Plantwise- a Center for Agriculture and Bioscience International (CABI) – led Extension Program for Farmers

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ABSTRACT

Thispaper described the broad aspects of the Center for Agriculture and Bioscience International (CABI)-led Plantwise programwhich supports and complements national plant health system including extension programs in developing countries. Essentially, Plantwise provided smallholder farmers with better access to advice and information - and thus losing less of what they grow due to plant health problems. The three key components of Plantwise were briefly discussed, *viz*., plant clinics run by trained plant doctors andsupported by a range of stakeholders including agro-dealers, the Knowledge Bank and Monitoring and Evaluation. Some aspects of these components were illustrated using brassicas and the concomitant pests and diseases. Aspects examined included the types of brassica crops that the farmers bring to the plant clinics, the key problems diagnosed by plant doctors and their management recommendations. The paper also included examples of farmer-friendly extension materials such as pest and disease factsheets and the pest management decision guide. The opportunities and challenges to implementing Plantwise in target countries are also addressed.

Keywords: Plantwise, brassica farmers, plant clinics, pests, diseases

INTRODUCTION

Many plant health problems threaten crop production. These include pests which are estimated to destroy 30-40 % of smallholder farmers' produce. Helping farmers to reduce losses can therefore make significant improvements in their livelihoods and family food security. In this context, effective management of plant health problems is crucial towards the many depending on it for their livelihoods.

Shelton (2015) in his keynote address presented in this Conference titled: *The Talekar Challenge: What Have We Learned and Where Are We Going with Practical DBM Research and Extension since 1985?*, highlighted the continuing challenges for the management of the diamondback moth (DBM), the key pest of brassicas worldwide causing billions of dollars in losses. Amongst these challenges were "*creating practical outreach programs that enable farmers to manage DBM in a more sustainable manner"* and the bridging of the *'disconnect between the Science and Service to Farmers*". Friis-Hansen and Egelyng (2007) (as quoted by Danielsen *et al.* 2011) made a comparative study of five major funds created to support local innovations, and revealed that there is a tendency for projects to focus on technologies, farmer learning, experimentation and farmers' motives, with less emphasis on innovations in delivery of services and information to farmers. This happened despite the historic failures with establishing advisory services. Danielsen *et al.* (2011) also suggested that the emphasis on projects has limited institutional innovations needed to create systemic changes in service delivery and integration of effort across the plant health spectrum *e.g.*,research, extension, input supply and regulatory services,which remain largely disconnected in many countries.

Issues in the current extension systems

Amongst the key issues that pervade many extension systems in countries include: (i) Weak horizontal and vertical integration of stakeholders across the plant health spectrum *viz*., policy makers, research, extension, input supply and regulatory services. Essentially, many of the stakeholders remain largely disconnected,(ii) Lack of resources and access to provide basic services especially for marginal or peripheral rural communities,(iii) Poor accessibility of advisory services which

is generally based on a 'as and when' basis. Currently, government-based extension services provide advisory services to farmers who bring their problems to them. However, not all farmers, especially those in the deep rural landscape, are able to access such services, and (iv) Inadequate or incomplete record keeping for future referencing and data mining for strategic and tactical interventions.

CABI-LED PLANTWISE PROGRAM

Plantwise (PW) is a global alliance, led by the Centre for Agriculture and Biosciences International (CABI), working together with various partners to improve food security and the lives of the rural poor by providing them knowledge they need to feed more and lose less to pests. The program helps countries to develop sustainable national plant health systems where community-based plant clinics provide practical advice to smallholder farmers when they need it. Thus, the PW program is about building crop production resilience, enhancing equity of smallholders and it integrates, both horizontally and vertically, with various stakeholders involved with the wellbeing of farmers, providing equal opportunity in terms of gender, accessibility and quality of service through effective farmer-friendly communication channels. The plant clinics play a pivotal role in providing plant health advisory services to farmers as well as inserving as an entry point for the Plantwise approach and catalyzing new patterns of interaction between stakeholders (Figure 1). Plantwise, through the knowledge bank, also strengthens the availability and exchange of knowledge, data and information among plant health system stakeholders. Thus, the CABI-led PW program provides a strengthened extension approach, supported by the knowledge bank (KB) and diagnostics components. PW is functional through three key components, *viz*., (i) plant clinics (PCs) supported by a range of stakeholders including agro-dealers; (ii) a comprehensive Knowledge Bank (KB) (www.plantwise.org/KnowledgeBank) and (iii) Monitoring and Evaluation system in place to assess the quality of PCs implemented. The key entry point relies on the establishment and operation of plant clinic (Figure 2) networks which provide primary health care and are run by trained 'plant doctors' (PDs) supported by the global knowledge bank. Generally, PDs are local extension staff with agriculture and/or plant protection background. The KB is made up of an open-access area, which is freely-accessible online for anyone with an internet connection (and offline as a USB) wanting to access information about pest and disease identification and management, and a closed access area in the Plantwise Online Management System (POMS), where data from clinics is kept under secure access control for viewing only by the in-country stakeholders. POMS providesdata management support across Plantwise, including analytics. For more salient details of the PW program, refer to the following website: www.plantwise.org.

The early proponents of PW-based clinics (PCs) (Boa 2009; Bentley and Boa 2011) suggested thatplant clinics are a catalyst, an entry point for improving and widening access to extension services. The overarching goal is to achieve sustainable productivity increases by making advisory services more effective, increasing outreach and providing timely, reliable and regular information. PCs are regular clinics (= visible extension) linked with diagnostics (= quality control) connected to in-country labs with international lab back-upwith remote microscopy,consolidated support data (knowledge bank),which are country-specific. Although the plant clinics are usually run in a fixed location to meet the convenience of the farmers, there are also mobile-based services provided *e.g*., in Thailand and Vietnam due to poor accessibility of farmers to the fixed PCs.

Based on the summary statistics from the Plantwise Annual Report 2014 (www.plantwise.org), the Plantwise programme is operating in 33 countries by the end of 2014. Nearly 2 million households (estimate: 1.9 million) were reached through direct and indirect reach of plant clinics and complementary activities. Plantwise Partnership Agreements signed with partners in Asia, Africa and Latin America. Plantwise training courses on various topics (field diagnosis, giving advice, producing extension materials, data management, monitoring and evaluation) delivered to 4,400 personnel from

partner organizations. A total of 661 plant clinics were newly established in 2014 (1,413 plant clinics in total). Successful trials of using digital tablets at plant clinics in Kenya and India for more efficient information exchange with and among plant doctors were conducted and over 75,000 plant clinic records from 20 countries were deposited in the POMS.

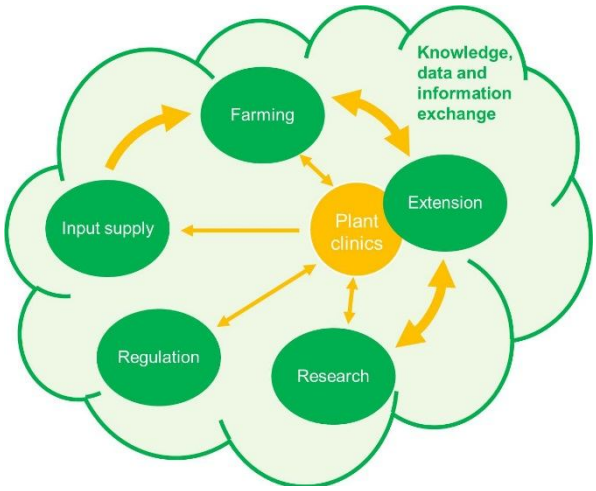


FIGURE 1

A plant health system is defined by the set of all national plant health stakeholders and their linkages.This diagram illustrates with orange arrows which stakeholder linkages Plantwise most effectively strengthens through plant clinics and other activities

FIGURE 2

Examples of plant clinics in action attended by plant doctors (in uniform) in Myanmar (top) and Thailand (bottom)

PLANTWISE AND BRASSICA PESTS AND DISEASES

Here, we briefly describe how the Plantwise program assist farmers against brassica pests and diseases.It should be mentioned that the paper outlined only some aspects of the Plantwise program. There are many other areas of activities, such as plant health rallies which are conducted as a mass communication approach to inform farmers on specific problems or issues, elements of the M&E component such as PC monitoring for performance, cluster meetings held with PDs and relevant stakeholders to discuss issues, improvements of PC performance, etc.

Use of data records

To elicit information on brassica pests and diseases, we examined data entries from the POMS. Essentially, each country's PC data are

entered into POMS after checking on the accuracy of the data entries for symptoms, diagnosis and recommendations. We obtained the following data: (i) List of Brassica crops that were brought to the PCs by farmers, (ii) Key pests and diseases, and (iii) List of recommendations given by PDs for managing the diamondback moth, a key pest of brassicas worldwide.

(i) Brassica crops brought to the PCs by farmers

Of the over 75,000 plant clinic records from 20 countries deposited in the POMS, more than 4000 records are of various species of Brassicas grown globally. The number of brassica records increased gradually from 45 (2011), to 672 (2012), 1269 (2013) and 1825 (2014). The crops recorded and examined in POMS included head cabbage (*Brassica oleracea* var. *capitata*), green or Indian mustard *(B. juncea* (L.) , broccoli (*B.oleracea* var. *italica*), cauliflower (*B. oleracea* var. *botrytis*), tronchuda cabbage or Portuguese kale (*B. oleracea* var. *acephala*), Chinese kale or kailan (*B. oleracea* var. *alboglabra*), kohlrabi (*B. oleracea* var. *gongylodes*), Brussels sprouts (*B. oleracea* var. *gemmifera*), canola (*B. napus*) and Chinese turnip (*B. rapa* var. *rapa*). For example, the distribution map for plant clinics in Cambodia and Vietnam with brassicas reports is shown in Figure 3.

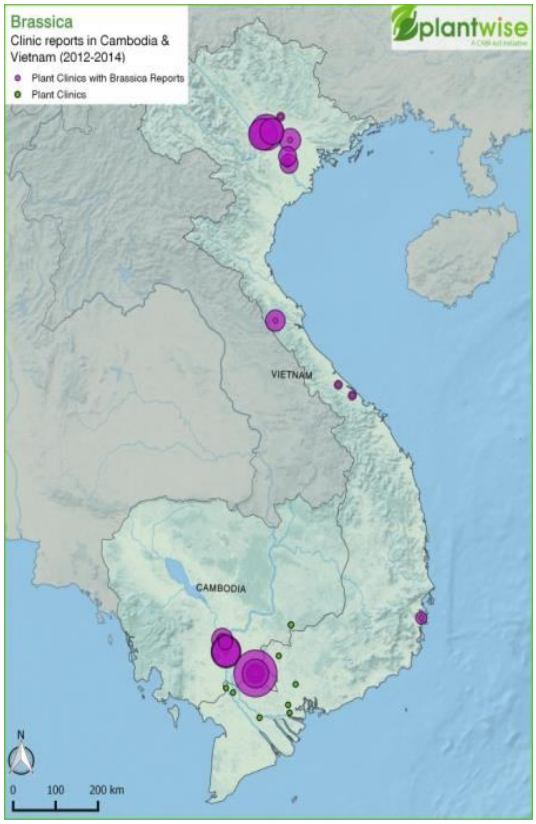


FIGURE 3

Map showing distribution of plant clinics showing brassica reports in Cambodia and Vietnam

(ii) Key pests and disease problems

Table 1 provides a sample crucifer pest and disease records from various countries. The majority of the problems (> 90%) addressed at the PCs by the PDs were biotic (*e.g.*, pests and diseases), whereas the rest were abiotic (*e.g.*, nutrient deficiency) problems. Amongst the key pests recorded by PDs were the diamondback moth (DBM), armyworm, aphids, cutworm,leaf-miners and the diseases included soft rot, black rot, and leaf spot. Globally, the DBM infested crops based on the number of records (in parenthesis) were as follows: cabbage (128), Chinese kale (46), Chinese cabbage (11), rape (9), mustard (7), cauliflower (4) and kohlrabi (3). Figure 4 shows an example of a map on the distribution of plant clinics and DBM reports in Cambodia and Vietnam.

TABLE 1

Sample crucifer pest and disease records from various countries

Damping off disease	Bangladesh
Diamondback Moth (DBM)	Cambodia
Cabbage head caterpillar	Cambodia
Cabbage looper	Cambodia
Cabbage webworm	Cambodia
Chinese kale - downy mildew	Cambodia
Chinese kale – striped flea beetle	Cambodia
Diamondback Moth	China
Downy Mildew of Chinese Cabbage	China
Rape Sclerotium	China
Soft Rot of Chinese Cabbage	China
Aphid in cabbage	Grenada
Cabbage aphid	India
Alternaria	Kenya
Aphids	Kenya
Armyworms on Brassica	Kenya
Bacterial leaf spot on Brassica	Kenya
Bacterial soft rot on Brassica	Kenya
Bagrada bug on Brassica	Kenya

(iii) Recommendations/Management options

At the PCs, the pest management recommendations for DBM were largely aligned towards the use of insecticides (54 %), followed by cultural (40 %) and biological control (5 %). Suggestions were also provided to monitor the problem. In addition to the recommendations given in a PC prescription form, where appropriate, farmers are also provided with farmer-friendly factsheets (FS) (examples on DBM and black rot of cabbage; Figures6 and 7) and Pest Management Decision Guides (PMDGs) (example of DBM; Figure 8). The Plantwise PMDGs are based on the Green and Yellow Lists of Plant Protection Measuresbased on the IOBC IP toolbox that enables and supports the implementation of Integrated Production (IP) into practice (Source:https://www.iobc-wprs.org/ip_ipm/IOBC_IP_Tool_Box.html#4) . To further demonstrate the use of the Knowledge Bank, one could also access some of the KB content. For example, search related to DBM has 43 records which include FS (indicate number of records) for farmers (12); PMDG (7); Technical FS (9); External FS (14) and video FS (1). The FSs are written in various languages (indicate number of records) which include English (27), Chinese (2), Spanish (2), Portuguese (1), Tamil (1) and Vietnamese (1). The KB also has news articles, pest alerts, images and global distribution map for DBM.

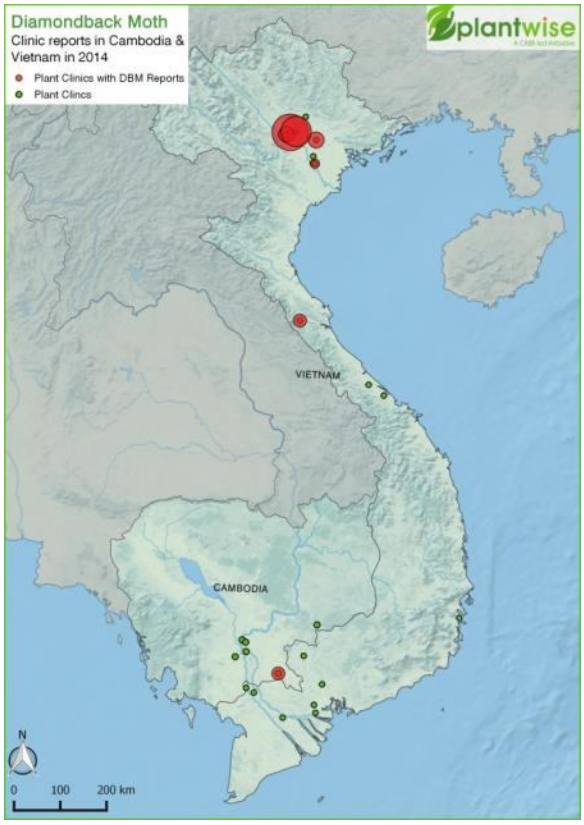


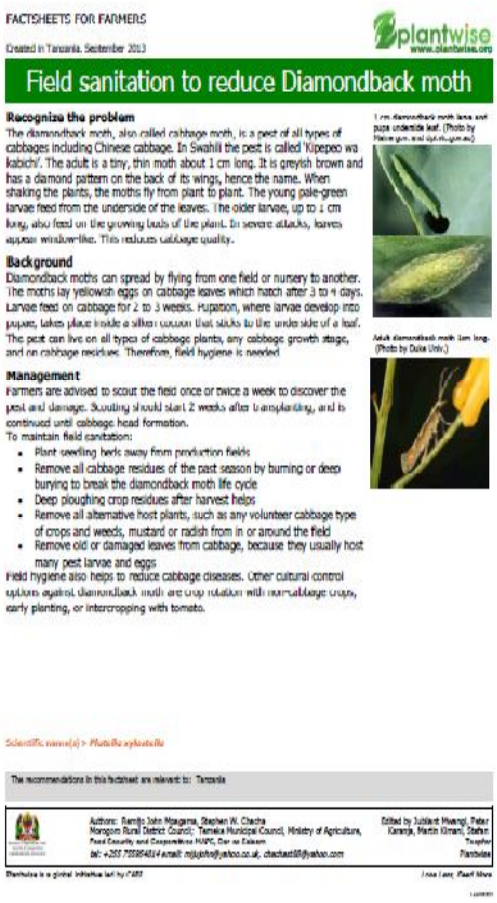
FIGURE 4

Map showing distribution of plant clinics showing diamondback moth reports in Cambodia and Vietnam

For identification of unknown pests or disease problems, the PW program also has a Directory of Diagnostic Services (DODS) both within and outside the country, to help the PDs for special or new problems. This is in addition to the referencing made using the KB as a source of diagnosis and identification. Where necessary, technical back-stopping visits (Figure 5) and plant health rallies are conducted to monitor and create awareness of key problems diagnosed in the PCs.

FIGURE 5

Cabbage with a club root problem (left) and (right) CABI experts helping with the diagnosis and explaining to a farmer on the management of the problem



FACTSHEETS FOR FARMERS

Created in Tanzania, September 2013

plantwise
www.plantwise.org

Field sanitation to reduce Diamondback moth

Recognize the problem

The diamondback moth, also called cabbage moth, is a pest of all types of cabbages including Chinese cabbage. In Swahili the pest is called 'Kipepeo wa kabichi'. The adult is a tiny, thin moth about 1 cm long. It is greyish brown and has a diamond pattern on the back of its wings, hence the name. When shaking the plants, the moths fly from plant to plant. The young pale-green larvae feed from the underside of the leaves. The older larvae, up to 1 cm long, also feed on the growing buds of the plant. In severe attacks, leaves appear window-like. This reduces cabbage quality.

Background

Diamondback moths can spread by flying from one field or nursery to another. The moths lay yellowish eggs on cabbage leaves which hatch after 3 to 4 days. Larvae feed on cabbage for 2 to 3 weeks. Pupation, where larvae develop into pupae, takes place inside a silken cocoon that sticks to the underside of a leaf. The pest can live on all types of cabbage plants, any cabbage growth stage, and on cabbage residues. Therefore, field hygiene is needed.

Management

Farmers are advised to scout the field once or twice a week to discover the pest and damage. Scouting should start 2 weeks after transplanting, and is continued until cabbage head formation.

To maintain field sanitation:

- Plant seedling beds away from production fields
- Remove all cabbage residues of the past season by burning or deep burying to break the diamondback moth life cycle
- Deep ploughing crop residues after harvest helps
- Remove all alternative host plants, such as any volunteer cabbage type of crops and weeds, mustard or radish from in or around the field
- Remove old or damaged leaves from cabbage, because they usually host many pest larvae and eggs

Field hygiene also helps to reduce cabbage diseases. Other cultural control options against diamondback moth are crop rotation with non-cabbage crops, early planting, or intercropping with tomato.

Adult diamondback moth 1cm long. (Photo by Duke Univ.)

Scientific name(s) > *Plutella xylostella*

The recommendations in this factsheet are relevant to: Tanzania

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FIGURE 6

An illustration of a factsheet for farmers on field sanitation for the diamondback moth

DISCUSSION AND CONCLUSION

Plantwise is a dynamic program that fits well within and strengthens the extension framework of various countries. As for vegetable brassicas, about 70% of which comes from Asia, the impact of pests and diseases on the livelihoods of the resource-striven Asian farmers cannot be overemphasized. Thus, a concerted focus on pests, such as the DBM, which is one of the world's significant agricultural pests costing farmers billions of dollars every year, the PW program could bring sustainable returns to investments based on its holistic approach. We already see some trends in certain aspects. For example, in PW countries, as result of the use of the PMDGs by PDs, we currently see

evidence of a tactical shift of pest management recommendations to more 'greener' approaches (*e.g.*, cultural and biological control measures) from the unilateral use of pesticides.

In terms of the over-riding policy implications, PW offers the message that systematic, cogent and responsible crop health advice and information is the key to sustainable agriculture and rural development. However, there are challenges that need to be addressed as PW evolves. Currently, many of the PW projects implemented in various countries are in the pilot phase, and as with any innovation, PW is still being refined and improved with the final objective of making the program a much broader holistic framework and an effective interface for total crop health i.e. *any crop, any problem*- beyond its current focus on pests and diseases. Danielsen *et al.* (2014) cautioned that for PCs, which are central to PW, to succeed, the fundamental issues of governance, resources and implementation structure need to be considered. They also underscored the importance of understanding not only the policy and institutional frameworks in which plant clinics operate, but also the effects of political imperatives and donors on policy implementation.

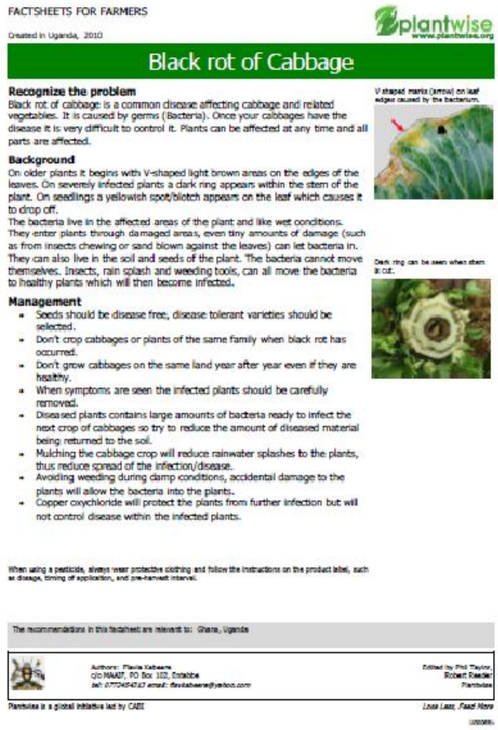

FIGURE 7

An Illustration of A Factsheet For Farmers on Black Rot of Cabbage

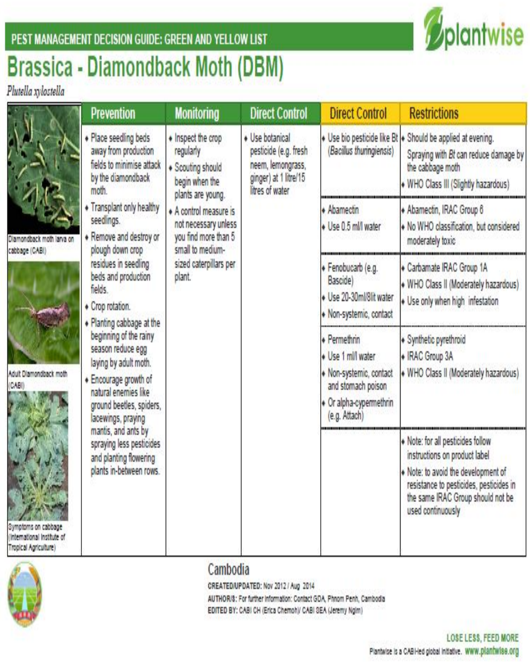

FIGURE 8

An illustration of a Pest Management Decision Guide (PMDG) for farmers e.g. the diamondback moth

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