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Strategies to Support Adoption of Integrated Pest Management (IPM)

Evidence from the Rainforest Alliance and Industry Experts

The Rainforest Alliance is creating a more sustainable world by using social and market forces to protect nature and improve the lives of farmers and forest communities.

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EXECUTIVE SUMMARY

Excessive use and misuse of pesticides is a well-known driver of global biodiversity loss and has negative impacts on human health. To support sustainable, regenerative farming, the Rainforest Alliance calls on farmers in our certification program to adopt Integrated Pest Management (IPM), which involves different cultural and biological practices to monitor and control pests, while minimizing the use of pesticides.

While the benefits of IPM are well established, there is a need to understand which strategies facilitate IPM uptake. Further, supply chain actors—including companies—need to better understand what they can do to support these strategies. This paper draws on research from the Rainforest Alliance and industry experts to investigate such strategies at the farm and market level, and in the enabling policy environment. These interventions are analyzed in order to derive actionable recommendations for supporting IPM and transitioning away from reliance on harmful pesticides.

- Farm-level strategies include access to training and critical information on pesticide alternatives, and support for farmers in implementing IPM solutions.
- Market-level strategies include economic support for IPM, lowering the cost of alternatives to traditional pesticides, and incentives for farmers to reduce their pesticide use.
- Policy-level strategies include bans on hazardous pesticides, limiting the influence of agrochemical companies, and promoting policies that facilitate IPM and reduce pesticide use.

Research shows that many of these strategies are effective but that their impact is boosted when implemented in parallel. To maximize the impact of these strategies on the ground, farm- and market-level interventions must be facilitated by an enabling policy environment and supported by all actors in the supply chain.

A Ugandan farmer displays a coffee cherry damaged by coffee borer beetles. Photo by Giuseppe Cipriani

INTRODUCTION: THE IMPORTANCE OF IPM AND SAFE AGROCHEMICAL MANAGEMENT

An estimated 20-40 percent of global crop production is lost to pests[i] each year, at a cost of roughly US$290 billion.[1, 2] To combat yield losses, farmers frequently turn to pesticides[ii] to protect their crops. However, pesticides are often misused and overused, and many are classified as Highly Hazardous Pesticides (HHPs) that pose serious threats to environmental and human health.

As part of our work to drive sustainable and holistic farming, the Rainforest Alliance calls on farmers in our certification program to adopt IPM and to implement safe agrochemical use and handling practices. IPM is an ecosystem approach to crop production and protection that combines different management strategies and practices to grow healthy crops while minimizing the use of pesticides. Because it can boost resilience and fortify ecosystems against climate-induced changes in pest populations, IPM is a critical component of climate-smart agriculture. IPM also plays an important role in regenerative agriculture as reduced pesticide use promotes soil health and supports biodiversity.

In IPM, pesticides are only used as a last resort, after other options for preventing and controlling pests have been exhausted. Where agrochemicals must be used, farmers should select the least toxic options and apply them only when necessary, with risk mitigation measures in place to protect human and environmental health.

i Includes insects, weeds, and microorganisms that cause disease

ii Insecticides, herbicides, and fungicides

SIDEBAR

Definition of IPM from the Food and Agriculture Organization (FAO)

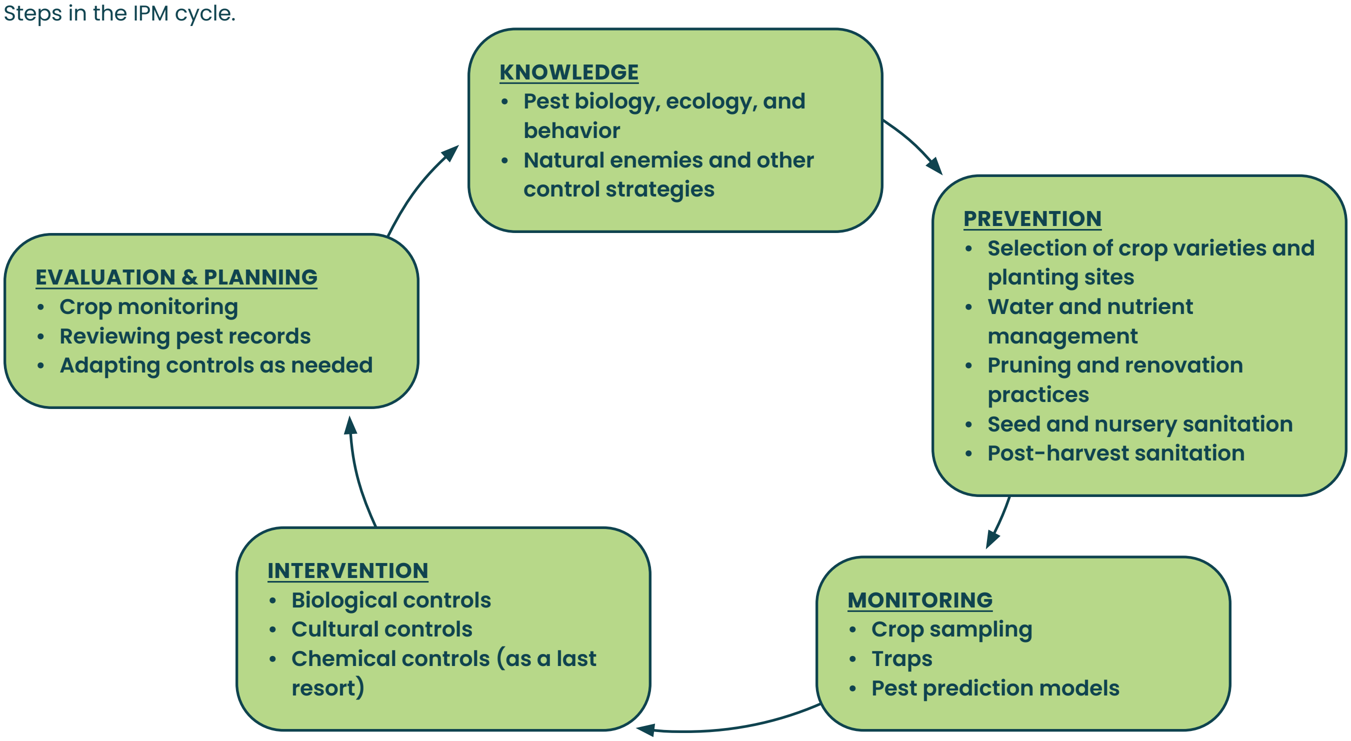
"The careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment."[114]

Requirements in the 2020 Rainforest Alliance Sustainable Agriculture Standard support IPM and safe agrochemical practices; These include guidelines for implementing IPM, complemented by training and other resources, as well as criteria on safe agrochemical storage, record keeping, handling, application, and disposal.

Evidence on the success of IPM is clear: Adopting IPM practices leads to reductions in pesticide use, with positive impacts on farmer livelihoods and environmental integrity.[3] Studies from across the globe show that training and support programs for IPM have enabled farmers to reduce their pesticide use by as much as 92 percent, while maintaining or improving yields.[4, 5, 6, 7, 8, 9] These reductions in pesticide use are associated with large cost savings,[10, 11] improvements in worker health,[12,13] and increased ecological resilience, with massive benefits for farmers.[14, 15]

FIGURE 1

Steps in the IPM cycle.



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Examples of IPM and Safe Agrochemical Practices[115, 116]

Examples of IPM practices

- Removal of infected cocoa pods and husks to control the spread of black pod disease (*Phytophthora megakarya*)
- Treatment of coffee plots with *Beauveria bassiana* spray as biological control for coffee berry borer (*Hypothenemus hampei*)
- Use of coffee cultivars that are resistant to coffee leaf rust (*Hemileia vastatrix*)
- Weekly sanitary defoliation to prevent accumulation of necrotic tissue caused by black sigatoka (*Mycosphaerella fijiensis*) in banana plantations

Examples of safe agrochemical practices

- Pesticides are clearly labeled and used according to the label instructions
- Pesticides are stored in a designated space that is well-ventilated, and inaccessible to children, animals, and unauthorized people
- Appropriate personal protective equipment (PPE) is used when handling pesticides
- Pesticide handlers are trained in application practices that minimize spray drift and optimize pesticide efficacy

However, IPM is knowledge-intensive, and implementation can be challenging and expensive. Research shows that when training, funding, and other support is removed, pesticide use by farmers rebounds.[16] To be successful, practices at the farm level must be supported by market-level strategies, company commitments, and government policies that promote IPM, discourage unnecessary pesticide use, reduce aggressive marketing by the agrochemical industry, and support the development of biological pesticides.

This report explores the effectiveness of such strategies, drawing on years of research and experience from the Rainforest Alliance and third parties. Although mainly focused on coffee, cocoa, tea, and bananas, the report includes evidence from other sectors where appropriate. In addition to investigating the impact of farm-level, market-level, and policy strategies on adoption of IPM and safe agrochemical practices, we include recommendations for companies to support uptake of these strategies, recognizing that enhancing agricultural sustainability must be a joint effort between farming communities, companies, and governments.

A farmer works with wasps for natural pest control on the Finca Buenos Aires coffee farm in Guatemala.

WHAT STRATEGIES SUPPORT IPM AND SAFE AGROCHEMICAL PRACTICES?

Research shows that many strategies at the farm, market, and government level are effective in supporting farmers to successfully adopt IPM and safe agrochemical practices. Certification through voluntary sustainability standards including Rainforest Alliance plays a role in encouraging IPM and safe agrochemical practices, through standard requirements, guidance, training, and other resources; results from research on the impact of these programs are included in the sections below. However, we recognize that certification is not a silver bullet and to maximize its impact, this intervention must be combined with other farm- and market-level strategies and supported by an enabling policy environment.

Farm-Level Strategies

Training and Farmer Field Schools

Integrated pest management requires farmers to fully understand their agroecosystem, including the crop physiology, climate conditions, life cycles and behavior of pests and their natural enemies, and control methods. If pesticides are to be used, farmers must also be knowledgeable about appropriate active ingredients, safe storage practices, application techniques, and associated mitigation measures to minimize potential impacts on humans and the environment. Training and access to technical support are therefore known to be important for proper implementation of IPM and safe agrochemical practices. In fact, insufficient training and support to farmers was cited as the top obstacle to IPM adoption in a 2014 survey of IPM professionals and practitioners from 96 countries.[17]

Multiple studies, across sectors and regions, find that training and knowledge on IPM are among the most critical predictors of IPM adoption.[18, 19, 20, 21, 22] Similarly, research on Rainforest Alliance farms and beyond shows that training on agrochemical management is associated with greater adoption of safe

"At first, there were problems with encouraging workers to use safety equipment [personal protective equipment] … There was a lack of awareness, and many workers did not see the value … But the more workers learned, the more they started to understand the benefits."

— Coffee Farmer in Nicaragua

pesticide storage and handling practices.[23, 24, 25, 26, 27] On Rainforest Alliance Certified coffee, cocoa, and banana farms, for example, training is associated with improvements in proper handling of diseased plant material, greater use of biological and cultural control, better recordkeeping on pesticide use, and safer agrochemical storage, handling, and application practices.[28, 29, 30, 31, 32, 33]

Not only does training support practice adoption, but evidence also shows that knowledgeable implementation of these practices improves their impact. For example, a long-term review of FAO Farmer Field School (FFS) initiatives for IPM in Asia shows that farmers who participated in FFS were able to reduce their pesticide use (by up to 92 percent) while simultaneously increasing their yields (by up to 25 percent).[34] However, FFS and other intensive training programs are costly, and the presence of supporting policies and funding are key—research shows that when this support is removed, pesticide use increases.[35]

These findings emphasize the important role of sustained extension programs, training, and other knowledge-sharing resources in promoting IPM and proper agrochemical management. In addition to training, farmers must have access to appropriate technologies and resources that allow them to continuously experiment with IPM to improve their strategies, facilitating an adaptive approach to pest management. Further, to be accessible and relevant for farmers, training and technical advising must take farmer constraints into account, be delivered by unbiased sources, and be tailored to different cultures and agroecological conditions.[36]

FIGURE 2

Examples of tools, technologies, and other solutions for Integrated Pest Management.[117]

- **Biological control agents and beneficial insects**
- **Pest-resistant crop varieties**
- **Early warning and forecast systems**
- **Crop monitoring technologies**
- **Soil tests**
- **Pest/disease identification**
- **Irrigation systems**

Access to IPM Solutions

IPM is not a set approach but instead a flexible process that needs to be contextualized to different producers' conditions, taking local pest pressures, weather conditions, and other factors into account. As a result, producers must have access to information, tools, technologies, and other resources that allow them to trial different pest prevention and control approaches.

Many IPM solutions are effective at preventing pest infestations, although these practices often require training or expert advising, and can be costly to implement. For example, in the coffee sector, use of resistant coffee cultivars is one of the most widespread methods of managing coffee leaf rust (caused by *Hemiliea vastatrix*).[37, 38, 39] However, many cultivars originally bred for resistance are losing their ability to fight rust infections due to increasing virulence, emphasizing the need for continuous reevaluation of resistant breeds and development of new ones.[40] This type of research and development is costly, as is the process of replanting plots with improved varieties.

Early warning and forecasting systems are another solution that can be deployed at the farm level to prevent pest outbreaks, but they require expert input to develop and set up. These systems support decision making by alerting farmers when pest outbreaks are imminent, so that pesticide applications in the absence of an outbreak can be avoided. Use of remote sensing technologies to detect early outbreaks of coffee leaf rust can be as accurate as human observation, reducing the need for—and cost of—monitoring labor.[41] Similarly, forecast models based on meteorological data have been shown to be very accurate in predicting outbreaks of black pod disease (caused by *Phytophthora* spp.) on cocoa farms in Nigeria.[42] On banana plantations, soil analyses can be used to detect likely outbreaks of Panama disease (caused by *Fusarium oxysporum*) based on bacterial and fungal communities present in the soil.[43]

Despite the benefits of IPM solutions, many farmers face barriers in accessing these resources. For one, smallholders need access to scale-appropriate IPM solutions. Often, farmers are given a discount on bulk purchases of inputs such as traps or biological control agents, which exceed the needs of small farm owners.[44] Further, small-scale farmers often lack the negotiating power needed to obtain discounts on purchases, unless they are members of groups or cooperatives.[45] Other solutions, such as pest-resistant plant cultivars, remote sensing, and biological control agents, can be prohibitively expensive in the absence of subsidies from the government or private sector. Moreover, while accessing these IPM resources can be difficult, agrochemicals are often easy to obtain due to subsidies, widespread marketing, and the powerful presence of the agrochemical industry, providing smallholder farmers little incentive to choose IPM.

Market-Level Strategies

When asked to identify the obstacles to IPM adoption, farmers and industry experts generally point to affordability.[46, 47, 48] The upfront costs associated with IPM—mainly equipment, inputs, and costs of labor—make initiating IPM difficult. Exacerbating the issue is the availability of cheap pesticides.[49] While IPM can reduce costs of production and increase income in the long-term,[50, 51, 52] farmers need direct support to overcome the financial barriers to adopting and maintaining IPM. This section investigates the market-level strategies that increase the accessibility of IPM.

Improving Farmers' Economic Outlook

For farmers to voluntarily adopt IPM practices, they must perceive a benefit in doing so. A study in Uganda found that expectation of benefits was one of the main determinants of IPM adoption, along with labor availability, resource requirements, and access to off-farm income.[53] Certain farm-level practices can make IPM more affordable, and in fact, IPM implementation itself can lower production costs for farmers since curbing the use of pesticides directly impacts production costs.

For example, a review of FAO-run Farmer Field Schools in Southeast Asia found that in some cases, farmers who switched to IPM experienced an average savings of US$40 per hectare from reducing pesticide use, in addition to costs avoided in environmental damage and human health impacts.[54] A separate study of 85 IPM programs across 24 countries in Asia and Africa found that yields increased by 40.9 percent while pesticide use declined 30.7 percent.[55] This combination of improved yields and costs saved through IPM can put farmers in a profitable position, which is particularly important as the costs of inputs continue to rise.

Further, both on- and off-farm diversification can support IPM. Enhancing on-farm biodiversity through activities such as cover cropping and intercropping is integral to IPM—not only because it can provide ecosystem services necessary for pest control, but because the production of alternative crops can also create an additional source of income for farmers.[56, 57] Income earned through off-farm diversification, on the other hand, can help fund IPM activities, although diverting labor to off-farm ventures can exacerbate already limited labor availability.[58]

While evidence shows that IPM can be profitable, assisting farmers in overcoming the upfront costs of IPM inputs and labor—and supporting farmers through any short-term impacts on productivity—are critical to persuading farmers to adopt IPM.

Lowering IPM Costs Through Credit

For many farmers, access to credit is a key driver of IPM adoption. Vietnamese tea farmers, for example, were more likely to convert from conventional to organic farming when they had access to credit.[59] Similarly, Rainforest Alliance certified cocoa farmers in Ghana had better access to credit than non-certified farmers, which in turn contributed to higher yields and better implementation of good farming practices on certified farms.[60]

While credit can enable farmers to afford otherwise expensive inputs, many credit programs have strict prerequisites, high interest rates, and repayment structures that present a significant barrier to farmers.[61, 62] Moreover, female farmers often face discrimination from credit institutions, and debt incurred from taking on credit can increase farmer vulnerability.[63, 64] Rectifying these barriers to credit access is therefore critical to improving uptake of sustainable agricultural practices such as IPM.

Rainforest Alliance research shows that while certified farms tend to have relatively high access to financial resources such as credit, costs of inputs and labor remain significant constraints for IPM.[65] Therefore, while credit may increase the accessibility of IPM practices, farmers need to be rewarded for IPM practices to ensure continuous implementation and improvement.

Rewarding Farmers for Good Performance

For many farmers, the incentive to switch to IPM is driven by the opportunity to gain a premium for their crops on the market. One study found that Vietnamese tea farmers were 90 percent more likely to pursue organic practices when the promise of a premium 20 percent above market prices was provided.[66] Similarly, a combination of subsidies and premiums proved to be an effective tool in increasing organic adoption among Spanish farmers.[67] Research also shows that Rainforest Alliance certified farmers employ more IPM practices and use significantly less pesticide than non-certified farms.[68, 69, 70] In many cases, premiums awarded through certification increase willingness to adopt IPM practices.[71]

Nonetheless, the role of premiums in encouraging IPM adoption is limited. Often, yields—rather than premiums—are the primary determinant of farmer income.[72] Therefore, farmers may be hesitant to transition to IPM if they perceive a potential trade-off between their yields and environmental outcomes.[73] While research shows that organic and low input farming can be as productive as conventional farming,[74, 75, 76]

SIDEBAR

Exploring Alternative Market Incentives: Payment for Ecosystem Services

A potential tool for incentivizing sustainable agriculture is payment for ecosystem services (PES). PES programs identify a particular ecosystem service or set of services—e.g. carbon capture by soil, water purification and erosion control from watersheds—that are vulnerable or at risk of destruction. A voluntary, contractual agreement is established between beneficiaries and service providers whereby service providers (i.e., farmers) are paid to implement practices that protect and/or enhance the ecosystem service in question. PES programs can be run by private entities, government agencies, and as public-private partnerships.

concern about yield losses underlines the importance of designing premium programs that reward good environmental practices which are competitive and can compensate farmers for potential losses.[77, 78, 79]

Enabling Policy Environment

Fostering an enabling policy environment—wherein farmers and supply chain actors have access to the institutional support they need, backed by policies that enable "agricultural innovation" and good agricultural practices[80]—is essential to addressing the barriers to IPM adoption. While research into the impact of policy instruments aimed at reducing pesticide use is limited, we do know that the most effective measures are ones that combine a variety of approaches such as regulation, economic incentives, and communal instruments.[81]

Public and Private Standards: Food and Safety Regulations

Food and safety regulations, such as agrochemical bans and Maximum Residue Limits (MRLs), set by both private labels and public institutions could serve as a vehicle for promoting IPM. Evidence from Europe suggests that a combination of pesticide limits coupled with other regulatory and economic tools—such as subsidies—have proven effective in reducing domestic use of pesticides.[82] However, research into the impact of food safety and pesticide standards set by importing countries on pesticide use in producing countries is unfortunately limited.

In one study, researchers examining pesticide standards set by the European Union—which stipulate pesticide limitations and require buyers to provide training to farmers—observed improved adoption of IPM practices and PPE use among green bean farmers in Kenya.[83] However, the study did not find a reduction in the quantity of pesticides used. A separate research effort in Kenya also found that adoption of international standards did not result in lower pesticide use, although the pesticides used by farmers in this study were compliant with WHO safety standards.[84] This finding illustrates that there are environmental and health benefits—such as reduced human exposure to hazardous chemicals—to be gained from complying with international standards. Similarly, research shows significant reductions in pesticide-related deaths in countries where certain classes of hazardous pesticides have been banned, such as Bangladesh and South Korea.[85, 86]

Research from Thailand, on the other hand, suggests that efforts to align domestic regulations with those of importing countries has not significantly altered pesticide use practices among farmers.[87] Across these studies, adoption of international pesticide standards was hindered by lack of farmer knowledge, insufficient auditing, and inadequate technical and financial support provided to farmers.[88, 89] To ensure compliance, public and private food and safety standards need to be matched with institutional support, and bolstered by policies that are aligned with IPM and safe agrochemical practices.

Limiting the Influence of the Agrochemical Industry on Farmer Behavior

Lobbying, marketing, and agrochemical industry influence constitute major barriers to IPM adoption globally.[90] Research shows that IPM adoption lags in settings where trainers and agronomic experts are paid by the agrochemical industry, where farmers rely on chemical suppliers for loans, and where agrochemical sellers are the main source of pest-control advice and inputs.[91] In these settings, the agrochemical industry plays an outsized role in affecting farmers' agrochemical choices and practices.

Tea pluckers in the Assam region of India, where Rainforest Alliance staff lead Integrated Pest Management trainings. Photo by Suvashis Mullick

Interactions and financial arrangements between farmers and pesticide sellers promote and sustain pesticide use, dictating which brands and chemicals are used in the field and how often pesticides are applied.[92] Sellers often live in the same villages as farmers, are easily accessible, and are knowledgeable about local pest issues. Sellers are also known to offer credit or discounts to farmers who agree to host pesticide demonstrations on their farms,[93] and to promote pesticide purchases with incentives including cash rewards and lottery tickets.[94] These marketing activities ingrain pesticide use within communities.

Other research shows that pesticide companies have a history of promoting highly hazardous pesticides such as neonicotinoids and paraquat, against the recommendations of independent research and global conventions.[95] In addition, pesticide companies have been known to stoke farmers' fears about crop and quality losses caused by pests through media and advertising outlets to drive sales.[96]

These activities by pesticide companies ultimately influence farmers' behavior and pose a major barrier to IPM uptake: A survey of IPM practitioners from 96 countries revealed that the powerful influence of the pesticide industry was a major barrier to widespread IPM adoption, along with a lack of favorable government policies.[97] Research also shows that the effectiveness of the industry's marketing and lobbying efforts is closely tied to the presence and strength of pesticide policy,[98] emphasizing the importance of ensuring that public and private sector policies are aligned in incentivizing IPM adoption and do not subsidize or promote overuse of chemicals. Governments, together with supply chain companies, have a responsibility to keep unsafe and outdated products off the market and ensure that viable alternatives are available. Further, public-private partnerships should be developed to support policies and processes that help farmers transition away from reliance on harmful agrochemicals.

Advancing Policies and Programs that Promote IPM and Reduced Pesticide Use

Adoption of IPM within a region is highly dependent on the prevailing policy attitude around pest control. Policies within developing economies are often positioned to boost yields and increase competitiveness by promoting and subsidizing chemical inputs.[99, 100] However, pesticide subsidies can encourage farmers to overapply agrochemicals and can lower the relative profitability and effectiveness of IPM. Simply phasing out agrochemical subsidies is not sufficient: In Indonesia, years of successful IPM promotion—achieved through cancelling pesticide subsidies and creating Farmer Field Schools—was undone following the loss of funding, de-regulation of pesticide prices, and aggressive marketing campaigns by pesticide manufacturers.[101, 102] To increase IPM adoption, agrochemical subsidies need to be repurposed to support IPM strategies and uptake.

In countries where use of agrochemicals is very high, IPM adoption is hampered by reliance on pesticides and ingrained policies that favor pesticide use. In Brazil, for example, which is the world's leading importer of agrochemicals, an "import-acceleration" policy is in place to speed up the registration process for new chemicals.[103] This policy, supported by a powerful pesticide lobby, has made it easier for agrochemical importers to bring chemicals to market and has led to the proliferation of toxic pesticides: In 2019, almost 500 new pesticides were approved, a third of which contain active ingredients that are banned or severely restricted in Europe.[104] Conversely, pesticide registration policies can also pose a barrier to IPM adoption by restricting the availability of less toxic chemicals, as observed in Costa Rica.[105]

SIDEBAR

Farmer Field School Model in Indonesia

In Indonesia, the government's National IPM Program, which introduced the Farmer Field School (FFS) model, was very successful at promoting widescale adoption of IPM. Extensive evidence shows that this program enabled rice farmers to drastically reduce pesticide use and lower their production costs while increasing yields. However, when the program terminated, pesticide producers and traders renewed an aggressive marketing campaign, which led to a resurgence in pesticide use. This finding emphasizes the importance of continuous government support and funding for sustainable agriculture.[118, 119]

Examples from other regions show how government policies that support low-input agriculture can result in successful adoption of sustainable agriculture practices, including IPM. In Cuba, the government has promoted a low-input agriculture model since the late 1980s, based on intensive crop monitoring, accurate diagnosis of pests, development of disease-resistant cultivars and biological control agents, and a focus on improving soil quality and fertility.[106] Development of biological control has been central to this approach, supported through government-run research plots and labs that develop biological control agents, and has successfully controlled many agricultural pests.[107]

Even in regions where pesticide use is high, policy advances can combat overuse of chemicals. A recent policy in Brazil—launched in response to calls for lower-impact pest control solutions—aims to stimulate use of biobased agricultural inputs.[108, 109] Through the "Bio-input Program", the government is manufacturing and disseminating biological inputs including growth promoters, biofertilizers, and pest control agents, to reduce dependence on imported chemicals and support more sustainable pest control practices.[110, 111] Uptake of biological inputs has already been accelerating as a result: Between 2019-2020, use of bio-based inputs increased 23 percent in Brazil, to a total of 50 million hectares treated with biological products.[112]

These examples suggest that policies to stimulate adoption of less toxic and lower-input agriculture models can be successful, especially if the influence of agrochemical industry is curtailed. Agrochemical subsidies should be replaced

Checking a pest trap at the School for Field Studies, an educational farm growing mangoes and oranges in Costa Rica.

with incentives and forms of income support that encourage farmers to adopt IPM and other sustainable agriculture practices. In addition, government policies must align with current knowledge and international standards to ban import and sales of highly hazardous pesticides. Supporting policies, such as funding for research, extension services, and training also encourage adoption of low-input agriculture.

RECOMMENDATIONS

The recommendations below provide information for companies wishing to support strategies for IPM implementation and safe pesticide use. In addition, companies can pursue Rainforest Alliance certification, or work with other supply chain sustainability programs that stipulate requirements for IPM and safe pesticide use, providing a simple solution for companies seeking to align their sourcing with best practices at the farm, market, and policy level.

At the farm level:

- **Boost the reach and effectiveness of contextualized IPM training** through developing the capacity of technical experts who interact with farmers, and carrying out monitoring and evaluation of training programs to assess challenges and conditions for success. Companies can also align with certification programs such as the Rainforest Alliance, which offer IPM trainings and company-specific tailored solutions.

- **Support IPM research and development** through grants and funding programs. This could include research on resistant cultivars and biological control agents; development of new technologies such as drone monitoring, remote forecasting, and pest identification through DNA barcoding; funding for pilot testing of emerging best practices, and more.

At the market level:

- **Adopt public supply chain commitments** that require IPM implementation and safe pesticide use by farmers and groups. In support of this approach, research shows that consumers are willing to pay more for agrochemical-free products.[113] To ensure compliance, commitments should be supported by monitoring, evaluation, and due diligence efforts.[iii]

- **Align with existing certification programs** and other sustainability initiatives, which often include best practices related to safe pesticide use and IPM, including training, payment of premiums, and support for farmers in reducing their pesticide use.

- **Contribute to shared responsibility in IPM implementation** through providing financial incentives or in-kind payments (such as rust-resistant seedlings, insect traps, and biological control agents) to farmers seeking to transition to low-input systems. This support can help buffer farmers from any short-term volatility in yields and income that may result from adopting IPM.[iv]

At the policy level:

- **Elevate IPM on government agendas** by voicing support for policies that prioritize IPM and biopesticides, regulate pesticide sales and use, and ban highly hazardous pesticides. Companies should use their voice and influence to help level the playing field between agrochemical companies and the interests of producers.

- **Establish public-private partnerships** to collect and disseminate critical information on pesticide use, risks, and IPM, by funding databases and other information services. Access to information on alternatives is essential to helping farmers reduce their pesticide use.

- **Support taxes and subsidies** that are aligned with reducing pesticide use and facilitate use of alternatives such as IPM. To be most effective, pesticide taxes should be coupled with policies and subsidies that support IPM and regenerative agriculture so that farmers' costs do not increase.

iii The biodiversity commitments made by Nespresso and corresponding communication serve as good examples of how companies can monitor their activities and effectively share their progress towards IPM. See https://nestle-nespresso.com/sites/site.prod.nestle-nespresso.com/files/Nespresso%20and%20Biodiversity_2021_1.pdf

iv The Nescafe Plan offers an example of how companies can benefit from work with local agronomists to distribute tools such as healthy coffee plantlets. See https://www.nestle.com/stories/nestle-breakthrough-coffee-breeding-low-carbon-drought-resistant-varieties

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