Plant clinics in Asia: reducing the use and risks of pesticides

Frances Williams, Heng Chhun Hy, Witchuda Rattanakarn, Chalermchart Luechaikarm, Chairat Channoo, Kyin Kyin Win, Pham Thi Xuân, Tran Danh Suu, Su Li Khing, Muhammad Faheem, Annamalia Sivapragasam, Malvika Chaudhary, Irshad Ali, Hong Twu Chan, Fook Wing Chan and Shah Faisal

Summary

One of the key aims of the Plantwise programme, led by CABI, is to reduce pesticide misuse. Through plant clinics, farmers are provided with a range of Integrated Pest Management (IPM) options by plant doctors who emphasise pest monitoring and prevention options before direct control measures. Country surveys carried out in Cambodia, Myanmar, Thailand and Vietnam in 2017 revealed that, after attending plant clinics, both men and women farmers had reduced the frequency of pesticide applications on their crops, replaced the most toxic chemicals with safer alternatives, increased the use of non-chemical options to tackle pests and diseases, stopped applying pesticides on the advice of friends and agro-dealers, and reported a dramatic decrease in health problems.

Key highlights

- Farmers have dramatically reduced the number of pesticide applications on their crops. While the number of farmers not spraying at all increased from 2.1% to 19.3% after visiting a plant clinic, the number of farmers who applied pesticides at least three times per crop dropped from 73.6% to 29.55%.

- After receiving advice from plant doctors to stop using the most toxic chemicals, farmers are using safer alternatives.
- With a greater understanding of the health and environmental costs of pesticides, increasing numbers of farmers have switched to non-chemical cultural methods (49.5%, up from 14.75%).
- After visiting a plant clinic, farmers are much less likely to rely on their own experiences or the advice of agro-dealers regarding pesticide use.
- After visiting a plant clinic, farmers reported a dramatic drop (81%) in health problems experienced as a result of pesticides.
- 100% of men and women stated that they were happy with the performance of plant clinics.

Context

Pests and diseases are a major constraint to food security, income generation and world trade. Worldwide, an estimated 70,000 different pest species damage agricultural crops. Global potential losses due to pests has been estimated to vary from about 50% in wheat to more than 80% in cotton production, with weeds producing the highest potential losses overall (34%) compared to animal pests (18%) and pathogens (16%) (Oerke, 2006).

To reduce and prevent crop losses, farmer have increasingly turned to pesticides. Yet despite a significant increase in pesticide use, crop losses have not significantly decreased. About 3 billion tons of pesticides are applied each year across the world, yet pests, insects, weeds and plant pathogens destroy about 40% of all crops, valued at US$2 trillion (Pimentel, 2009). Pesticides are also being over-used and used incorrectly, leading to human health and environmental concerns.

What we did

Working closely with national agricultural advisory services, CABI's global Plantwise programme establishes and supports networks of local plant clinics, run by trained plant doctors, where farmers receive practical plant health advice. Farmers visit the clinic with affected crop samples, and plant doctors help diagnose the problem and provide science-based pest management recommendations and options.

Plant doctors are trained to offer sustainable plant health management advice to farmers, following the principles of Integrated Pest Management (IPM), which involves the use of cultural[1] methods, alongside the targeted use of chemical[2] pesticides and fertilisers when justified. Pesticides are only recommended when there is no other option, and plant doctors ensure that farmers apply the least toxic chemicals[3] making sure the application follows recommended practices and that farmers adhere to safety standards.

To assist plant doctors and other agricultural extension workers and researchers with diagnosis and management options, an array of resources are provided by the CABI Plantwise Knowledge Bank. For example, pest management decision guides[4] support practical IPM implementation through lists of green (cultural) and yellow (chemical pesticide) methods/options. The lists guide plant doctors and other extension staff through the most appropriate pest preventative measures and management options. In some cases, farmers may attend a plant clinic too late to use preventative measures, so the only option for control may then be a pesticide. However, importantly, where pesticides are

[1] Cultural controls are practices aimed at altering conditions, or pest behaviours or pest populations (crop rotation, tillage and field sanitation) that have been scientifically studied and proven to work. These practices are often recommended by local agricultural departments.
[2] As outlined by the Food and Agriculture Organization of the United Nation's 2013 International Code of Conduct on Pesticide Management.
[3] Including pesticides listed as Classes Ia and Ib by the World Health Organization's (WHO) Recommended Classification of Pesticides by Hazard (WHO, 2009).
[4] Plantwise Knowledge Bank: Pest Management Decision Guides https://tinyurl.com/y89m4sez

provided as a potential management option in the Knowledge Bank information resources, all references to internationally-restricted pesticides are avoided.

In Cambodia, Myanmar, Thailand and Vietnam, CABI carried out questionnaires and focus group discussions with farmers using plant clinics to discover whether pesticide use had changed as a result of attending the clinics. A total of 90 farmers (56 men, 34 women) were interviewed, with 35 from Cambodia, 28 from Vietnam, 17 from Myanmar and 10 from Thailand. No tests of statistical significance were carried out due to the small sample size.

What impact was achieved?

Spray applications

Number of applications

Farmers surveyed across all four countries reported a significant change in pesticide application frequency after visiting a plant clinic (Figure 1 and Figure 2). The number of farmers applying the most sprays (at least three applications per crop) reduced from 72.2% to 45.5% for men and 75% to 13.6% for women after attending a plant clinic visit. As a result of farmers reducing the overall number of pesticide applications, the numbers of farmers applying only 1-2 sprays per crop increased from 27.8% to 59.1% of men and 20.8% to 54.5% of women after visiting a plant clinic. The survey also revealed an increase in the number of farmers who did not apply any pesticides, from no men and only 4.2% of women, to 6.8% of men and 31.8% of women. The drop in the frequency of pesticide applications suggests that farmers are more aware that judicious use of pesticide application is beneficial, from both a safety and financial viewpoint, as illustrated in more detail in Figures 1 and 2.

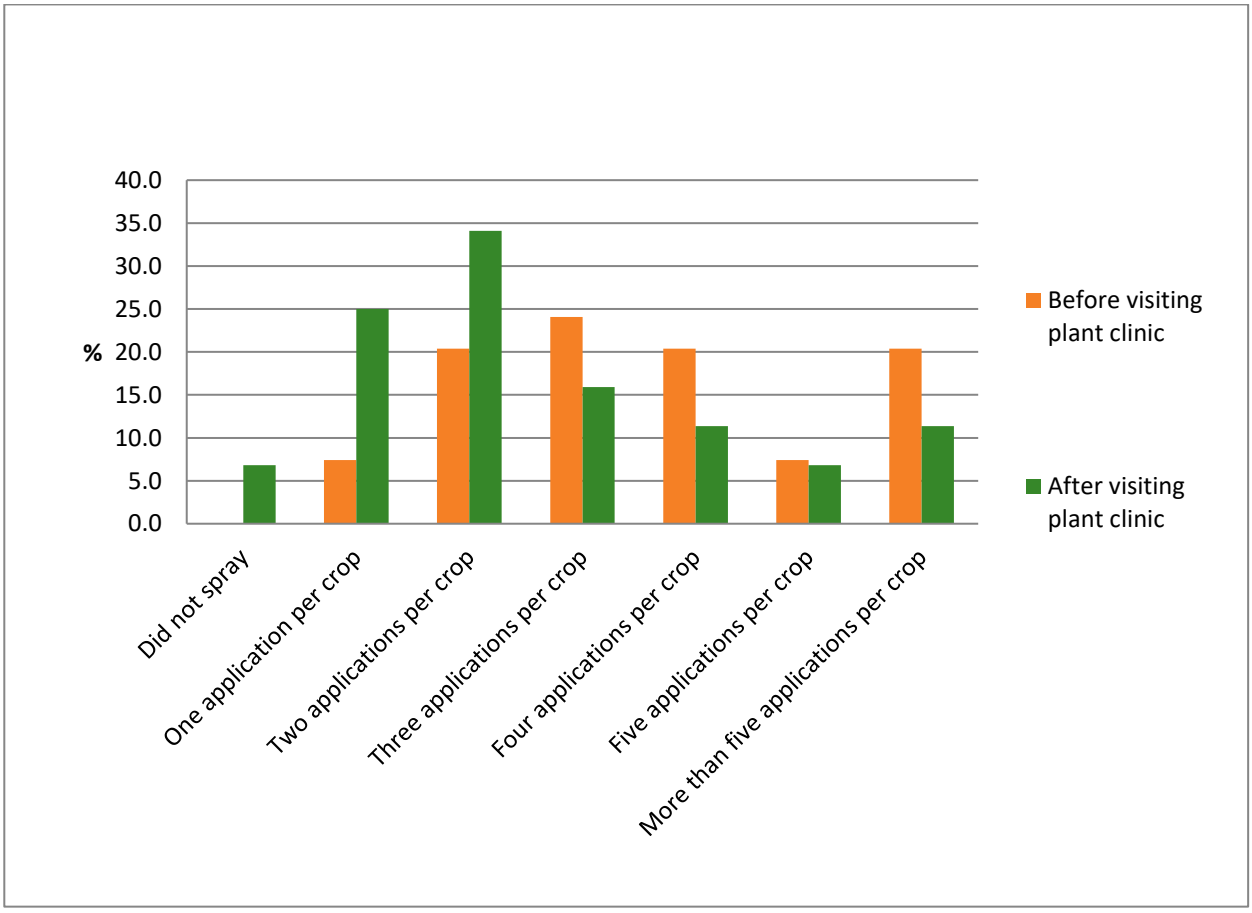

Figure 1: Number of spray applications (men) (n=56)

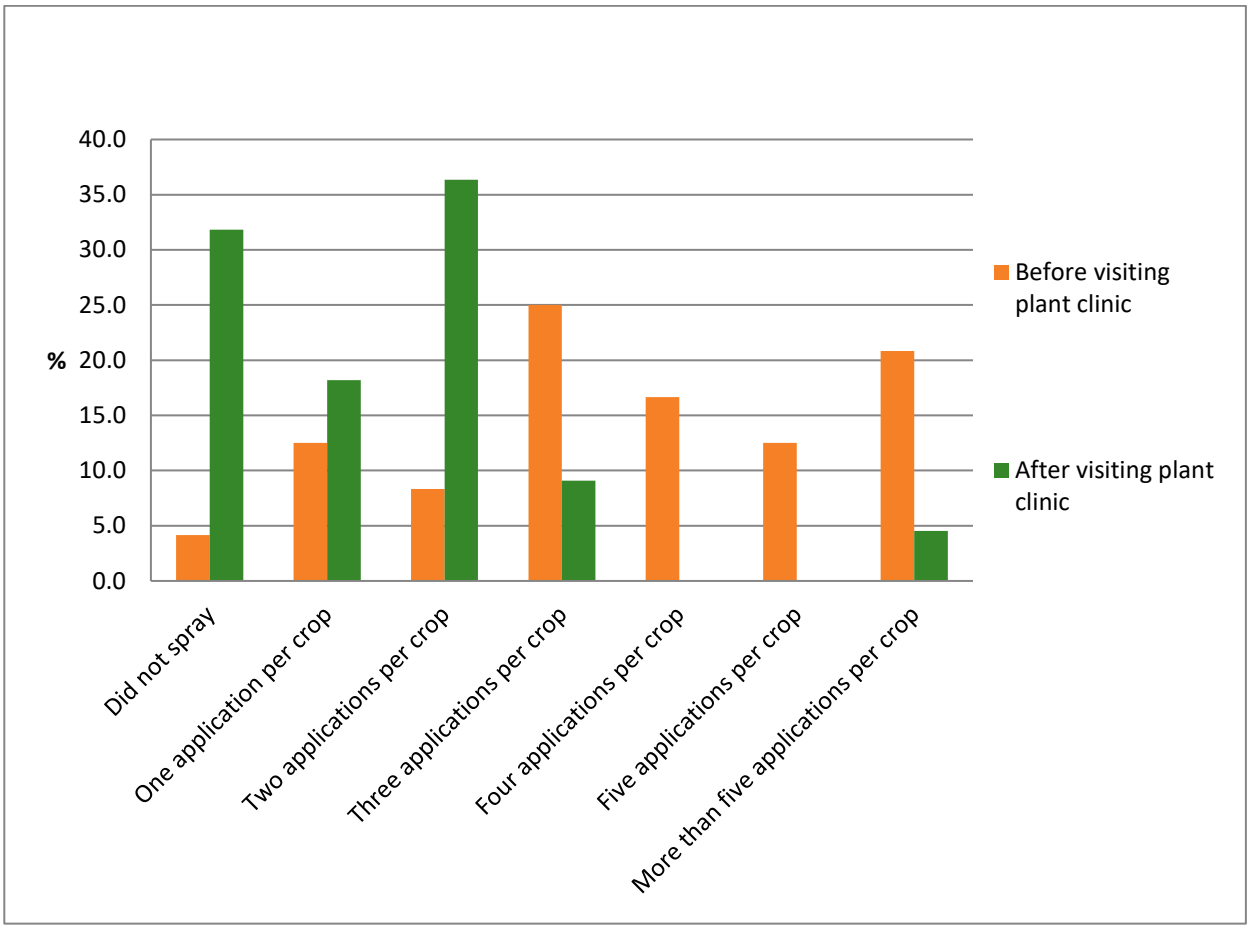

Figure 2: Number of spray applications (women) (n=34)

Spray toxicity

When plant doctors recommend a pesticide, farmers are steered away from chemicals that are banned or restricted by international agreements. Plantwise has a 'Red List' of pesticides based on World Health Organization classification of pesticides by hazard (Classes Ia and Ib: WHO, 2009). This advice has affected farmer behaviour with the surveys suggesting that farmers are cutting the use of the most toxic chemicals and replacing them with safer alternatives.

In Vietnam, the survey found that farmers have stopped using pesticides found on the Plantwise Red List, and instead have begun to use Green and Yellow List chemicals. Agro-dealers interviewed also noticed a marked reduction in use of Red List chemicals. In Cambodia, farmers reported no longer using Amistar Top (active ingredients Azoxystrobin [Toxicity Category U, the lowest toxicity] and Difenoconazole [Toxicity Category II, moderately hazardous]) or Cypermethrin (Toxicity Category II), and instead were using Azoxystrobin (Toxicity Category U).

Pesticide practices

Use of cultural and traditional methods

As plant doctors make farmers aware of the health and environmental costs of using pesticides, increasing numbers of farmers are beginning to adopt non-chemical means of tackling plant pests and diseases (Figures 3 and 4). In the four countries surveyed, the number of male plant clinic users applying cultural practices – such as crop rotation, trap crops, use of mulches, intercropping or tillage practices – increased from 12.5% to 35.7%, while the number of women applying cultural practices increased from 17% to 31.6% after attending a clinic.

While the number of men who applied traditional[5] (non-biological) methods dropped from 11.4% to 4.1% after visiting a plant clinic, the number of women applying traditional methods increased slightly from 7.5% to 10.5%. Although the survey did not specifically ask men or women why they chose a traditional over a cultural practice, women's greater use of traditional practices than men may have been because women are often more limited by money or time.

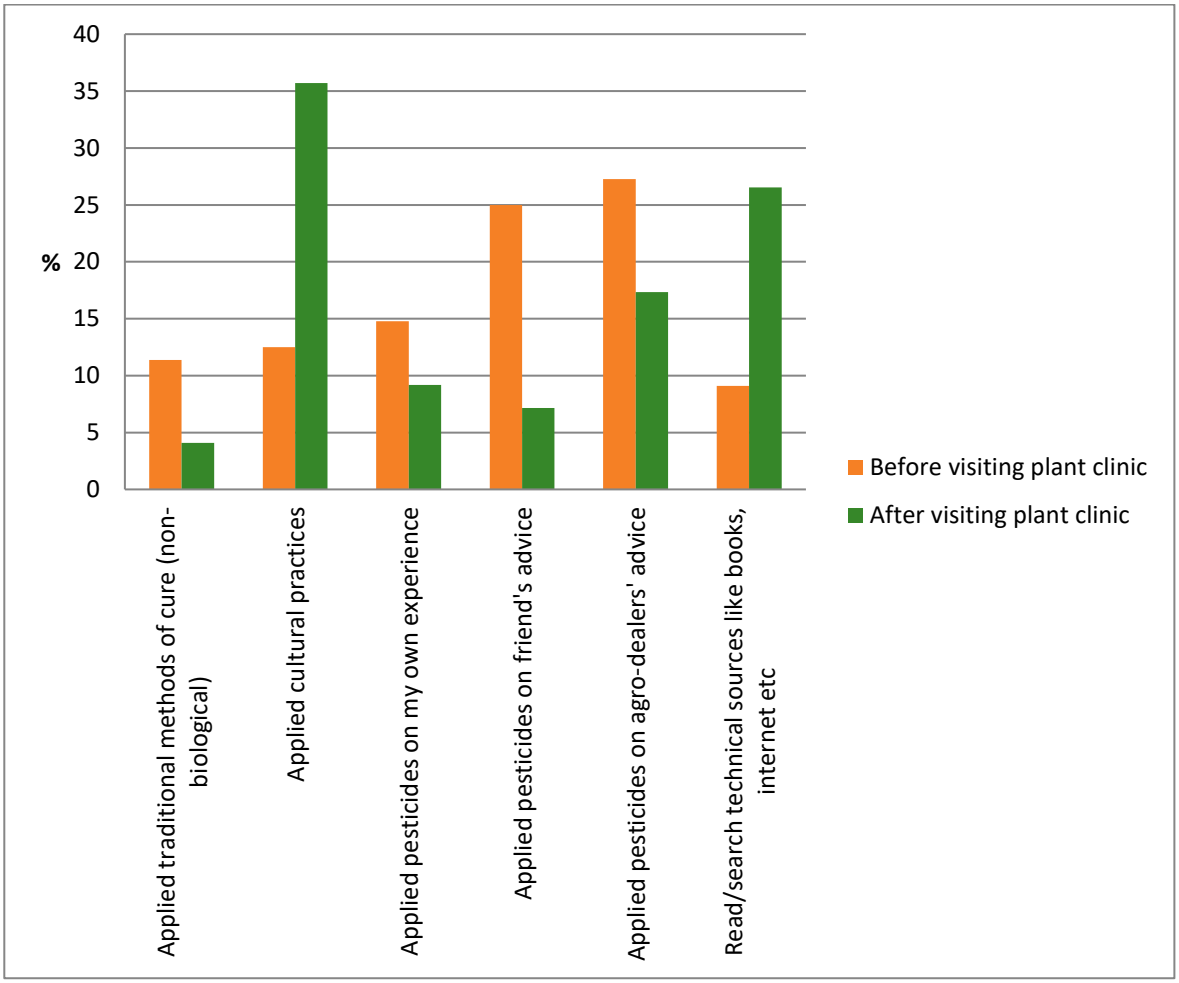

Figure 3: Pesticide practices of men (n=56)

[5] Traditional (non-biological) methods are local practices that have not been studied through research, i.e. spray of diluted milk for fungal disease management, and use of different local herbal extracts.

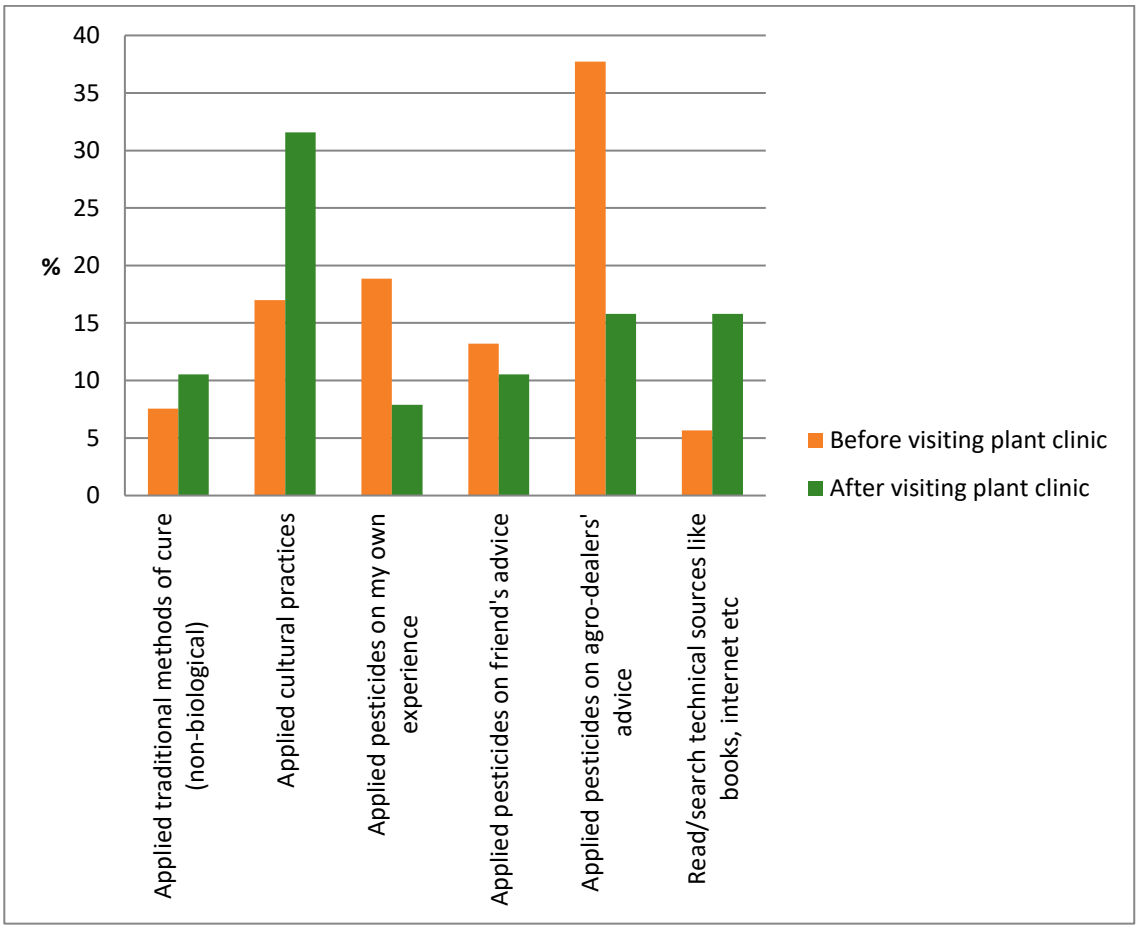

Figure 4: Pesticide practices of women (n=34)

Source of plant health information

The study revealed that farmers regard plant clinics as trusted sources of information (Figures 3 and 4) about pests and diseases, management options and crop cultivation practices. Men and women reported relying less on their own experiences and advice from agro-dealers regarding pesticide use after visiting clinics. The percentage of men who applied pesticides based on their own experiences, dropped from 14.8% to 9.2% after attending a plant clinic, compared to a drop of 18.9% to 7.9% for women. Similar drops were seen for applying pesticides on a friend's advice (25% to 7.1% for men and 13.2% to 10.5% for women) and on an agro-dealer's advice (27.3% to 17.3% for men and 37.7% to 15.8% for women). Increasing numbers of farmers are also searching for information on pesticides from technical sources, including books and the internet.

Health implications

After visiting a plant clinic, the number of farmers reporting health problems as a result of pesticide use dropped dramatically, by 76.6% for men and 85.7% for women. The most common health issues experienced included tiredness, dizziness, headaches, allergies, vomiting, sore eyes and respiratory problems, which indicates that personal protective equipment was not being used properly, or at all, to protect the sprayer from harmful pesticide effects.

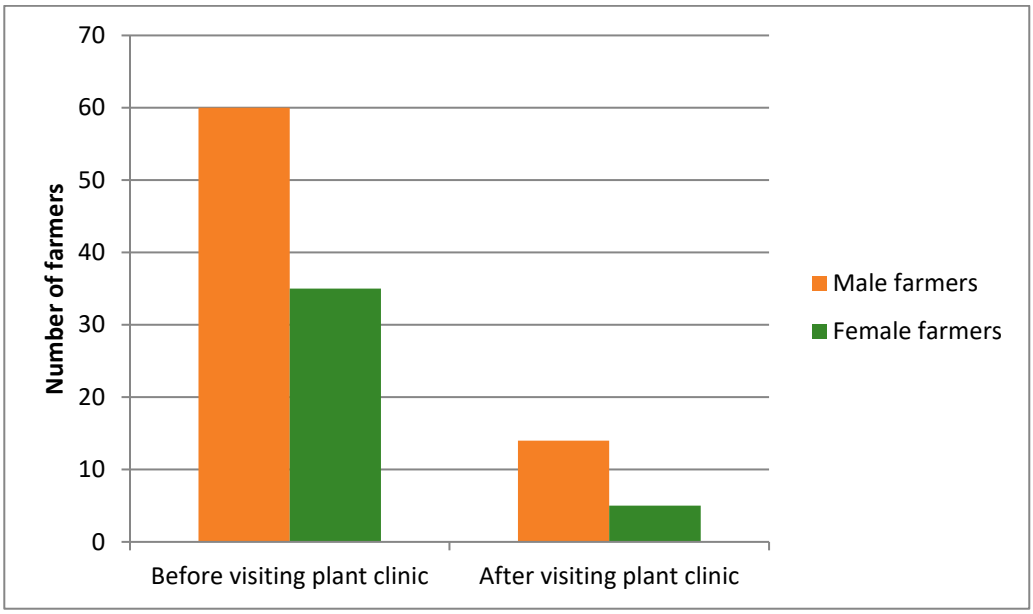

Figure 5: Number of farmers with health problems due to pesticide use (n=90)

Pesticide cost

A drop in the cost of pesticide application per crop was also revealed in Cambodia and Thailand. In Cambodia, 81% of farmers spent more than 10,000 Cambodian riel (US$2.5) on pesticides per crop, compared to 16.6% after they had visited a plant clinic. The numbers of farmers who spent less than 10,000 Cambodian riel increased from 19% to 33.3%. In Thailand, before visiting plant clinics, no one spent less than 100 Baht (US$3) on pesticides, but after visiting clinics 60% spent less than 100 Baht. The reduction in pesticide cost is likely to be a result of the increased use of cultural methods instead of pesticides, as well as the decrease in the number of pesticide sprays per crop. While there was no dramatic rise or fall in cost in Myanmar or Vietnam, it is possible that the decrease in pesticide use was evened out by price increases in pesticides, or by plant doctors recommending safer but more expensive pesticides.

The way forward

Plant clinics have changed farmers' behaviour towards pesticides by providing unbiased, impartial advice and good quality information, and working with local plant health stakeholders, including plant protection staff, extension services, and agro-dealers, to help farmers tackle their crop problems. Across all four countries, farmers indicated that they trust the clinics as an important and reliable information source, and 100% of men and women stated that they were happy with the performance of plant clinics. As well as gaining knowledge about their crops and IPM practices, farmers stated that plant doctors were friendly and knowledgeable and the advice they provided was helpful and easy to understand.

In addition, by attending plant clinics, farmers are being made aware of the health and environmental costs of using pesticides. Although pesticides are still the predominant method used to manage pests and diseases, farmers are reducing the rate and frequency of pesticide application, with farmers increasingly adopting non-chemical measures to prevent and control pest and disease problems. The four country surveys also highlighted a marked reduction in the sale of chemicals on the Plantwise Red List, which proves that not only are plant doctors recommending less toxic alternatives to farmers, but that farmers are following their advice. As a result of using fewer and less-toxic pesticides, farmers have reported dramatic drops in health problems.

For the positive changes in pesticide use to become permanent, or more ingrained into the mindset of farmers, plant doctors need to continue to teach farmers about chemical toxicity, and the safe use of pesticides. Another recommendation from the country studies was to increase the use of ICTs, where

possible. Many farmers wanted to see plant doctors making more use of smartphones to help them solve their crop problems. In Thailand, for example, the government's rice department have created chat groups, linking rice department specialists all over the country to enable them to share information, identify and diagnose pest and disease problems, and exchange knowledge.

Across all four countries, agro-dealers also welcomed the plant clinics stating that they felt the clinics educated their clients and made it easier for them to make sales, particularly of chemicals not found on the Plantwise Red List. Many interviewed dealers suggested that they would be willing to financially support clinic operations if it helped to sustain their business, and going forward they wanted strengthened collaboration between farmers, agro-dealers and plant doctors.

References

CABI. (2014). Plantwise Policy on the Use of Pesticides. CABI, Wallingford. Available at: https://tinyurl.com/y9gjbjef

CABI. (2015). Plantwise Strategy 2015-2020. CABI, Wallingford. Available at: https://tinyurl.com/ybtdvg3x

Hy, H.C., Khing, S.L., Faheem, M., Sivapragasam, A., Chaudhary, M., Ali, I., Chan, H. T., Chan. F.W., Faisal, S. and Hy H.C (2017). Collective Evidence of Outcome and Impact: Role of Plant Clinics in Changing Use of Pesticides. Case Study Report Cambodia. CABI, Wallingford.

Oerke, E.-C. (2006). Crop losses to pests. The Journal of Agricultural Science, 144(1):31-43.

Pimentel, D. (2009). Pesticides and pest control. In: Peshin, R. and Dhawan, A.K. (eds). Integrated Pest Management: Innovation-Development Process. Springer, Dordrecht.

Popp, J., Pető, K. and Nagy, J. (2013). Pesticide productivity and food security. A review. Agronomy for Sustainable Development, 33:243-255.

Rattanakarn, W., Luechaikarm, C., Channoo, C., Faheem, M., Sivapragasam, A., Chaudhary, M., Ali, I., Chan, H. T., Chan. F.W., and Faisal, S. (2017). Collective Evidence of Outcome and Impact: Role of Plant Clinics in Changing Use of Pesticides. Case Study Report Thailand. CABI, Wallingford.

Win, K.K., Faheem, M., Sivapragasam, A., Chaudhary, M., Ali, I., Chan, H. T., Chan. F.W., and Faisal, S. (2017). Collective Evidence of Outcome and Impact: Role of Plant Clinics in Changing Use of Pesticides. Case Study Report Myanmar. CABI, Wallingford.

World Health Organization. (2009). The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009. Wissenchaftliche Verlagsgesellschaft mbH, Stuttgart, Germany.

Xuân, P.T. and Suu T.D., Faheem, M., Sivapragasam, A., Chaudhary, M., Ali, I., Chan, H. T., Chan. F.W., and Faisal, S. (2017). Collective Evidence of Outcome and Impact: Role of Plant Clinics in Changing Use of Pesticides. Case Study Report Vietnam. CABI, Wallingford.

Acknowledgements

CABI is an international intergovernmental organisation, and we gratefully acknowledge the core financial support from our member countries (and lead agencies) including the United Kingdom (Department for International Development), China (Chinese Ministry of Agriculture), Australia (Australian Centre for International Agricultural Research), Canada (Agriculture and Agri-Food Canada), Netherlands (Directorate-General for International Cooperation), and Switzerland (Swiss Agency for Development and Cooperation).

The authors would like to thank the farmers in the four study countries who took the time to share their views and experiences, as well as the plant doctors and plant clinic coordinators.

Project donors

Plantwise is supported by:

Partners

Authors

Frances Williams, CABI Kenya, *Heng Chhun Hy*, Plant Protection, Sanitary and Phytosanitary Dept, Cambodia, *Witchuda Rattanakarn*, Rice Department, Thailand, *Chalermchart Luechaikarm* and *Chairat Channoo*, Rice Station, Suphanburi, Thailand, *Kyin Kyin Win*, Plant Protection Division, Myanmar, *Pham Thi Xuân* and *Tran Danh Suu*, Vietnam Academy of Agricultural Sciences, *Su Li Khing, Muhammad Faheem* and *Annamalia Sivapragasam*, CABI Malaysia, *Malvika Chaudhary*, CABI India, *Irshad Ali,* CABI Pakistan, *Hong Twu Chan* and *Fook Wing Chan*, CABI Malaysia, *Shah Faisal*, CABI Pakistan.

Editorial team

Olivia Frost, WREN*media* (technical writer)

Susanna Cartmell, WREN*media* (technical writer)

How to cite this paper

Williams F., Hy, H.C., Rattanakarn, W., Luechaikarm, C., Channoo, C., Win, K.K., Xuân, P.T., Suu, T.D., Khing, S.L., Faheem, M., Sivapragasam, A., Chaudhary, M., Ali, I., Chan, H.T., Chan, F.W., Faisal, S. 2018. Plant clinics in Asia: reducing the use and risks of pesticides. CABI Study Brief 27. DOI: https://dx.doi.org/10.1079/CABICOMM-62-8114