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Integrated Pest Management and Protection Practices by Limited Resource Farmers

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Abstract: This article focuses on the perceptions of limited resource farmers (LRFs) on integrated pest management (IPM) and protection practices. Data were collected from 90 LRFs in the Alabama Black Belt and analyzed by descriptive statistics. The results revealed that most farmers used pesticides and practiced crop rotation and other practices, yet a majority was not familiar or inadequately familiar with IPM. It is recommended that instituting a coordinated or seamless IPM education program on a long-term or continuing basis will enable the LRFs to be well familiar with and also practice IPM on a sustained basis.

Introduction

Small farmers use a wide range of different chemicals to control various types of pests on their farms. The lack of proper training in the application of pesticides could present several challenges. These challenges include health risks to farmers and consumers as well as environmental damage or degradation. Integrated pest management (IPM) reduces these risks.

The EPA (2008) stresses IPM is an environmentally sensitive approach to pest management that relies on a combination of common-sense practices. These practices use comprehensive information on life cycles of pests and other interaction with the environment in combination with available pest control methods to prevent or control pest damage. The EPA further emphasizes that farmers who practice IPM use a four-pronged approach: setting thresholds, monitoring and identifying pests, implementing preventive measures (e.g., crop rotation), and implementing control measures (e.g., insect trapping and weed control).

The California Plant Health Association (1990) summarizes tools and goals of IPM. It states tools of IPM as comprising biological practices (protect/enhance/release natural enemies); cultural practices (crop rotation, cultivation, irrigation, pest monitoring); chemical practices (pesticides, insect growth regulators, pheromones); and genetic practices (sterile release, resistant varieties, transgenic plants). Furthermore, the association states two goals of IPM as, first, "to ensure production of high quality food and fiber in a sustainable, environmentally sensitive economical manner, and second, to minimize the risks to human health and to the environment."

Weeden, Shelton, and Hoffman (2008) explain that the objective of IPM is not to eliminate all pests, but rather to reduce pest populations to less damaging numbers using multiple tactics. Using multiple tactics minimizes the chances that a particular pest will adapt to any one of the tactics.

Most small farmers face challenges in dealing with insects, diseases, and weeds affecting their crops. Small farmers demonstrated less familiarity with IPM than other farmers in studies conducted by Molnar, Bitto, and Brant (2000) and Tackie, Jackai, Ankumah, Noble, and Hardney (2004). This shortcoming needs to be addressed, taking into consideration the likelihood of farmers' exposure to pesticide residues on farm. Similarly, consumers could be exposed to pesticide residues when they purchase and consume farm produce. Having proper knowledge of IPM and applying that knowledge is a way by which the risk of pesticide exposure can be reduced.

The unsafe use of pesticides and other chemicals by small farmers may have a significant impact on the quality of their farm products, which will ultimately affect the consumer and may also affect farmers' health. Moreover, ascertaining small farmers' understanding and their use of IPM practices could help formulate strategies or programs to assist them in carrying out effective practices on their farms. This article summarizes a larger study that focuses on assessing small farmers' perceptions of IPM and protection

practices; the emphasis is on a subset of small farmers called "limited resource farmers" (LRFs). Specifically, this article looks at management of pest problems, pesticide use, and familiarity with IPM.

Literature Review

The literature on IPM practices displays a mixed bag of studies and results, as the studies in this review show. Govindasamy, Italia, DeCongelio, Anderson, and Barbour (2000) evaluated grower characteristics and satisfaction with organic production by examining closely the influence of IPM. They reported that only 19% of the organic producers that they surveyed used IPM. They also found that the use of IPM enhanced farming operations, because of its ability to rid farms of pests, or at least, greatly reduce the presence of pests. They concluded that IPM acts as a kind of insurance against crop losses and that farmers who use it are able to expand operations without fear of major losses.

Molnar, Bitto, and Brant (2001) assessed core conservation practices among small farmers and reported that one-third of the farmers surveyed did not view the use of conservation tillage as useful on their farms. They also found that many of the farmers were not familiar with the term IPM and did not fully understand what it meant. Only a third believed IPM would be useful on their farms.

Stevens et al. (2003) investigated the long-term effectiveness of soil solarization integrated with biological control agents, chemical fungicides, organic amendments, or physical methods to reduce southern blight and southern root knot disease in tomatoes and sweet potato production. They concluded that, while soil solarization was effective in reducing soil-borne diseases in the first year, IPM methods were needed to improve the effectiveness of soil solarization for increased vegetable production in the second year.

Hodur, Larry, and Dean (2004) assessed the effectiveness of IPM, flea beetles only as biocontrol agents, and herbicides only on leafy spurge (an invasive plant that displaces native vegetation) by interviewing landowners and county weed board representatives. Many of them (a little over 50%) rated IPM as the most effective tool in controlling leafy spurge.

Tackie, Jackai, Ankumah, Noble, and Hardney (2004) analyzed small farmers' perceptions of IPM. A majority (73%) of farmers they surveyed cultivated vegetables and sprayed pesticides on crops. Malathion, Sevin, and Bravo were the most common pesticides used; Roundup, 24-D, and Poast were the most common herbicides used; and 90% stated that that they used precaution when spraying. Nearly 88% indicated that they had inadequate or no knowledge of IPM, yet 44% had taken a course in pesticide application. About 76% used crop rotation for soil improvement or disease control, but did not use IPM as a tool to control pests.

Description of Limited Resource Farmers

LRFs are a subset of small farmers of great interest to many researchers because of their unique characteristics. According to Lewis (1978), they are most often described in terms of acreage of land operated, units of livestock in operation, value of farm output produced, total assets owned, level of income, and days worked off-farm and on-farm. The USDA-ERS (2001) define them as those farmers with farm sales less than $100,000 per year, and Dishongh and Worthen (1991) define them as those who earn $40,000 or less in farm sales annually. Tackie, Findlay, and Baharanyi (1997) simply define LRFs as those targeted by the USDA for program assistance because of their lack of accessibility to resources.

Three studies conducted by Baharanyi, Tackie, Pierce, Woolery, and Hopkinson (1993); Tackie, Findlay, and Baharanyi (1998); and Tackie, Jackai, Ankumah, Noble, and Collins (2004) on farmers in the Alabama Black

Belt showed that LRFs earned low annual farm income (66%-71% earned $10,000 or less) and had low education (44%-67% with high school education or less). Based on the aforementioned studies, it is evident the LRFs, at least in the Alabama Black Belt, generally earn less income compared to LRFs elsewhere. This is apparent when one looks at the USDA-ERS and Dishongh and Worthen definitions for LRFs.

Methodology

Data were collected using a modified version of the questionnaires developed by Tackie, Jackai, Ankumah, Noble, and Hardney (2004) and Tackie, Jackai, Ankumah, Noble, and Collins (2004). The questionnaire focused on questions relating to background information and crop protection practices. In-person interviews were conducted from spring 2006 to winter 2007 in several Alabama Black Belt Counties using purposive sampling. A Black Belt County is a county that has higher than average percentage of Blacks and also displays certain socioeconomic indicators (e.g., high rates of unemployment and low educational achievements).

A total of 90 LRFs were interviewed. No farmer refused to be interviewed, and as a result this, nonresponse error was not a threat (Lindner & Wingenbach, 2002). The data were entered using SPSS 12.0 for Windows and analyzed using descriptive statistics, namely, frequencies and percentages. The reliability coefficient (alpha) was 0.60 for the questionnaire, which is considered adequate for the study (Patten, 2005).

Results

Sixty percent of the farmers had farmed over 30 years. About 50% of them had farm sizes 40 acres or less, and nearly 36% had farm sizes 20 acres or less. Approximately 67% were 55 years or older. Forty percent had high school education or below; 96 % were males; 91% were Blacks; and 64% earned $10,000 or less in annual sales income.

Table 1 reflects management of pest problems by farmers. The major crops grown by respondents were vegetables-peas, corn, beans, watermelons, squash, tomatoes, collards, okra, and sweet potatoes. The most common insect pests were "worms" [i.e., larvae of insects] (53%), aphids (22%), and beetles (20%). Other insect pests were whiteflies and fire ants. The most common diseases were blight (29%), gummy stems (16%), and brown rot (13%). The most common weeds were nut grass (44%), coffee weed (27%), and pig weed (16%).

When asked how insect pests, diseases, and weeds were managed, 73% indicated pesticide application, and 22% indicated non-chemical control. With regard to ranking the difficulty of dealing with these problems, 42 % ranked diseases as the most difficult to manage, 33% ranked weeds the most difficult to manage, and 4% ranked insect pests the most difficult to manage.

The most frequently used pesticides on insects were Sevin (38%), Orthene (13%), and Malathion (11%). Very few farmers responded to chemicals sprayed on diseases; 7% used Bravo; and 4% sprayed Captan. The most frequently used herbicides were Roundup (40%), Poast (20%), and 2,4-D (18%).

Table 1.
Management of Pest Problems

Category	Number	Percent

How Problems Are Managed (Multiple Answers)		
Pesticide Application	66	73.3
Non-chemical	20	22.2
Most Difficult Problem		
Insect Pests	4	4.4
Diseases	19	42.2
Weeds	30	33.3
Pesticide Sprayed to Control (Multiple Answers)		
Insect Pests		
Sevin	34	37.7
Orthene	12	13.3
Malathion	10	11.1
Diseases		
Bravo	6	6.7
Captan	4	4.4
Weeds		
Roundup	36	40.0
Poast	18	20.0
2,4-D	16	17.8

Table 2 reflects respondents' knowledge of pesticide application. Nearly 38% sprayed in the morning, and 27% sprayed in the evening. When asked what determines when they sprayed, 47% stated insect population, 33% stated the weather, and nearly 30% indicated the level of damage. Forty-four percent had no schedule for spraying; 20% sprayed weekly; and 18% sprayed biweekly.

The main guide on selection of technology for dealing with pests was the farmer (47%), followed by the Extension agent (29%), and then the university researcher (22%). A little over 62% used safety precautions when they sprayed. Among these precautions were facial mask, gloves, and protective clothing as well as not spraying when windy. About 50% said that they had taken a short course in pesticide application. All of them took the course with Cooperative Extension.

Table 2.
Knowledge of Pesticide Application

Category	**Number**	**Percent**
Time of Day of Spraying		

Morning	34	37.8
Evening	24	26.7
Determination of When to Spray (Multiple Answers)		
On calendar basis	4	4.4
Weather	30	33.3
Level of damage	26	28.9
Insect population	42	46.7
Regularity of Spraying		
No Schedule	40	44.4
Weekly	18	20.0
Bi-weekly	16	17.8
Guide on Selection of Technology (Multiple Answers)		
Self-Taught	42	46.7
Extension agent	26	28.9
University researcher	20	22.2
Use Safety Precautions?		
Yes	56	62.2
No	26	28.9

Table 3 focuses on familiarity with IPM. When asked how familiar they were with IPM, 82% indicated that they were not familiar, slightly familiar, or somewhat familiar with IPM. About 33% surmised the benefits of IPM as providing savings; 27% surmised the benefits as providing better yield; 40% surmised the benefits as reducing pesticide use; 11% surmised the benefits as providing better soil conditions; 13% each surmised the benefits as providing better water quality; and another 13% surmised the benefits as providing a safer environment. Approximately 58% spent 25% or less of their farm expenses on pesticides, and 20% spent 26-50% of their farm expenses on pesticides.

Almost 78% used crop rotation on their farms. When asked why they used crop rotation, 56% indicated to improve the soil; 16% indicated to control insects; 13% indicated to improve yield; and 11% indicated to control diseases. Furthermore, when asked what other pest control practices they used on their farms, 38% said that they scouted crops; 29% said that they used conventional tillage; and 22% said that they used multiple cropping.

Table 3.
Familiarity with Integrated Pest Management

Category	**Number**	**Percent**

How Familiar Are You With IPM?		
Not familiar	28	31.1
Slightly familiar	16	17.8
Somewhat familiar	30	33.3
Very familiar	10	11.1
Proportion of Farm Expenses Pesticides		
25% or less	52	57.8
26-50%	18	20.0
51-75%	2	2.2
Use Crop Rotation?		
Yes	70	77.8
No	16	17.8
Other Practices (Multiple Answers)		
None	6	6.7
Scout crops	34	37.8
Use beneficial insects	4	4.4
Conventional tillage	26	28.9
Multiple cropping	20	22.2

Conclusion

The demographics reflect the limited resource status of the respondents. Insects were the most common pests, yet the least difficult to manage. This is an indication of intense use of pesticides, and this has health risks and/or environmental implications. However, a majority indicated they used safety precautions when spraying. This action may be the result of the pesticide application course they had taken. Although almost half of the farmers said they had training in pesticide application, most were not familiar or adequately familiar with IPM implying that the training was not in IPM.

There is a role for Extension to play in educating LRFs in IPM practices and making farmers more familiar with the technology. It is obvious that, though they were practicing some aspects of IPM (e.g., crop rotation and scouting), they were not doing these in a coordinated or seamless manner. IPM is a holistic pest management system. The education process should include both classroom and hands-on demonstrations in the field. This training should be done on a long-term or continuing basis.

This will allow for LRFs to learn and practice IPM. This will, in turn, help reduce the usage of pesticides, and hence, protect human health and the environment. Also, the impact of this training should be monitored in order to ascertain the success of it.

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