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Sean Malone
Virginia Tech Tidewater Agricultural Research and Extension Center, smalone@vt.edu

D Ames Herbert Jr
Virginia Tech Tidewater Research and Extension Service, herbert@vt.edu

Susan Pheasant
Pheasat Projects, Inc, pheasant@nwi.net

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Determining Adoption of Integrated Pest Management Practices by Grains Farmers in Virginia

Abstract
This article describes the results of three integrated pest management (IPM) surveys of corn, soybean, and small grains farmers in the coastal plains region of Virginia. Farmers identified their weed, disease, insect, and animal pests, and the reasons they use (or do not use) IPM practices for those pests.

Sean Malone
Research Associate
Virginia Tech Tidewater Agricultural Research and Extension Center
Suffolk, Virginia
smalone@vt.edu

D. Ames Herbert, Jr.
Extension Entomologist
Virginia Tech Tidewater Agricultural Research and Extension Center
Suffolk, Virginia
herbert@vt.edu

Susan Pheasant
President and Principal Consultant
Pheasant Projects, Inc.
Wenatchee, WA
pheasant@nwi.net

Introduction

There are many constraints to integrated pest management (IPM) adoption on the farm. Drost, Long, Wilson, Miller, and Campbell (1996) reported that time, information, and marketing were important considerations in whether farmers adopt new practices. The IPM practices must be economical. While some IPM practices have become widely used, there are other practices that meet the above criteria and never become accepted by farmers. The objective of the research discussed here was to determine what IPM practices corn, soybean, and small grains farmers in the coastal plains region of Virginia are (or are not) using and why they are (or are not) using them. This information could help Extension personnel determine what farmers need in terms of IPM programs as well as indicate areas to provide more education, service, or support.

Methods

In 2002, three 6-page surveys (one survey per crop) were developed to obtain farmers' opinions on corn, soybean, and small grains IPM practices. Survey questions were based on personal interviews with four Virginia Tech Extension Specialists, 10 Virginia Cooperative Extension Agriculture and Natural Resources (ANR) Agents, and three farmer focus groups (consisting of seven or eight individuals per group). The focus groups indicated important pest problems, what IPM practices were needed, and which IPM practices were popular or unpopular with farmers. Surveys were reviewed by cooperating ANR agents.

A total of 747 different addresses were provided by ANR agents, representing all known corn, soybean, and small grains farmers in their respective counties. This mailing list was sorted alphabetically and printed in three columns. The randomization for the mailing of the surveys was

done by column. (All names in column one received the corn survey, the soybean survey was distributed to those in column two, and the small grains survey was sent to those in column three.) This was done so that relatives who worked on the same farm would most likely receive different surveys.

Surveys were mailed in October, and a reminder postcard and replacement survey was mailed to those who did not respond within 2 to 3 weeks. Surveys were coded to keep track of returns. "Usable" surveys were ones completed and returned by farmers. "Unusable" surveys were ones returned by retired farmers, spouses of recently deceased farmers, and non-farmers. A returned survey where the respondent did not follow directions was considered unusable.

In one part of the survey, farmers were asked to rate their feelings and/or experiences with IPM on a Likert-type scale of 1-4 (1 = very false, 2 = somewhat false, 3 = somewhat true, and 4 = very true). This rating system provided an equal number of positive and negative choices, required the potential respondents to characterize their own behavior to a greater extent than simpler responses such as "true/false" or "agree/disagree" would entail, and made the surveys as user-friendly as possible.

Practices with mean ratings of 1.0-1.9 were considered "rarely used." Those with ratings of 2.0-2.9 were "sometimes used," and those from 3.0-4.0 were "often used." For example, a mean response of 3.5 to the survey question, "I personally scout my field for insect pests of soybean" falls between the "somewhat true" and "very true" categories and therefore the IPM practice was considered to be often used.

In another part of the survey, farmers were asked to indicate all weeds, diseases, and insects that were moderate or major pests on their farm for a specific commodity. They rated crop damage caused by vertebrate animal pests on a scale of 1-4 (1 = no economic damage, 2 = minor damage, 3 = moderate damage, and 4 = major damage). We used multiple-choice questions to determine whether farmers had used specific IPM resources available on Virginia Tech's Web site and why they were (or were not) used.

Results and Discussion

Overall, we had a 49.1% survey return rate, 24.6% of which were usable. Unusable surveys came mostly from individuals who no longer farmed. From the surveys, we described the most important pests for the three commodities (Tables 1 and 2) and use of IPM Internet resources (Table 3). Likert-type ratings of all the individual IPM practices were too numerous to include here, so we provided highlights from the "often used" and "rarely used" categories.

Table 1.
Major Crop Pests in the Coastal Plains Region of Virginia

Weeds		**Diseases**		**Insects**	
Species	**%[1]**	**Species**	**%**	**Species**	**%**
Corn					
Morningglory	70	Smut	32	European corn borer	46
Pigweed	65	Gray leaf spot	28	White grub	37
Italian ryegrass	49			Seedcorn maggot	33
Johnsongrass	49			Cutworm	33
Lambsquarters	49			Wireworm	32
Honeyvine milkweed	49			Armyworm	30
Soybean					

Morningglory	84	Purple seed stain	22	Corn earworm	80
Lambsquarters	63	*Phytophthora*	13	Soybean looper	42
Pigweed	55			Spider mite	33
				Armyworm	31
				Thrips	27
Small grains (wheat, barley, oats, rye)					
Italian ryegrass	75	Powdery mildew	81	Cereal leaf beetle	79
Wild garlic	67	Barley yellow dwarf	48	Aphid	68
Chickweed	54	*Septoria*	40	Armyworm	24
Henbit	44	Head scab	37		
Vetch	43	Leaf rust	30		
Cornflower	30				
Johnsongrass	30				

[1] Percentage of farmer surveys indicating the species as a moderate or major pest on their farm.

Table 2.
Crop Damage Caused by Vertebrate Animal Pests

Animal pest	**n[1]**	**Mean rating[2]**
Corn		
Deer	50	2.5
Crows	46	2.3
Geese	46	1.8
Soybean		
Deer	56	2.8

Groundhogs	57	3.1
Small grains		
Deer	52	2.5
Geese	49	2.2
Swans	41	1.5
[1] Number of responses for each questionnaire item. [2] Mean of all responses for each questionnaire item, using a 1-4 scale where 1 = no economic damage and 4 = major damage.		

Table 3.
Use of IPM Internet Resources by Farmers

IPM resource	n[1]	Usage (%)[2]
Corn		
Virginia weed identification guide Web site (http://www.ppws.vt.edu/weedindex.htm)	53	13.2
Virginia Insect Control Expert for Corn (VICE Corn) Web site (http://www.isis.vt.edu/~pbhogar/vicecorn.html)	53	1.9
Soybean		
Virginia weed identification guide Web site (http://www.ppws.vt.edu/weedindex.htm)	59	15.3
Corn earworm advisory	58	55.2
Corn earworm threshold calculator Web site (http://www.ipm.vt.edu/cew/)	64	4.7
Small grains		
Virginia weed identification guide Web site (http://www.ppws.vt.edu/weedindex.htm)	59	8.5
[1] Number of responses for each questionnaire item. [2] Percentage of respondents indicating use of the IPM Internet resource.		

Farmers often used the following IPM practices in all three commodities (unless indicated otherwise):

- Scouting for weeds and insects.
- Using scouting to determine whether herbicide applications are needed.
- Basing herbicide selection on weed scouting.
- Use of scouting to manage weeds and diseases in future crop rotations

- Rotation of herbicide modes of action between crops.
- Use of reduced-till or no-till practices.
- Selection of disease-resistant corn and small grains varieties.
- Use of rapid canopy closure to control weeds in soybean.
- Having agricultural suppliers or chemical dealers scout for diseases and insects in small grains.
- Use of thresholds for corn earworm in soybean and cereal leaf beetles and aphids in small grains.

Farmers rarely used the following IPM practices in all three commodities (unless indicated otherwise):

- Having independent crop consultants scout for weeds, diseases, and insects.
- Use of cultivation to control weeds.
- Making maps of weed hotspots in a field.
- Having ANR Agents scout for weeds, diseases, and insects in corn and soybean.
- Use of bait stations and baited wire traps to monitor soil insect pests in corn.

Convincing farmers to adopt IPM programs is usually a slow process, but farmers understand that IPM is necessary. When corn, soybean, and small grains farmers were asked about their feelings on the statement "IPM is important," the average response on the 1-4 Likert-type scale was 3.5, falling halfway between "somewhat true" and "very true." Programs that are financially sound, offer incentives for their use, and fit with current farming practices have the best chance of being adopted (Herbert, 1995).

Farmers have limited time available to personally scout their fields, and it may not be economically feasible to hire an independent crop consultant. Agricultural suppliers and chemical dealers often scout without charge and outnumber ANR Agents (more people can scout more land). Surveys showed that agricultural suppliers and/or chemical dealers scouted fields more than ANR Agents or independent crop consultants.

The surveys provided the following farmer insights into why IPM practices are (or are not) popular:

- The Virginia Tech Web site offers pest identification guides, expert crop management systems, suggestions for managing pests, and pest advisories. Use of these resources was 15.3% or less, with the exception of the corn earworm advisory, which had 55.2% usage. These IPM resources are infrequently used due to lack of awareness and limited computer or Internet access. Pocket-sized references (pest identification and management guides appropriate for the region) could be of value, especially for limited-resource farmers. The corn earworm advisory had higher percent usage than other Internet resources because it is also available through local media. While farmers considered developing satellite and/or unmanned aircraft scouting technologies "somewhat important," low computer usage suggests that it may be difficult to get them to use more complicated technologies.

- Farmers have confidence in their pest identification skills, but mentioned a need for more scouting education. A workshop on farmer constraints to IPM adoption indicated the need for better-educated scouts (Sorensen, 1993). For example, farmers ranked the soybean looper as the second most important insect pest of soybean (Table 1), while an Extension Specialist stated that it is rarely a problem in Virginia. Green cloverworms are often misidentified as soybean loopers. Because a green cloverworm eats only about half as much as a soybean looper, a plant can tolerate more green cloverworms than soybean loopers. Proper identification of these pests could prevent unnecessary pesticide usage.

- Farmers are generally aware that pest thresholds are available, especially for their most important species such as corn earworm in soybean and cereal leaf beetles and aphids in small grains. However, thresholds for single weed species and species complexes do not exist, causing each farmer to develop his/her own weed tolerance level. Focus group farmers mentioned a need for IPM practices for vertebrate pests; surveys indicated that deer and groundhog damage approached moderate levels (Table 2).

- Few corn farmers scout and monitor soil insect pests because they are difficult to observe and require special traps, therefore demanding more of the farmers' time and money. Although farmers did not feel that the techniques were too complicated, they were provided with a simpler alternative--digging and counting them before planting--but this too was rarely done.

- Farmers know that crop rotation helps to avoid problems of diseases, weeds, and insects; maximizes land usage and profits; and affects nutrient management practices. They rarely cultivate for weed control because of the benefits of reduced-till or no-till practices (reductions in erosion, increased soil quality, and compliance with conservation and nutrient management requirements).

- Farmers realize the importance of herbicide rotation and resistance monitoring. A farmer focus group indicated that those who planted glyphosate-resistant soybean were still concerned about and scouted for weeds, even though they typically had few weed problems.

- Farmers indicated little concern about corn diseases or about nematodes and diseases in

soybean. They may feel that these are held in check by use of resistant varieties and crop rotation. Nematode assays were rarely performed in soybean fields. Surveys indicated that farmers did not know how to collect samples and were not confident in their ability to associate nematodes with disease. Laboratory processing time for samples and cost did not seem to be a deterrent.

Conclusions

Surveys indicated that corn, soybean, and small grains farmers understand the importance of using IPM practices. Scouting and use of thresholds were two of the most often used IPM practices. Extension should continuously help farmers learn about IPM and provide IPM refresher courses. Computer training may help farmers become better scouts and keep them aware of current IPM practices; however, posting IPM information on the Internet does not guarantee that it will be discovered, so providing hard copies of information is also recommended. Lack of familiarity, time, and resources were recurring reasons for non-use of IPM practices; therefore, researchers and Extension personnel should develop and emphasize IPM programs that are economical and easy to use.

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