Farmers' and rural extension workers' perceptions on the adoption of the integrated pest management

Percepção de agricultores e extensionistas rurais sobre a adoção do manejo integrado de pragas

DOI: 10.55905/rdelosv16.n46-018

Recebimento dos originais: 14/08/2023
Aceitação para publicação: 13/09/2023

Eliane Araújo Robusti
PhD in Agronomy
Institution: Universidade Estadual de Londrina
Address: Londrina - PR, Brasil
E-mail: robusti.eliane@gmail.com

Humberto Godoy Androcioli
PhD in Agronomy
Institution: Instituto de Desenvolvimento Rural do Paraná (IAPAR)
Address: Londrina - PR, Brasil
E-mail: humbertoandrocioli@gmail.com

Fernando Teruhiko Hata
PhD in Agronomy
Instituição: Universidade Estadual de Maringá
Address: Maringá - PR, Brasil
E-mail: hata.ft@hotmail.com

Dimas Soares Junior
PhD in Agronomy
Institution: Instituto de Desenvolvimento Rural do Paraná (IAPAR)
Address: Londrina - PR, Brasil
E-mail: dimasjr@idr.pr.gov.br

Ayres de Oliveira Menezes Junior
PhD in Biosciences
Institution: Universidade Estadual de Londrina
Address: Londrina - PR, Brasil
E-mail: ayres@uel.br

ABSTRACT
As one important element of food culture, the common bean can be found in diverse countries and social classes. Integrated Pest Management (IPM) can help rationalize the use of insecticides to control insect pests in bean crops. This grain is an important element for food security and can be found in different countries and social classes. The present study aimed to examine rural
extension professionals' and farmers' after participating in the “Plante seu Futuro” (“Grow your future”) program of the Government of the State of Paraná-Brazil in its component “Integrated Management of Pests and Diseases”, with the objective of identifying common points of view, positive and negative aspects that can be considered in the dissemination of the IPM. For that, semi-structured interview scripts were applied. The technical procedure used was the multi-case study, based on seven farmers and seven rural extension workers, employees of an official institution of Technical Assistance and Rural Extension, totaling about 20% of the program participants. The information was transcribed, organized, and subjected to content analysis. The intensity of discourses concerning the IPM before and after the experiment shows that even those farmers and rural extensionists who had a negative opinion about the IPM present favorable discourses and unanimity in the categorization of ends in the face of material success as justification for adopting the IPM after the experience. However, lack of information and/or knowledge about the practice was mentioned as a barrier, implying the need for technicians and farmers to be trained in order to spread IPM.

**Keywords**: interviews, content analysis, *Phaseolus vulgaris* L.

**RESUMO**

O feijão comum está presente em todas as regiões e classes sociais do Brasil como um dos principais elementos da cultura alimentar. Produzido em todo o país, alcança altas produtividades geralmente associadas ao cultivo convencional e ao uso significativo de agroquímicos. Apesar de sua baixa adoção, o Manejo Integrado de Pragas (MIP) pode ser uma alternativa a ser considerada para a racionalização do uso de inseticidas visando o controle de insetos praga na cultura do feijão. Nesse contexto, o estudo em questão buscou analisar as percepções de profissionais da extensão rural e de agricultores do estado do Paraná acerca da adoção dessa prática, com o objetivo de identificar pontos de vista comuns, aspectos positivos e negativos que possam ser considerados na difusão do MIP. Para tanto, aplicaram-se roteiros de entrevistas semiestruturadas para sete agricultores e sete extensionistas rurais, servidores de instituição oficial de Assistência Técnica e Extensão Rural. Todos os entrevistados participaram do programa “Plante seu Futuro” do Governo do Estado do Paraná-Brasil em seu componente “Manejo Integrado de Pragas e Doenças”. Os dados foram transcritos, sistematizados e submetidos à análise de conteúdo. A análise de intensidade dos discursos em relação ao MIP antes e depois do experimento mostra que mesmo os agricultores e extensionistas rurais participantes que possuíam opinião desfavorável ao MIP, depois da experiência, apresentam discursos favoráveis e com unanimidade na categorização de fins frente ao êxito material como justificativa para adoção do MIP. Contudo, foram mencionados como pontos dificultadores, a falta de informação e/ou conhecimento acerca da prática, indicando necessidade de capacitação de técnicos e agricultores para a massificação do MIP.

**Palavras-chave**: entrevistas, análise de conteúdo, *Phaseolus vulgaris* L.

**1 INTRODUCTION**

The Integrated Pest Management (IPM) is a practice that uses a combination of methods, in addition to chemical control, to keep the occurrence of insect pests below the level of economic
damage. Therefore, IPM prevents the use of insecticides on an indiscriminate basis (DARA, 2019). When used as a preventative measure or calendar-based spraying, these agrochemicals increase the risk to human health and the environment, as well as the cost of unnecessary expenditure and the possibility of insect resistance to chemicals (STABACK et al., 2020).

Although the reasons for not adopting MIP are not well established, the profile of the farmer, individual motivations, and social commitments explain in parts the level of inputs used or alternative practices adopted (NAVE et al., 2013). Another challenge is that growers have to maintain the quality and quantity of their production with reduced amounts of pesticides used in IPM (LAMICHHANE et al., 2016). This may turn the IPM adoption as a non-safety economically and agronomically option in the farmer’s perception and therefore they do not adopt that system. Then, to understand the farmers, extension and pest control professionals, and other professionals related to agriculture perceptions on IPM are crucial for increase its adoption.

In this regard, the current work presents the findings of research conducted through semi-structured interviews with farmers and rural extension professionals in charge of areas where IPM and conventional pest management (Non-IPM). The bean (Phaseolus vulgaris L.) is one important legume for human consumption, being an important crop in addressing global food security challenges due to adaptable to different edaphoclimatic conditions (SANTOS SOUZA et al., 2022).

The study aimed of identifying the ex-ante and ex-post perceptions of the adoption of IPM, after participating in the “Plante Seu Futuro” program of the Government of the State of Paraná-Brazil in its component “Integrated Management of Pests and Diseases”. Brazil is one of the five largest producers of beans in the world, with more than three million tons produced (FAOSTAT, 2021) and the state of Paraná exceeds the national average in terms of average productivity (IBGE, 2017). The intensive use of agrochemicals has been used to achieve such levels of productivity, increasing the risk of human and environmental contamination, and increasing production costs.

2 MATERIALS AND METHODS

The research had a qualitative, descriptive, and exploratory approach. As for the technical procedure used, the study of multiple cases was applied, covering productive units that were part of the "Plante seu Futuro" ("Grow Your Future" in literal translation) program of the Government.
of the State of Paraná-Brazil in its component "Integrated Management of Pests and Diseases", involving rural extension professionals, researchers and teachers from public institutions, in addition to farmers.

From May 21 to 24, 2018, fourteen semi-structured, personal (face-to-face), and individual interviews were conducted to better understand the ideas and opinions of farmers (7) and rural extension workers (7) involved in the IPM project, in different production units, using Quivy and Campenhoudt (1992) proposed definitions and procedures. This account for approximately 20% of farmers participating with the project.

The study's geographical scope includes the municipalities of Guamiranga, Ivaí, Paula Freitas, Araucária, Lapa, and Mandirituba, which are in Curitiba's Metropolitan and Southeast regions and account for more than half of the state's black bean production, as well as the municipality of Ortigueira (Central Eastern mesoregion of Parana State), which accounts for more than 45% of the state's bean production (IBGE, 2017).

The farmers’ interviews were taped for later recording, with *ipsis litteris* transcription and verification using the content analysis technique (BARDIN, 1977). The content analysis methodology was adopted by Richardson (2012); Silva et al. (2020). The set of data obtained allowed the performance of qualitative analyses, since even in essentially quantitative studies, qualitative analyzes could be applied (RICHARDSON, 2012).

The information was systematized using content analysis, in which analysis techniques are used to infer knowledge using indicators that can be quantitative or not (BARDIN, 1977). Table 1 shows the scheme for organizing the information, coding, and analyzing the responses obtained.

<table>
<thead>
<tr>
<th>Phases</th>
<th>Analysis</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repetition/Frequency</td>
<td>Per question</td>
<td>Answers: Yes or No</td>
</tr>
<tr>
<td>Codification</td>
<td>Expressions mentioned at some point in the interview</td>
<td>Identified expressions: Lack of knowledge and/or information; Calendar-based applications; Application reduction; Cost reduction; Environment;</td>
</tr>
</tbody>
</table>

Table 1. Scheme for organizing information, coding, and analyzing semi-structured interview responses
3.1 ASSOCIATIONS, TECHNICAL ASSISTANCE, AND EXPERIENCE WITH INTEGRATED PEST MANAGEMENT AMONG THE INTERVIEWED FARMERS

The first questions intended to know the conditions of the farmer in the face of external influences. There was contact with other technicians and agronomists other than the Institute or agrochemical resellers for four of the interviewees, who were willing to provide technical assistance if requested by the farmer interviewed. These were the same farmers who were members of associations and/or cooperatives. Farmers need to be educated and better informed about the process of adopting sustainable practices (DE SILVA and FORBES, 2016).
When they answered yes to the following questions, they indicated that either they were in a good position to apply the IPM, because of new knowledge or a desire to continue based on work results. It was also possible to verify that six of the farmers had prior experience with the IPM. Despite this fact, only three of the interviewees had carried out training in relation to the IPM, either via field days and/or courses. It was reported in a training program in the southern Philippines that farmers who completed the trainings were more likely to adopt IPM (JOSUE-CANACAN, 2022), corroborating with our results.

Field days and visits by extension agents are cited as a stimulus for adoption in integrated IPM practices, with field days being more effective for simpler practices and recommended visits for more elaborate practices, owing to the high cost of field days (RICKER-GILBERT et al., 2008). Most farmers had prior IPM experience, primarily with soybeans. The most interesting finding is that after the study's experience, all the interviewees intended to continue using the IPM in bean cultivation. In terms of IPM adoption, visits by extension agents are seen as favorable to stimulate adoption (RICKER-GILBERT et al., 2008).

3.2 REDUCTIONS IN INSECTICIDE APPLICATIONS, COST REDUCTIONS, ENVIRONMENTAL CONCERNS AND DIFFICULTIES IN APPLYING IPM

The steps of coding, intensity analysis, and purpose categorization were used for content analysis. The responses of the farmers and the rural extension workers interviewed were compared. Establishing criteria, categories, attitude scales, and speech intensities are tools for converting qualitative data into quantifiable data (RICHARDSON, 2012).

Coding is the division of data into units that allow the representation of ideas or textual content, including steps such as determining registration units, establishing numbering rules, and defining analysis categories (RICHARDSON, 2012). It is the process of extracting the main features of a discourse from raw data using clipping, aggregation, and enumeration (BARDIN, 1977). Table 2 presents the coding of the expressions used in the interviews under analysis.

The interviews were analyzed, and we were able to identify some common expressions that demonstrated the main idea in each speech. Farmers’ and rural extensionists’ speeches, with a few exceptions, shared many of these expressions. In the opinion of farmers and rural extensionists interviewed, cost reduction and insecticide application were the most similar. The IPM adoption reduced in insecticide sprays, corroborating previous reports in soybean, *Glycine*
max L. Merril (STABACK et al., 2020). Thus, the adoption of IPM has the potential to reduce production costs (ALFORD and KRUPKE, 2018).

<table>
<thead>
<tr>
<th>Occurrence of Use</th>
<th>Coding of Expressions Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cost-cutting</td>
</tr>
<tr>
<td>Farmer</td>
<td>Absolute value</td>
</tr>
<tr>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Extension workers</td>
<td>Absolute value</td>
</tr>
<tr>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

Source: Table prepared by the authors based on data from the study.

When it came to the challenges of implementing the IPM, farmers and rural extension workers were concerned about the lack of knowledge and/or information. One of the barriers to IPM is a scarcity of personnel trained in sampling methods to advise farmers (PESHIN et al., 2009). It should be noted that the rural extension workers interviewed had attended IPM-related training provided by the project's participating institutions. One of the reasons for the complexity of IPM is the dynamics of insect pests, where producers need accessible information about the effects of agrochemicals on natural enemies, not always available in field recommendations (BUENO et al., 2017). Public policies and a proactive search for information should be strongly encouraged for higher levels of IPM adoption (CREISSEN et al., 2021).

The literature also cites the farmer's belief that natural enemies are ineffective in pest control as a barrier to adherence to the IPM, as well as the issue of profit, which in the initial view would not be increased (TIMPRASERT et al., 2014). However, such questions were not raised in this study, and 5/7 of the farmers were unable to identify the disadvantages of using the IPM. Increased work and/or a lack of time were more prevalent in the speeches of rural extension workers, only appearing once in farmer testimony.

The term "environment" was mentioned in one of the farmer interviews and two of the rural extension worker interviews, indicating the need for more work on information and dissemination of environmental issues related to agriculture in the region. Increased public
Investment in rural extension has a positive impact on rural development by increasing access to new technologies and knowledge, particularly among small farmers (DE FREITAS et al., 2021).

It should also be noted that one of the issues mentioned in the speeches regarding the adoption of the IPM was the harassment perpetrated by agrochemical sales professionals who recommend scheduled applications. The IPM faces large pesticide companies as a barrier, which use marketing resources to propagate the adoption of agrochemicals with visible and immediate effects (PESHIN et al., 2009). The development of public policies to encourage IPM is one tool for overcoming this barrier. When regional subsidies are factored in, IPM is preferred over conventional management for risk averse to moderately risk averse farmers (LAVIK et al., 2020).

3.3 Ex-ante and Ex-post Analysis and Categorization of Purposes in IPM Adoption

The categories of intensity and purposes were included to complement the previous analyses regarding the perception of values that the IPM theme proposes. The intensity category was divided into favorable, unfavorable, or neutral before and after the interviewee's participation in the project, indicating the statement's direction.

The intensity of the speeches in relation to the IPM before and after the experiment revealed that there was a shift in attitude toward the subject. Even those farmers and rural extensionists who had previously held a negative opinion of the IPM changed their minds after participating in the project (Table 3). Property (material success), affection (power and prestige), and the environment were the three categories of ends cited as justifications for IPM adoption. These steps are not required in content analysis but given the volume of expressions and searches associated with value analysis, they make classifications and analyses easier (RICHARDSON, 2012).

There was unanimity in the categorization of purposes in the face of material success as a justification for adopting the IPM, confirming the financial results as a decisive criterion. In this regard, it is important to note that price differentials for beans produced in an IPM system were not considered in the current study, even though there may be a price differential in favor of production based on concepts and principles of good agricultural practices in demanding markets (Goulart Silva et al., 2012). However, the reduction in costs mentioned in the interviews has proven to be a decisive factor in the adoption of the IPM practice.
Table 3. Analysis of the intensity of the responses of the farmers and rural extension workers interviewed

<table>
<thead>
<tr>
<th>Intensity Analysis</th>
<th>Opinion before the experiment</th>
<th>Opinion after the experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech in relation to the IPM</td>
<td>Favorable</td>
<td>Unfavorable</td>
</tr>
<tr>
<td>Farmers</td>
<td>Absolute value</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>42.8</td>
</tr>
<tr>
<td>Extensionists</td>
<td>Absolute value</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>71.4</td>
</tr>
</tbody>
</table>

Source: Table prepared by the authors based on data from the study.

Only one of the participants in the study mentioned environmental benefit as a reason for adopting the IPM. In the rural extensionists, the environment was cited as one of the justifications for the IPM in interviews, validating the professionals' awareness. A significant factor in the environmental aspect of production stems from the fact that pollinating insect behavior and natural enemies can affect a wide range of agricultural crops. Other groups of organisms that should be preserved are the biological control agents, which manage to naturally reduce the population of pests and consequently reducing the use of agrochemicals (NDAKIDEMI et al., 2021).

Regardless of whether the term "environmental" is currently used explicitly or implicitly in farmer speeches, it is an undeniable fact that fewer agrochemical applications result in a chain linked to a lower risk of environmental contamination and/or intoxication of farmers. The abusive use of insecticides can interfere with farmer and environmental health in the short, medium, and long term, as pesticides are potential risk factors (STABACK et al., 2020). Farmers with less labor availability use more inputs, and extension actions have less influence in these groups. Farmers who practice agriculture with few inputs, on the other hand, are more environmentally conscious and receptive to extension actions (NAVE et al., 2013).

In general, all point to financial benefits because of the practice of IPM. This point favors the producer's adherence and the technician's recommendation. Both farmers and rural extension workers were willing to continue with IPM practices for beans, regardless of whether they had participated in one or more crops, and three of the seven farmers intend to expand IPM to other crops besides beans, particularly soybean. This indicates that just one crop with IPM can be
enough to raise farmer awareness of the benefits of this management. The experience with the IPM program indicated that when farmers and IPM professionals were trained and gained more information about the benefits of IPM, improves the adoption of MIP (BUENO et al., 2021).

4 CONCLUSIONS

The results of the interviews back up farmers' and rural extensionists' views on the importance of lowering costs in the practice. After the experience, all of the farmers who took part in the study plan to continue using IPM in bean cultivation.

Even those farmers and rural extensionists who had an unfavorable opinion of the IPM before the experiment, present favorable discourses and unanimity in the categorization of ends against material success as a justification for adopting the IPM, according to the analysis of the intensity of discourses in relation to the IPM before and after the experiment.

Farmers, rather than rural extension workers, perceive a lack of knowledge, information, and training about the sampling technique as a source of difficulty in applying the IPM, as well as increased work and harassment from agrochemical sellers.

Despite being a multi-case study, there was a limitation of the research regarding the number of productive units contained in the interviews, which is justifiable as the study is based on the units participating in the program. Given the relevance of the topic, a future one can contemplate a greater number than the 20% of the participants, in addition to the need to expand the program.

The study makes it possible to compare the perceptions of farmers and rural extension professionals for adherence, as well as difficulties and potential of the IPM after the experience of the agents involved.

ACKNOWLEDGMENTS

To the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), for granting a doctoral scholarship to the first author. We also thank the collaborating farmers and researchers and the Technical Assistance and Rural Extension team of the Instituto de Desenvolvimento Rural do Paraná - IAPAR - EMATER, for their support and collaboration with the research, in addition to the professors at the State University of Londrina (UEL).
DECLARATION OF CONFLICT OF INTEREST

We have no conflict of interest to declare.

AUTHORS’ CONTRIBUTIONS

All authors contributed equally for the conception and writing of the manuscript. All authors critically revised the manuscript and approved of the final version.
REFERENCES


