not.

Discussions with technical consultants suggest that MSU IPM print and online material may not be accessible to many growers. They opine that MSU IPM reports are too technical for most growers and largely written in a language that best targets technical consultants. While many of these reports are outside the purview of the MSU IPM Program, the MSU IPM Program may consider how they can facilitate broader appeal of MSU Extension research and reports if this is a target. With this consideration is the question who should be targeted with MSU Extension print material. All consultants related some perception that growers largely fall into two categories. One category, most exemplified by young and tech-savvy growers, tend to keep up with technological and latest management practices. These users seek out improved options and are may be more engaged in information collection. In summary, the MSU IPM Program should align itself with its comparative advantage in delivering actionable intelligence relative to others. Such should take the target audience into consideration. More progressive growers will likely respond to more technically complex messages than less progressive growers. Less progressive growers may need more coaxing, or salesmanship, than more progressive growers.

While this section outlines some opportunities, we believe it is important to not lose sight of the praise MSU has received for the IPM Program. Most specifically, technical consultants place great emphasis on the importance of the research coming out of MSU. As 73 percent of grower survey respondents indicated that their neighbor is an important source of guidance in pest management, we can be assured that those growers with good track records and good consultants impact how their neighbors manage their fields. In addition, 87 percent of respondents indicated that their consultants are essential or important to their pest management decisions. It would be difficult to find many growers not directly or indirectly impacted by the MSU IPM Program.

Practices Reviewed

1) Scouting for insects and diseases
2) Scouting for beneficial insects
3) Referencing weather modeling to make management decisions (e.g., Enviro-weather)
4) Only treating for pests when the economic threshold is reached, as applicable
5) Supporting beneficial insect habitat to promote pest control via natural enemies
6) Selecting pest-resistant varieties or cultivars
7) Using sanitation practices (removing inoculum, sterilizing or cleaning implements, etc.)
8) Considering biological impacts when choosing pesticides
9) Protecting native pollinators (mowing before spraying, spraying at night, etc.)
10) Accessing MSU IPM print or online resources for reference
11) Using biocontrols for insect pest management in greenhouses
12) Purchasing disease-free or virus-free planting stock whenever possible
13) Using in-house ELISA test kits for rapid disease identification

Appendix: Discussion Group Instrument

July 10, 2015

MSU Extension IPM Program Evaluation

MICHIGAN STATE UNIVERSITY EXTENSION

Project Description

This is a program evaluation project for MSU Extension that seeks to understand the extent of IPM adoption in Michigan, the factors contributing to the adoption of IPM practices and the impacts of such practices.

Your participation will help us better understand grower adoption of IPM practices and help us quantify how IPM practices impact growers and ecological outcomes. Findings from this focus group discussion and a survey of Michigan crop growers will be used to quantify outcomes of MSU Extension programming around IPM practices and improve programming and resources developed in the future. It will also be used to help identify research objectives and may be used to support grant-making activity.

Nature of the Michigan Field Crops Consultant Focus Group Discussion

The objectives of the focus group discussions are to understand the prevalence and impacts of adopting IPM practices including:

1. how individual practices impact the usage of chemicals,
2. the operational costs of adopting IPM practices, and
3. the impact on agricultural production and the environment.

Discussion will be informal. We only ask that participants respect others in the focus group.

All comments will be recorded anonymously, and only the roles of participants will be recorded as a whole. Each topic is designed to be discussed as a group. However, participants will be provided a form for comment on each topic as well as for providing estimates requested by the focus group moderator. These forms will be collected at the end of the focus group.

The discussion moderator is Steven Miller, the Director of the Center for Economic Analysis at Michigan State University. If you have any questions or would like to contact the moderator, his contact information is provided below.

Justin S. Morrill Hall of Agriculture
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East Lansing, MI 48824-1039
Email: mill1707@msu.edu
Office: 517-355-2153
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Below you will find the questions that will be posed to the focus group at the meeting. You may review them in advance if you like but no preparation is required.

1

Appendix: Discussion Group Instrument

1. Through what channels are growers getting information about IPM practices?
   - What or who is informing these channels?

Comments:

2. Next, we want to understand the nature of grower demand for IPM education programs. Primarily, are there trends in the markets for pest management or for growers' output that are driving changes in growers' demand for IPM education programs? Does it aid in risk management?
   - Given this discussion, what are the primary motivations growers have for pursuing IPM education programs?
   - How significant is grower interest in adopting IPM practices?

Comments:

3. In this section, we want to understand the follow-through of growers exposed to IPM practices. We will approach this along three lines,
   - What IPM practices are most advanced by consultants or others?
   - Which IPM practices are most impactful (i.e. results in substantial reduction in pests, costs, applied active ingredients, etc.)?
   - What IPM practices are most adopted?

Comments:

4. We have identified 13 core IPM practices and would like to know your opinions on how they impact management. We seek your input on these practices, including barriers to adoption, practices they replace, impact on crop production and impact on operating costs. Each of the next pages will ask for your input concerning an IPM practice.

2

Appendix: Discussion Group Instrument

1. Scouting for insects, diseases and weeds.

a. What are barriers to the adoption of this IPM practice?

How significant are the barriers to adopting this IPM practice?		
Insignificant	A moderate obstacle	Significant
☐	☐	☐

Comments:

b. What practices are abandoned with the adoption of this IPM Practice?

Comments:

c. From your experience, how does this IPM practice impact <u>output/yield</u>?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

d. From your experience, how does this IPM practice impact the <u>costs of production</u>?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

e. How widely is this IPM practice adopted in row crops? (place X along graph)

Percent of Adoption

0% 25% 50% 75% 100%

Comments:

3

Appendix: Discussion Group Instrument

2. Referencing weather modeling to make management decisions (e.g. Enviro-weather)

a. What are barriers to the adoption of this IPM practice?

How significant are the barriers to adopting this IPM practice?		
Insignificant	A moderate obstacle	Significant
☐	☐	☐

Comments:

b. What practices are abandoned with the adoption of this IPM Practice?

Comments:

c. From your experience, how does this IPM practice impact output/yield?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

d. From your experience, how does this IPM practice impact the costs of production?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

e. How widely is this IPM practice adopted in row crops? (place X along graph)

Percent of Adoption

0% 25% 50% 75% 100%

Comments:

4

3. Only treating for pests when the economic threshold is reached, as applicable

a. What are barriers to the adoption of this IPM practice?

How significant are the barriers to adopting this IPM practice?		
Insignificant	A moderate obstacle	Significant
☐	☐	☐

Comments:

b. What practices are abandoned with the adoption of this IPM Practice?

Comments:

c. From your experience, how does this IPM practice impact output/yield?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
__________	☐	☐	☐	☐	☐	☐	☐

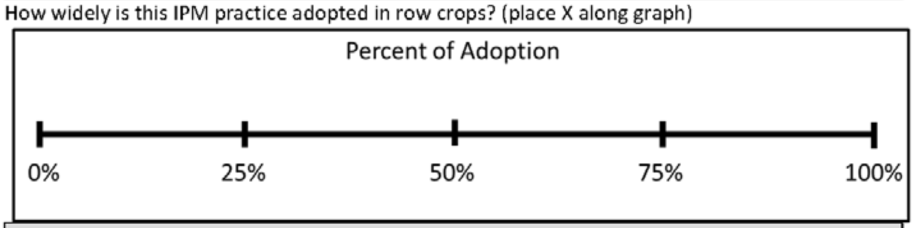
Comments:

d. From your experience, how does this IPM practice impact the costs of production?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
__________	☐	☐	☐	☐	☐	☐	☐

Comments:

e. How widely is this IPM practice adopted in row crops? (place X along graph)



Comments:

5

4. Supporting beneficial insect habitat to promote pest control via natural enemies

a. What are barriers to the adoption of this IPM practice?

How significant are the barriers to adopting this IPM practice?		
Insignificant	A moderate obstacle	Significant
☐	☐	☐

Comments:

b. What practices are abandoned with the adoption of this IPM Practice?

Comments:

c. From your experience, how does this IPM practice impact output/yield?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

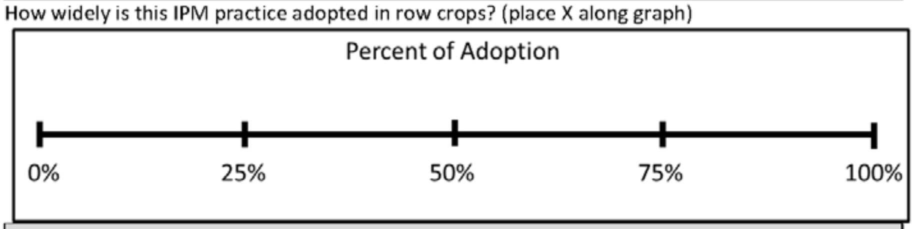
Comments:

d. From your experience, how does this IPM practice impact the costs of production?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

e. How widely is this IPM practice adopted in row crops? (place X along graph)



Comments:

6

5. Selecting pest resistant varieties or cultivars

a. What are barriers to the adoption of this IPM practice?

How significant are the barriers to adopting this IPM practice?		
Insignificant	A moderate obstacle	Significant
☐	☐	☐

Comments:

b. What practices are abandoned with the adoption of this IPM Practice?

Comments:

c. From your experience, how does this IPM practice impact output/yield?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

d. From your experience, how does this IPM practice impact the costs of production?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

e. How widely is this IPM practice adopted in row crops? (place X along graph)

Percent of Adoption

0% 25% 50% 75% 100%

Comments:

7

6. Using sanitation practices (removing inoculum, sterilizing or cleaning implements, etc.)

a. What are barriers to the adoption of this IPM practice?

How significant are the barriers to adopting this IPM practice?		
Insignificant	A moderate obstacle	Significant
☐	☐	☐

Comments:

b. What practices are abandoned with the adoption of this IPM Practice?

Comments:

c. From your experience, how does this IPM practice impact output/yield?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

d. From your experience, how does this IPM practice impact the costs of production?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

e. How widely is this IPM practice adopted in row crops? (place X along graph)

Percent of Adoption

0% 25% 50% 75% 100%

Comments:

7. Protecting native pollinators (mowing before spraying, spraying at night, etc.)

a. What are barriers to the adoption of this IPM practice?

How significant are the barriers to adopting this IPM practice?		
Insignificant	A moderate obstacle	Significant
☐	☐	☐

Comments:

b. What practices are abandoned with the adoption of this IPM Practice?

Comments:

c. From your experience, how does this IPM practice impact output/yield?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

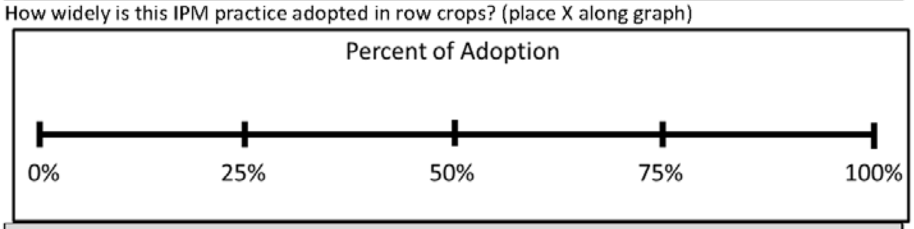
Comments:

d. From your experience, how does this IPM practice impact the costs of production?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

e. How widely is this IPM practice adopted in row crops? (place X along graph)



Comments:

8. Accessing MSU IPM print or online resources for reference

a. What are barriers to using these IPM resources?

How significant are the barriers to using these IPM resources?		
Insignificant	A moderate obstacle	Significant
☐	☐	☐

Comments:

b. From your experience, how does the adoption of these IPM resources impact output/yield?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

c. From your experience, how do these IPM resources impact the costs of production?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

d. How widely are these IPM resources adopted in row crops? (place X along graph)

Percent of Adoption

0% 25% 50% 75% 100%

Comments:

10

9. Using in-house ELISA test kits for rapid disease identification

a. What are barriers to the adoption of this IPM practice?

How significant are the barriers to adopting this IPM practice?		
Insignificant	A moderate obstacle	Significant
☐	☐	☐

Comments:

b. What practices are abandoned with the adoption of this IPM Practice?

Comments:

c. From your experience, how does this IPM practice impact output/yield?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

d. From your experience, how does this IPM practice impact the costs of production?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

e. How widely is this IPM practice adopted in row crops? (place X along graph)

Percent of Adoption

0% 25% 50% 75% 100%

Comments:

11

10. Using seeds treated to specific pest and disease needs

f. What are barriers to the adoption of this IPM practice?

How significant are the barriers to adopting this IPM practice?		
Insignificant	A moderate obstacle	Significant
☐	☐	☐

Comments:

g. What practices are abandoned with the adoption of this IPM Practice?

Comments:

h. From your experience, how does this IPM practice impact output/yield?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

i. From your experience, how does this IPM practice impact the costs of production?

	Decrease of 25 to 50%	Decrease of 10 to 25%	Decrease up to 10%	No Change	Increase up to 10%	Increase of 10 to 25%	Increase of 25 to 50%
Row Crops	☐	☐	☐	☐	☐	☐	☐
Fruit/Nuts	☐	☐	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐	☐	☐
_________	☐	☐	☐	☐	☐	☐	☐

Comments:

j. How widely is this IPM practice adopted in row crops? (place X along graph)

Percent of Adoption

0% 25% 50% 75% 100%

Comments:

12

Appendix: Discussion Group Instrument

11. What or who is the primary Influencers affecting one's adoption of IPM?

Degree of Influence			Influencer
None	Moderate	Significant	
☐	☐	☐	MAEAP
☐	☐	☐	MSU Extension programing or personnel
☐	☐	☐	MSU Extension print or internet
☐	☐	☐	NRCS
☐	☐	☐	neighbors
☐	☐	☐	private crop consultant
☐	☐	☐	chemical or seed dealer/representative
☐	☐	☐	fieldman (includes chem./seed rep, industry rep)
☐	☐	☐	trade journals
☐	☐	☐	grower/commodity/industry group.
Comments:			

12. Discuss the cost-share opportunities for growers to adopt IPM practices. Are they effective?

Comments:

13. Do you have any advice you would like to pass on to MSU Extension regarding its IPM program?

Comments:

13

Appendix: Grower Survey Instrument

MICHIGAN STATE UNIVERSITY EXTENSION

January 24, 2014

You are invited to participate in the following Integrated Pest Management (IPM) program evaluation survey for growers. The survey's purposes are to find out which IPM practices Michigan growers are adopting, what influences their decisions to adopt such practices and where they turn for information concerning IPM practices. You were randomly selected to participate in this survey from the population of Michigan crop and tree growers, and your participation is strictly voluntary. You are not obligated to complete any part of the survey; however, your participation will help MSU Extension IPM educators better serve the community in designing and distributing programming and media content related to IPM practices. All survey responses are collected anonymously, as no identifying information is collected with this survey form. The results of this survey will be made public by the CEA and will be available on-line at http://www.cea.msu.edu/ around June of 2014. You will also be able to ask for a copy of the results by contacting me directly at the information below.

We hope you will complete this survey as your opinions and experiences are important to us. We anticipate this short survey should not require more than five minutes of your time and ask that you complete and mail the survey in the self-addressed business return envelope no later than February 28, 2014. No postage is necessary. If you have any questions, please contact me, the survey administrator:

Steven R. Miller, Center for Economic Analysis
Michigan State University
Justin S. Morrill Hall of Agriculture
446 W. Circle Dr., Room 88
East Lansing, MI 48824-1039
Web: http://www.cea.msu.edu/ Email: mill1707@msu.edu Office: 517-355-2153

Thank you for your time and consideration.

Appendix: Grower Survey Instrument

Michigan State University IPM Program Evaluation Survey

MICHIGAN STATE UNIVERSITY EXTENSION

1. Please indicate the area you operated in 2013 of each of the following:
(Include the land you rent and exclude any land rented out.)

Corn	101 acres	Vegetables	106 acres
Soybeans	102 acres	Fruit	107 acres
Other field crops	103 acres	Christmas Trees	108 acres
Berries	104 acres		
Nursery	105 acres	Greenhouses	109 Ft^2

Definition: Integrated pest management (IPM) is a system of complementary management actions used to assess and mitigate pest damage while protecting human health, the environment and economic viability. IPM is a dynamic system that is adaptable to diverse management strategies.

2. Have you attended an Extension education session that included IPM? **Yes** ☐ 110 **No** ☐ 111
(Example: pest identification, pest management strategies, horticultural practices and supporting beneficial insects)

3. Have you attended a non-Extension IPM education session with IPM topics? **Yes** ☐ 112 **No** ☐ 113

4. Do you routinely utilize Integrated Pest Management (IPM) practices on your farm operation?

114 ☐ Yes - Please continue with the survey.

115 ☐ No - Please skip the remaining questions, but feel free to record any comments on the back of this page and return the survey. THANK YOU

5. Which of the following IPM practices or resources do you routinely use on your farm operation?
√ **(check all that apply)**

☐ 116 Scouting for damaging insects and diseases
☐ 117 Scouting for beneficial insects
☐ 118 Referencing weather models to make management decisions (e.g. Enviro-weather)
☐ 119 Only treating for pests when the economic threshold is reached, as applicable
☐ 120 Supporting beneficial insect habitat to promote pest control via natural enemies
☐ 121 Selecting pest resistant varieties or cultivars
☐ 122 Using sanitation practices (removing inoculum, sterilizing or cleaning implements, etc.)
☐ 123 Considering biological impacts when choosing pesticides
☐ 124 Protecting native pollinators (mowing before spraying, spraying at night, etc.)
☐ 125 Accessing MSU IPM print or online resources for reference
☐ 126 Other (please specify):____

Appendix: Grower Survey Instrument

6. How important was each source of information in your decision to adopt IPM practices?

	Essential	Important	Not Important
MSU Extension programming or personnel	130	140	150
MSU Extension print of Internet material	131	141	151
Participating in the Michigan Agricultural Environmental Assurance Program (MAEAP)	132	142	152
Natural Resources Conservation Service (NRCS) programs	133	143	153
Neighbor	134	144	154
Private crop consultant (not associated with a chemical dealer)	135	145	155
Field man, chemical, or seed dealer representative	136	146	156
Trade journals	137	147	157
Grower, commodity or industry group	138	148	158
Other (please specify):	139	149	159

7. Has your use of IPM resources or practices increased, decreased, or not affected the amount of pesticides you apply on average?
   Decreased ☐ 161 No Change ☐ 162 Increased ☐ 163

8. Has your use of IPM practices or resources helped protect your crop (for example from primary or secondary pests or invasive species)?
   Yes ☐ 164 No ☐ 165

9. Has your use of IPM practices or resources increased yield?
   Yes ☐ 166 No ☐ 167

10. Has your use of IPM practices or resources increased crop quality?
    Yes ☐ 168 No ☐ 169
    a. If yes, has the crop quality improvement increased prices?
       Yes ☐ 170 No ☐ 171

Comments: If you have any comments you wish to share with Extension IPM educators or program administrators, please add them here:

____

____

____

____

Response		Respondent		Mode		Enum.	Eval.
1- Comp 2- R 3- Inac 4- Office Hold 5- R – Est 6- Inac – Est 7- Off Hold – Est 8- Known Zero	901	1- Op/Mgr 2- SP 3- Acct/Bkpr 4- Partner 9- Other	902	1- Mail 2- Tel 3- Face-to-Face 4- CATI 5- Web 6- E-mail 7- Fax 8- CAPI 19-Other	903	904	905
S/E Name							