

Plantwise Sustainability: Two Years on Follow-up assessments in six countries











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Front cover photo: A RADA plant doctor works with a local farmer in Jamaica (photo: Noah Friedman-Rudovsky for CABI, with the permission of the subjects).

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Acronyms

ASWAP	Agriculture Sector Wide Approach Support Project (Nepal)
CABI	Centre for Agricultural Biosciences International
CASE	College of Agriculture Science and Education (Jamaica)
DAES	Directorate of Extension Services (Ghana, Malawi)
DCA	Data collection app
DG	Director General
DoA	Department of Agriculture (Pakistan, Nepal)
DPP	Department of Plant Protection (Pakistan)
FAO	Food and Agricultural Organization of the United Nations
FAW	Fall armyworm
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
iDE	International Development Enterprise (Nepal)
IICA	Inter-American Institute for Cooperation on Agriculture
KALRO	Kenya Agricultural and Livestock Research Organization
KEPHIS	Kenya Plant Health Inspectorate Service
KPI	Key performance indicator
LUANAR	Lilongwe University of Agriculture and Natural Resources (Malawi)
MNFSR	Ministry of National Food Security & Research (Pakistan)
MoA	Ministry of Agriculture (Malawi)
MoAF	Ministry of Agriculture and Fisheries (Jamaica)
MoALD	Ministry of Agriculture and Livestock Development (Nepal)
MoALF&C	Ministry of Agriculture, Livestock, Fisheries and Co-operatives (Kenya)
MoFA	Ministry of Food and Agriculture (Ghana)
M&E	Monitoring and Evaluation
MoU	Memorandum of Understanding
NDC	National Data Centre (Pakistan)
NGO	Non-governmental organization
NPPO	National Plant Protection Organization
PARC	Pakistan Agriculture Research Council
PMDG	Pest Management Decision Guides
POMS	Plantwise Online Management System
PPD	Plant Protection Directorate (Nepal)
PPL	Plant Protection Laboratory (Nepal)
PPRSD	Plant Protection and Regulatory Services Directorate (Ghana)
PQPMC	Plant Quarantine and Pesticide Management Centre (Nepal)
PRISE	Pest Risk Information SErvice
QA	Quality assessment
RADA	Rural Agricultural Development Authority (Jamaica)
SOP	Standard Operating Procedure
ТоТ	Training of trainers

Abstract

CABI implemented its global Plantwise programme from 2011 to 2020 to address smallholder farmers' plant health challenges with more than 200 partner organizations in around 30 countries. Two years after Plantwise funding ceased, a follow-up sustainability assessment was carried out in six countries: Nepal and Pakistan (Asia); Ghana, Kenya, and Malawi (Africa); and Jamaica (Caribbean). The aim of the assessment was to gain an understanding of Plantwise's legacy, or elements thereof, and how the country context has influenced what happened, positively or negatively, since the programme ended, as well as what the drivers and blockers are to sustainability. Information was gathered through interviews and group discussions with Plantwise partners, and a review of recent programme documents, country policies, selected literature, and Plantwise Online Management System (POMS) data. This was followed by in-depth conversations over Zoom with country study teams to discuss findings and key lessons. The country studies for this assessment show that sustainability is highly contextual: knowledge on national policy, institutional mandates, mode of operation, and available resources, is paramount to ensure that interventions fit with structures and capacities in a particular setting. The country cases also show the different ways in which a particular circumstance, or combination of circumstances, helped or hindered sustainability in one country, while a different set of circumstances was influential in another country. Sudden changes can undermine partnerships and achievements made, which makes it difficult to engineer or promote sustainability. Using a flexible, adaptive approach, in which opportunities are spotted and seized, is vital.

Background

Plantwise 2011–2020

In collaboration with more than 200 partner organizations in around 30 countries across the world, CABI implemented its global Plantwise programme from 2011 to 2020 to address smallholder farmers' plant health challenges. Plantwise applied a systems approach, recognizing that attainment of plant health outcomes requires functional linkages among key actors: farmers, extension services, regulatory bodies, research institutions, and agricultural input and information suppliers (David *et al.*, 2019; CABI, 2021). A central component of Plantwise was the establishment of networks of plant clinics, where farmers can receive practical plant health advice from extension staff trained as plant doctors. A plant clinic, as a primary plant healthcare unit, is the principal entry point for problem detection and delivery of advice and plays a key role in driving change as the "front end" of a plant health system. The plant clinics were reinforced by the Plantwise Knowledge Bank, a gateway to online and offline actionable plant health information, including diagnostic resources, pest management advice, and the Plantwise Online Management System (POMS) for managing plant clinic record data (Cartmell, 2021).

With the transition in 2021 to CABI's new global programme, PlantwisePlus, the engagement with 'Plantwise classic' countries transitioned to become more hands-off, providing occasional follow-up support and backstopping for prioritized areas, such as refresher training, training of trainers (ToT), troubleshooting of clinic data issues, diagnostic support, and monitoring visits. Plantwise's digital resources, which will be further developed under PlantwisePlus, remain a permanent resource for any country to access and use.

Plantwise sustainability assessments

Plantwise generated a significant amount of learning and insights into the different ways that the programme created value for farmers, service providers, and multi-stakeholder partners, as well as the complexities of plant health systems, institutional dynamics, and the influences of the diverse country contexts (David *et al.*, 2019; Cartmell, 2021). From 2015, increased focus was given to sustainability, defined as: "The likelihood that the positive effects of Plantwise will continue, or are likely to continue" (adapted from Kusters *et al.*, 2017, and OECD, 2019). Annual assessments of progress towards sustainability of the Plantwise approach were made using a 5-point 'sustainability scoring tool' from 2015–2020 (e.g. CABI, 2017), and various pieces of evidence of sustainability were documented in the Plantwise Annual Reports and in the 2011–2018 Impact Report (David *et al.*, 2019). In 2020, an in-depth assessment was conducted in 30 countries, based on partners' perceptions of which Plantwise elements were likely to continue (Cartmell, 2021). The main findings from the synthesis report are summarized in the Annex.

In 2022, two years after Plantwise funding ceased, a follow-up sustainability assessment was carried out to address the questions: What survived? Why? And if elements didn't survive, why not? The aim was to gain an understanding of the legacy of Plantwise, or elements thereof, and how the country context has influenced what happened, positively or negatively, since the programme ended, as well as what the drivers and blockers are to sustainability.

Approach

Six countries were chosen where clear signs of country commitment to the Plantwise approach had been observed during programme implementation: Nepal and Pakistan (Asia); Ghana, Kenya, and Malawi (Africa); and Jamaica (Caribbean).

The assessment focused on selected topics of particular relevance to each study country, mainly concerning the government sector, plant clinics, and data management. As such, it should not be seen as a comprehensive, nor systematic study. Rather, it is based on the views and experiences of some of those involved in managing and implementing the programme, juxtaposed with documented evidence of action and change.

Information was initially gathered in each country through interviews and group discussions with Plantwise partners, mainly plant doctors, coordinators, and senior officials. Initial findings were written into a draft report. The number of informants varied from country to country, based on people's proximity and availability within the study period from July to October 2022.

This was followed by a series of iterative, in-depth conversations over Zoom with the CABI study teams to reflect on the findings and to pull out key lessons for each country. Key documents, such as programme reports, country policies, published papers, and POMS data were used as inputs to triangulate the findings and enrich the discussions, especially to get a deeper understanding of *why things happened, or not*.

These conversations were prompted by questions such as:

- What has been happening in the last two years with regards to Plantwise activities?
- How have governance structures/change in administration/government commitment impacted on what has or not been sustained?
- Where is Plantwise embedded in national policy/official documents, if at all?
- How/where did particular personalities have an impact in what was achieved?
- What challenges have been experienced?
- What unexpected/under-narrated outcomes are evident?
- Where are we now in terms of legacy and sustainability?
- How would you do things differently if you had the opportunity?
- What lessons/next steps are there for anything Plantwise-related going forward?

The information was written up as six 'country stories', which are presented in this report. The final synthesis chapter brings together the main learning points that emerged across the six countries.

Findings: Country assessments



Farmers attending a plant clinic in Beshishahar, Nepal (Photo: Solveig Danielsen, with the permission of the subjects).

Overcoming the challenges of decentralization in Nepal

Vinod Pandit, Malvika Chaudhary, Shalikram Adhikari and Dannie Romney

Year Plantwise started: 2013 (pilot clinics started 2008 under the Global Plant Clinic)

Active partners and roles:

- Plant Quarantine and Pesticide Management Centre (PQPMC), formerly Plant Protection Directorate (PPD) – national responsible organization¹, provision of training and farmer advice
- Provincial Plant Protection Laboratories (PPL) clinic implementation and trainings
- Agriculture Knowledge Centres clinic implementation
- International Development Enterprise (iDE) clinic implementation

Active plant clinics:

- 2021:35
- 2022: 54
- Clinics established in total: 80

Uptake of Plantwise elements in policy, strategy, procedures:

- The Pesticide Management Act 2019 mandates PQPMC to implement plant health systems programmes such as Plantwise
- A national policy guidance document on Plantwise activities is currently under development

Country investment 2021–2022:

- GBP 75,000 approx. allocated annually across the provinces by the Ministry of Agriculture and Livestock Development (MoALD) for plant clinic operations and plant doctor training
- iDE provided GBP 5,600 in 2021 for plant clinic operations and plant doctor training

Plantwise in Nepal

Building on experiences from pilot clinics initiated in 2008 with support from CABI's Global Plant Clinic (Khatiwada, 2009), Plantwise in Nepal was launched in 2013, initially working with a centralized government system. However, in 2015, the Government of Nepal adopted a new constitution to form a federal system of governance. Under federalization, Nepal created a three-tier system with seven provinces, 77 districts, and 753 local governments (municipalities and district assemblies). This major restructuring proved challenging to effect and progress was further hindered by natural and economic crises. In 2015, a severe earthquake struck and a six-month economic blockade had a significant impact on the country. As a result, the new devolved structure took some years to implement and become functional, affecting delivery of agricultural extension services (Tamang *et al.*, 2020).

Despite these challenges and the movement of government staff from one area to another, the Plantwise initiative has proved remarkably resilient in Nepal. Plant clinics continue to be run as part of the Provincial Government's extension system across all seven provinces, and are staffed by trained plant doctors who are mostly agricultural extension staff (Plantwise blog, 2020). As of 2022, 54 government-led plant clinics are still operational, led by Agriculture Knowledge Centres and Plant Protection Laboratories (PPL). Both these agencies fall under the provincial Directorate of Agriculture Development. In addition, non-governmental organizations (NGOs) like International Development Enterprise (iDE) provide funding for

¹ The national responsible organization is the main coordinating partner for the Plantwise programme

plant doctor training of Community Business Facilitators and support these community agents in delivering their services to remote locations ('last mile agents')². In addition, there is undocumented evidence that some local governments, the lowest tier in the governance system, continue to run plant clinics with staff trained early in the Plantwise programme. However, the national investment and commitment that these 'off-shoots' represent need to be further examined to get a full picture of Plantwise sustainability in Nepal.

The Plant Quarantine and Pesticide Management Centre (PQPMC) – Nepal's National Plant Protection Organization (NPPO), previously named the Plant Protection Directorate (PPD) – became the main coordinating partner for Plantwise in Nepal and formally responsible for *'implementing Plant Health System related programs, such as Plantwise,*' as stated on the PQPMC website³. This role is officially supported by the Pesticide Management Act 2019, Articles 43 and 45, which approve the operation of programmes that will help to mitigate the adverse use of chemical pesticides (Government of Nepal, 2019).

Under Plantwise a national forum was formed comprising officials from PQPMC, the Ministry of Agriculture and Livestock Development (MoALD), provincial Directorates of Agriculture Development, the Nepal Agricultural Research Council, NGOs, agro-vet associations, farmers' associations, and academic institutions. The national forum was set up to review overall progress and functioning of a national plant health system. Since the end of Plantwise in 2020, the national forum, with backstopping support from CABI, has played an important role in developing a policy guidance document which will provide a formal structure for the continuation of plant clinics, plant doctor training modules, development of pest management decision guides (PMDGs), and data collection and management across Nepal.

What has worked well

Before the launch of Plantwise, CABI was not well known in Nepal. However, through the work of the programme, there is now greater awareness of not only Plantwise activities, but CABI as an organization and where plant health and pesticide management support can be provided.

Since Plantwise began, the government has invested annually in training plant doctors and supporting plant clinics. Since 2020, when Plantwise funding ended, the Government of Nepal has continued to include Plantwise activities (like plant clinics and plant doctor training) in its annual budget. A total of approx. GBP 70-80,000 is allocated across the country each year.

In addition, Purbanchal University, despite not being a Plantwise partner, included a 'plant clinic course' in its curriculum for BSc students in 2016. It is likely that the university was influenced to take up the training by the affiliated college Himalayan College of Science and Technology (HiCAST), who had a number of students trained as plant doctors prior to the launch of Plantwise (Adhikari *et al.*, 2013).

As data is currently not being submitted to POMS by the plant doctors running the clinics, it is challenging for CABI to ascertain the exact number of operational clinics in 2022 across the

² iDE project "Expanding Nepal's Business Access to Improved Technologies for Agriculture": <u>https://www.ideglobal.org/key-project/enbaita</u>

³ Plant Quarantine and Pesticide Management Centre: http://www.npponepal.gov.np/content/38/2018/64342437/

different provinces. Nevertheless, it is known that in Province 4 (Gandaki), for example, a large number of plant clinics are run across the districts, mainly under the provincial PPLs. Training is conducted several times a year by master trainers for government officials as well as for Farmer Field School facilitators. In contrast, Province 2 (Madesh) runs some plant clinics but does not currently allocate any money to training.

This marked difference in provincial support for training is influenced by personal commitment. For example, the head of one of the District Agriculture Knowledge Centres in Province 4 was trained as a plant doctor under the Global Plant Clinic in 2008 and ran one of the first plant clinics in the country, supported by World Vision. The plant clinic caught the attention of the Director of Agriculture, who subsequently included plant clinics and training as part of the agricultural interventions in Province 4.

In contrast, although Directors of Agriculture for other provinces were previously part of the central ministry, MoALD, and keen on plant doctor training, other provincial priorities have taken precedence over plant doctor training requirements. Overall, in Nepal, emphasis is on plant clinic implementation using already trained staff, which poses a risk to staffing stability. For comparison, plant doctor training is only prioritized in three to four out of the seven provinces.

As yet, no plans exist to train additional master trainers. ToT was initially conducted by CABI in 2015 and these master trainers (from PQPMC and other central and provincial government agencies) are called upon by provinces to deliver plant doctor training. Training in the additional Plantwise modules (extension materials, performance monitoring) is not currently funded. However, PQPMC – the nodal body for plant protection – is currently working with input from the national forum to develop a policy guidance document to enable various components of Plantwise to be embedded in the national system. Elements will include the plant doctor training modules as well as data management, development of PMDGs, and performance monitoring of plant clinics.

The development of the guidance document was recommended by the national forum in 2021 and its outline was agreed upon in 2022. However, such policy documents take time to develop and many consultations and revisions are required. A technical committee of 5-6 officials recommended by the national forum stakeholders, including provincial officials and academia, provided technical inputs and, in November 2022, a full draft was submitted to PQPMC, which is currently under review. Once the document is approved and incorporated into Nepal's plant protection policy, the MoALD will be able to request additional funds from the Ministry of Finance using agreed codes. The embedding of these activities in policy means that budget lines and reporting requirements can be detailed for each element.

Challenges encountered

Devolution has made it more challenging for CABI to operate at the national level as was originally envisaged at the launch of Plantwise in Nepal. Collaboration with national partners has been further complicated by continual restructuring of ministries. The Ministry of Agriculture has had various departments incorporated or discontinued (e.q. cooperatives/land). The last portfolio changes for agriculture took place in 2018 with the renaming of the ministry to include livestock, MoALD. At the start of Plantwise, the PPD was under the administrative management of the Department of Agriculture (DoA). However, since its name changed to the PQPMC, it is now directly under the MoALD with no formal linkage to DoA. Previously, PPD officially coordinated actions with District Agriculture Development Offices, for example to implement plant protection-related training and extension activities. In contrast, PQPMC does not have local representation, which makes their coordinating role difficult. At the provincial level, each of the 7 provinces have a Ministry of Agriculture assisted by a Directorate of Agriculture Development. However, under the devolved system and ministry restructuring, staff are constantly moved/relocated which has impacted on the continuity of plant clinic activities in some provinces.

The PQPMC, being the NPPO and the Plantwise national coordinator, has a major interest in plant clinics as they contribute to solving plant health problems. However, the PQPMC does not deliver extension services, hence they rely heavily on a well-functioning, albeit informal, working relationship with the provinces. Even where PQPMC *does* have a national mandate – i.e. plant protection and pesticide management – they can only request the provinces to support and implement certain activities. In the end, the provinces have the right to decide whether or not to meet the request. As such, the formal institutional mandates are not fully supported by the current governance structure. While the decentralization of agricultural extension has provided opportunities for local participation and more targeted priority-setting, the disconnect between governance levels and departments is affecting service delivery. According to Tamang *et al.* (2020): "Nepalese agriculture extension service delivery has been facing difficulties in transforming itself in the changed context due to lack of the coordination between the layers of government, niche-based expertise, long term visualisation, and capitals."

The system to fund Plantwise activities is also convoluted. Based on requests from the MoALD, the Ministry of Finance provides an annual budget for agricultural activities and allocates specific codes for different activities, including Plantwise. Once the request is approved, the Ministry of Finance provides a budget to the provinces to allocate funds to the approved activity codes. However, whilst MoALD may recommend funds for plant doctor training or plant clinic operations, for example, if these activities are not deemed a provincial priority, the code(s) is not used.

Following decentralization, MoALD agencies (and those of other line ministries), have significantly diminished in importance, as the provinces have taken over the decision-making power and budgets. In the same way, the connection between the PQPMC and the provinces has also weakened substantially; there is no specific coordination budget for Plantwise and other activities, which means that any interaction with the provinces depends on the goodwill and commitment of individuals within the system. Both the provinces and MoALD acknowledge that this is a problem. For example, pest surveillance and data management require a well-coordinated national effort, which is not currently possible.

Plant health query data is currently not collected by the plant doctors. Senior officials at provincial and central levels want the data but field level officers are less keen. They find the process laborious (form too long) and there is currently no incentive for them to undertake data collection. However, under the policy guidance document, if approved, it is envisaged that this situation will change – as data collection, management, and validation, as well as monitoring and evaluation, will be a requirement of all officials running clinics and they will have to justify what activities are conducted. Some of the data procedures may need to be reviewed to ensure they match work flows and roles within the existing system. This includes paying attention to incentives at all levels. Otherwise, there is a risk that the data flow will break. So far, it is mainly people at the national level and CABI, who have used the data. The

districts and provinces also need to see the value of the data in order to invest time and resources in keeping the system going.

In conclusion

Ideally, CABI needs to engage in future activities at both the provincial and national levels. However, it is critical to prioritize provincial engagement, despite the challenge of dealing with seven provinces, as it is at this level that agricultural extension is implemented.

At one time, Plantwise in Nepal had a national coordinator and a national data manager at the central level. In the future, such roles need to be aligned with the new federal system, such as establishing these functions at the provincial level, through the PPLs, and creating a provincial forum to help implement/guide plant health activities locally. The inclusion of the Directors of the Provincial Directorates of Agriculture Development at the national forum will enable feedback to be given from the provinces regarding the progress and challenges to national stakeholders.

Despite the complexities of the federal system in Nepal, and the challenges of decentralization, the legacy of plant clinics in providing plant health advice to farmers as part of the government's extension system is encouraging. So, too, is the development of a policy document to set out and provide provision for plant protection across the provinces, even if it takes some time to be formalized.

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Prospect for Pakistan's plant health as the government engages and takes charge

Naeem Aslam, Sajila Sohail Khan and Yasar Saleem Khan

Year Plantwise started: 2012

Active partners and roles:

- Ministry of National Food Security & Research (MNFSR) national coordination
- The Federal Department of Plant Protection (DPP), Karachi host of the national data centre
- Pest Warning and Quality Control of Pesticides, Punjab local implementing partners
- The Department of Agriculture (DOA) in Sindh, Punjab, Balochistan, Khyber Pakhtunkhwa, Gilgit-Baltistan, and Azad Jammu and Kashmir clinic implementation

Active plant clinics:

- 2021:711
- 2022: 530
- Clinics established in total: 1,060

Uptake of Plantwise elements in policy, strategy, procedures:

• Implementation of plant clinics has been incorporated into staff key performance indicators in Punjab and Sindh

National investments in PW activities 2021–2022:

- A total of GBP 154,525 allocated in 2021 by DOA of Sindh, Punjab, Balochistan, Khyber Pakhtunkhwa, Gilgit Baltistan, and Azad Jammu and Kashmir for Plantwise activities. Similar figure for 2022.
- In two of the provinces (Punjab and Sindh), all Plantwise operating costs are solely covered by the government, with funding under way for scaling up the programme in Sindh (to be approved)

Plantwise in Pakistan

Launched in 2012 in two districts, the province of Punjab has played a leading role in Plantwise activities in Pakistan. The Plantwise support period, up to 2020, saw the expansion of clinics across almost the entire Punjab, Sindh, Balochistan, Gilgit Baltistan, and Khyber Pakhtunkhwa provinces, with more than 1,000 clinics established and run by over 2,000 extension staff trained as plant doctors (Cartmell, 2021). In Punjab and Sindh, all operating costs, training, clinic monitoring, and data management are carried out by government staff, without any external support (Cartmell, 2021). In 2021, the Agriculture Extension Department expanded the programme to Azad Jammu and Kashmir (CABI, 2021).

In 2021, a national data centre in Karachi was also established to collate clinic data to strengthen the plant health system in Pakistan (Plantwise blog, 2021a). A national forum was previously established in 2020, including key Plantwise partners such as the Pakistan Agriculture Research Council (PARC), the Department of Plant Protection (DPP), Agricultural Extension Departments from across Pakistan, and representatives from different agriculture universities to provide a platform for planning, reviewing progress, and experience-sharing (Plantwise blog, 2021b).

The recent decline in numbers of plant clinics reported for 2021 (711) and 2022 (530) was caused by delays in signing a new Memorandum of Understanding (MoU) between CABI and the province of Punjab, where most plant clinics are located. The continuing collaboration with CABI (for backstopping, data management) is seen as crucial for the functioning of the system. Until the MoU was in place (approved 22nd December 2022), the districts of Punjab were not formally authorized to ensure proper functioning and follow up of plant clinics. Following the new MoU, the clinic numbers are expected to rise again after the Director General (DG) of Agriculture, Punjab, issued a letter to the Divisional Directors requesting them "to activate all plant clinics in their true spirit."

What worked well

Since the start of the Plantwise programme in Pakistan, government engagement has been strong. A visit in May 2012 by the DG of the Department of Agriculture Extension in Punjab to the two districts where clinics were initially established, convinced him of the approach. This led him to expand clinics to all 36 districts in Punjab over the following years – resulting in 665 plant clinics and the expansion of clinics to other provinces. Most provinces established at least 50 clinics and they continue to be supported as part of the national extension system in Pakistan. Initially, CABI trained master trainers in all provinces. Since then, all plant doctor training has been funded by the provincial governments and all clinics are run by district agriculture extension staff.

In 2012, there was only one female agriculture extension officer in Punjab due to the low number of women attending agriculture universities at the time. However, over the last 10 years, this situation has changed significantly and many more women are now being admitted to agriculture universities, particularly as the government allocated a 15% quota for female attendance. Consequently, up until 2021, more than 200 women had been inducted into the national agriculture extension system, some of them playing roles in the Plantwise programme as plant doctors, data managers, and master trainers, etc. The greatest number of female plant doctors are now in Rawalpindi district in Punjab (12-13) (Plantwise blog, 2018), whereas most districts have only 2-3 female plant doctors. In contrast, a significant number of data managers are women. In Punjab, almost two-thirds (20 out of 36 districts) of data managers are women.

All plant doctors are supported and monitored through monthly 'cluster meetings' run by the province officials. The meetings are an opportunity to discuss with plant doctors the mistakes found by district data managers during data entry and harmonization and to advise them on the correct recommendations. At the start of any crop season, all plant doctors are also given information about specific crop problems along with the proposed recommendations. Further support is provided through the Plantwise Factsheet Library app and WhatsApp groups where plant health issues are exchanged between plant doctors.

Prior to 2020, there was no official coordinating body or steering committee to lead the programme at a national level. However, a national forum has now been established to meet twice a year. These meetings are funded by CABI. The forum provides an opportunity for the heads of all relevant departments (e.g. DPP and Agriculture Extension) from across Pakistan, and representatives from different agriculture universities, to share their achievements and plan for the future. The national Plantwise forum not only provides valuable input to the

Plantwise programme but is also very helpful for other CABI projects and programmes because of close coordination with these stakeholders.

Plant clinics are part of the key performance indicators of every plant doctor which are evaluated every year as established in the MoU. However, CABI's continuing support and backstopping, especially for data management, monitoring, and stakeholder engagement, remains vital and an essential part of the success in Pakistan's progress and further development of its plant health systems.

Since 2021, CABI has been supporting the DPP with the establishment of a National Data Centre (NDC) in Karachi. The NDC will provide a comprehensive 'Plant Health Pakistan' dashboard, using data gathered from plant clinics via POMS (Fig. 1). Clinic data will be analysed by DPP Karachi officials and trends disseminated every quarter in order to help farmers stay one step ahead of pest threats. The provincial data managers are also envisioned to become main users of the system. The data centre aims to enable reliable, efficient, and secure access to plant health data, meaning partner organizations will no longer be required to host their own applications (Plantwise blog, 2021a). The system is still under development and undergoing user testing.



Fig. 1. Screenshots of Plantwise National Data Centre dashboard (trial version) being developed by PPD Karachi and CABI (accessed 17th January 2023).

So far, the plant clinic data has been under-used by Pakistan partners. Only a few individuals logged into POMS during the past year, and data summaries have largely been prepared and disseminated by CABI. Yet, Plantwise partners have accepted the Plantwise data management system because no such system existed previously for hosting plant health data. With a harmonized, centralized system, it is hoped that the use of the plant clinic data will increase – for example, for monitoring pest occurrence, helping to identify new and emerging plant health issues, and providing information about the use of highly hazardous chemicals, termed red list chemicals. A notable case showing the value of the data was the identification of red list pesticides in the clinic records. This led to the decision by Pakistan's Agricultural Pesticides Technical Advisory Committee to phase out pesticides belonging to the World Health Organization (WHO) hazard classes 1a and 1b by 2022 (Plantwise blog, 2019). So far, some products, such as endosulfan, have been banned, while others remain in use due to non-availability of alternatives.

The decentralized system for data management in Pakistan down to district/tehsil (sub-district) level has contributed to the sustainability and prioritization of data collection in Pakistan, although it is acknowledged that most data comes from the 36 districts of Punjab. The district data managers work closely with the plant doctors to send the data to POMS and, according to the CABI team, the data quality is generally considered good. Quality assurance is conducted in several ways: i.e. plant clinic visits, harmonizing data at district level, and cluster meetings. The Punjab government has its own monitoring and evaluation (M&E) department to regularly monitor the performance and quality of work at clinics (Aslam and Khan, 2020).

At the start of Plantwise, the MoU was initially signed with the DG of the Department of Agriculture Extension in Punjab. CABI's involvement was either with the DG, who was head of the province, or at field level, with the plant doctors who were agriculture officers and field assistants. As CABI was not involved at other levels of the management structure, they faced challenges because officials at these levels were not well informed about Plantwise. To overcome this, CABI invited Divisional Directors at division level, Deputy Directors at district level, and Assistant Directors at tehsil level for different trainings, e.g. monitoring plant clinic performance and data harmonization, and also involved them in the cluster meetings. This resulted in greater engagement and ownership of Plantwise, which was sustained even when people were promoted and moved up the system.

Challenges encountered

One particular issue encountered in Pakistan has been in reaching female farmers. Different provinces have varying norms, with some areas having very strict requirements regarding head covering, travel, and whether women can work. In most places, women cannot approach a male extension agent directly and have to rely on male intermediaries. A study from Punjab showed that, when women farmers face pest problems in their kitchen garden, they bring the problem to the attention of male members of their household, who then contact plant doctors for advice (Terefe *et al.*, 2022). Therefore, female plant doctors play an important role in breaking this gender barrier. Nonetheless, reaching female farmers through female plant doctors has been a challenge.

In areas where cotton and rice are grown, women are involved in farming, particularly the transplanting and harvesting of rice, so they are more likely to make use of advice provided by female plant doctors. In rainfed, hilly areas close to the capital city, such as Rawalpindi and

Attock, landholdings are small and women tend to be involved only in kitchen gardening or are more educated and not involved in farming. In these areas, the services of female plant doctors have not been well accessed. However, it is envisaged that this will change over time as more females become part of the extension system – and this will make it easier for female farmers to interact with female plant doctors and access plant health advice.

Maintaining plant doctor capacity is a concern. Several of the plant doctors trained in the early years have moved on to other positions. Staff turnover is considerable and funds are insufficient to keep up with the demand for training of new people and equipping the clinics. This affects both the performance of clinics and data management. To avoid erosion of the capacity built, CABI's backstopping support, both financial and technical, for training of new master trainers will be required over the coming years.

Whilst Pakistan is working to centralize its data management system, there are nevertheless issues with data collection. In Punjab, data collection is becoming digitalized and 600 laptops have been provided by the Punjab government for plant doctors to enter paper-based data. A further 3,600 tablets have been provided by Government of Punjab to agriculture officers, which will also be used by plant doctors to run plant clinics and record query data in the Plantwise data collection app (DCA). However, older officials are not willing to work electronically and learn how to use digital equipment.

Plant doctors who do use the DCA face issues in retrieving or retaining data once it is submitted as they are unable to access the data system. To retain a copy of their recommendations, they have to print a copy so that they have an official record to fulfil their key performance indicators (KPIs). Overall, 80% of plant clinics remain paper-based and CABI still provides prescription books, as paper is viewed as important for accountability, planning, and follow-up.

As a result of the cumbersome data collection process, data to POMS comes from around 170 clinics mainly in Punjab, with some clinics outside this area submitting only a few queries. However, it is envisaged that more data will be submitted to the NDC (via POMS) now that the MoU with Punjab is signed.

In conclusion

The future of plant clinics and plant health data collection looks bright in Pakistan, with strong government ownership and engagement and a commitment to set up its own national data centre for strengthening its plant health systems. Yet, for the time being, Plantwise Pakistan remains dependent on CABI's close engagement to build national capacity and establish procedures that fit institutional structures, roles, and capacities.

With the new MoUs signed with CABI (under PlantwisePlus, which includes backstopping support to plant clinics), it is envisaged that further refresher trainings will be given to master trainers, plant doctors, and data managers, particularly in new provinces. In addition, existing clinics will be rejuvenated with infrastructure like furniture and clinic materials as needed. National investment in Plantwise activities depends on the priorities of provincial governments who are independent of the federal government. Priorities may vary from province to province, and year to year, and are often influenced by the views and experiences of particular personalities within the system, who may or may not have an affinity for agriculture and

extension services. Hence, the commitment of key decision-makers is crucial for continuing support.

The influence of personalities is particularly evident, with CABI staff leading the programme knowing people at every level and being well-respected. Stakeholder events are well attended, such as the one held on 15 December 2022 with broad, high-level representation of key stakeholder institutions (Plantwise blog, 2022). Succession is, however, a critical issue for CABI activities in Pakistan, not only for Plantwise, although CABI staff work as a team, with senior staff preparing colleagues alongside them so that CABI's role can be maintained.

It is also important to be realistic. Pakistan is a huge and complex country. Strengthening national and provincial plant health systems takes time and involves many actors. While the national forum provides a valuable platform for discussion and collaboration, different institutions (MNFSR, PARC, DPP, etc) have differing mandates and priorities. All are working for farmers, but not always in the same direction – and this can sometimes slow down progress. Nevertheless, the establishment of the national forum is a step in the right direction towards strengthening the connections between key plant health stakeholders.

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Collaboration nation: multi-stakeholder support for plant health action in Jamaica

Yelitza Colmenarez and Chantelle Pattemore

Year Plantwise started: 2015

Active partners and roles:

- Ministry of Agriculture and the Rural Agricultural Development Authority (RADA) national responsible organization and local implementing organization
- Ministry of Industry, Investment and Commerce supporting activities and diagnostics
- University of West Indies; Caribbean Agricultural Research and Development Institute; Pesticide Control Authority – working together as a steering committee

Active plant clinics ('mobile plant doctors'):

- 2021: 122
- 2022: 121
- Clinics established in total: 122

Uptake of Plantwise elements in policy, strategy, procedures:

- Plant clinics ('plant doctor services') were included in the Priority Programmes of RADA's Strategic Business Plan for 2018–2021 and 2022–2025
- The plant clinic work has been included in the plant doctors' annual work plan

National investments in PW activities 2021–2022:

- 2021: GBP 8,813 for plant clinics (direct costs) within RADA's operational plan and budget
- 2022: GBP 9,452 for plant clinics (direct costs) within RADA's operational plan and budget

Plantwise in Jamaica

Plant clinics and their corresponding activities began in Jamaica in 2015. At a national level, the Plantwise programme, or as it is called in Jamaica, the 'Plantwise Plant Doctor Programme', was rolled out by the country's Ministry of Agriculture and Fisheries (MoAF) through the Rural Agricultural Development Authority (RADA). Meanwhile, the Ministry of Industry, Investment and Commerce was also involved in conducting Plantwise activities and diagnostics. Through its associations with the market board and commodities group, this Ministry was able to organize and work with extension officers and assist in problem-solving issues. Finally, a steering committee, comprising members from organizations including the commodities groups, market board, Research Division, Quarantine Unit, University of West Indies, the Caribbean Agricultural Research and Development Institute, and the Pesticide Control Authority, served to oversee programme activities. This group meets twice a year, to initiate plans and assess the progress. The committee's broader, high-level agenda makes it significantly more advanced than the steering committees of most other Plantwise countries. Because CABI's funding for Plantwise Jamaica was minimal, co-financing was necessary from the beginning and this encouraged greater commitment and ownership from partners. This independence from CABI has also enabled the steering committee to continue even as the Plantwise programme has come to an end.

While funding for plant clinics through Plantwise ceased in 2020, their activities and successes continue. During Plantwise, 122 plant clinics were established in Jamaica – and, impressively, 121 still run today. In Jamaica, a plant clinic is defined slightly differently than in most other

Plantwise countries. There, they are called 'Plant Doctor Clinics', indicating that it is the actions of the plant doctors that define them. As of 2022, most plant clinics are mobile and run by individual plant doctors, which explains the continuing high number.

To date, nearly 11,000 farmers have been reached through the clinics – with about a quarter of this figure being women. The clinics' successful continuation is largely due to the fact that the MoAF and the RADA took strong ownership of the programme and institutionalized its components into their Strategic Business Plans for 2018–2021 and 2022–2025 (MoAF, 2020), as formulated in the results framework 'Mainstreaming of plant doctor services into RADA's extension delivery.'

Plantwise has made a significant difference to Jamaicans involved in plant health: from farmers and extension workers to researchers and regulatory bodies. Meanwhile, the Plantwise Knowledge Bank and the plant health data – collected through POMS via the DCA – continues to be appreciated by the Ministry of Agriculture. Together with the RADA, the Ministry of Agriculture is keen to ensure these platforms' longevity, so they can continue to use information to understand and respond to agricultural problems in the country.

What has worked well

Good plant health cannot be achieved by one party alone: it requires many actors to connect and work together. Previously, those involved with plant health in Jamaica – such as farmers, extension researchers, workers. and input providers - rarely communicated with each other. However, as a result of Plantwise, these parties now contact each other frequently and directly. This not only ensures they remain on the same page, but also allows them to initiate approaches to effectively tackle plant health issues. For instance, these groups have worked together, and still do, to run Plant Health Rallies: events that bring together many farmers so they can be efficiently informed on a specific issue at scale (Plantwise blog, 2018).

Training has been an integral factor to the success of Plantwise in Jamaica (through the 'Plantwise Plant Doctor Programme'). Over 100 plant doctors have been trained by ToTs – a group



Fig. 2. Announcement of the 2021 Plantwise Awards ceremony, Jamaica.

organized by the Research and Quarantine units, RADA, and MoAF – with these individuals being selected from RADA and other associated institutions, such as the commodities group. RADA has been instrumental in the doctors' continued learning and development, paying for them to undertake CABI Academy training courses. Furthermore, to aid in incentivizing the

plant doctors, management at Plantwise and RADA organized a national televised event, during which the best performing plant doctors were recognized and given awards (Fig. 2). Winners were selected not only on the amount of recommendations given to farmers, but also on the quality of these – with farmers reporting their levels of satisfaction and how effective their plant doctor's recommendations were (Plantwise blog, 2022).

In addition, faculty members and students at the College of Agriculture Science and Education (CASE) have also been trained by the ToTs on various Plantwise components – with a more condensed curriculum being used to help maintain engagement. This shortened version has proven so successful that other organizations have since approached CABI and asked to use it for farmers. Meanwhile, there is also a plan to offer final year students an elective of the Plantwise Plant Doctor Programme.

The POMS – which contains a wealth of data relating to plant health and farmer activity – has proven a critical new tool, as hard data in this area was previously limited. Information has been collected through the DCA, with plant doctors entering data following consultations with farmers. Not only are these insights used by the MoAF and RADA, but they are also relied on by private sector actors as part of their business strategies in targeting farmers, along with community colleges and other research institutions, such as the Inter-American Institute for Cooperation on Agriculture (IICA).

Unlike most other Plantwise countries, entry of farmer query data into POMS has been consistent in Jamaica, and even increasing over the last years (Table 1) – confirming strong ownership and commitment to clinic data management and use.

Due to the fact that Jamaica's Plantwise programme was launched a few years after other countries, the team was able to learn and benefit from the experiences of others. For instance, the data validation process introduced by Plantwise had turned out to be too time-consuming in
 Table 1. Farmer queries from

 Jamaica recorded in POMS by

 101

16th January 2023.	
Period	#records
2019	2,894
2020	1,738
2021	3,046
2022	3,403
Total (2015–2022)	12,401

most countries, and unfeasible for routine monitoring of the quality of diagnoses and advice. To avoid similar challenges, the Jamaican partners opted for the simpler quality assessment (QA) tool – introduced in the training course 'Monitoring Plant Clinic Performance' – as an alternative means to validate the clinic data. The QA procedure is based on simple questions and answer options (Table 2), supported by a one-page guide.

Item	Diagnosis	Advice						
Overall QA question	Does the symptom description match the diagnosis?	Is the advice given of good quality?						
Answer options	Y –Yes; P –Partially; N –No; CA –Can't assess	Y–Yes; P–Partially; N–No; CA–Can't assess						
Aspects to consider when carrying out the assessment	 Are the symptoms described <i>typical</i> of the diagnosed problem? Is the description <i>precise</i> enough (not too vague or contradicting)? 	 Does the advice work? Is it safe? Is it feasible? Are main 'best practices' included? Other key aspects to consider? 						

Table 2. Basic features of QA tool used in Jamaica to assess the quality of diagnoses and advice from clinic records (CABI, 2016).

A technical group, with people representing Research and Quarantine units and RADA, carry out a quarterly quality check using the QA tool on a sub-sample of the plant clinic data in POMS. These regular checks help to identify what topics need to be addressed in plant doctor trainings, as well as any weak points that need to be followed up on.

Challenges encountered

Initially, fixed clinic locations with set dates and times were proposed for Jamaica's clinic implementation. However, because of the nature of the country's extension system, mobile plant clinics and consultations were found to be more effective and are now the primary approach used by plant doctors ('mobile plant doctors').

Another early challenge was posed by extension officers. Initially, they were reluctant to take on Plantwise activities as these were seen as 'extra work'. Fortunately, as the programme evolved, they recognized and understood the benefits for farmers and the agricultural sector – so they became more willing to engage. Making plant clinics part of their formal role and increasing accountability has been crucial to the institutionalization of the plant doctor role.

While the DCA and POMS have proven invaluable for data collection and sharing, they weren't without their issues. For instance, plant doctors encountered multiple, recurring technical difficulties with both platforms, and had to rely on members of CABI's Knowledge Bank team to solve them. Lost data and form entries, along with trouble retrieving previously entered information, reduced trust in the system – and led to plant doctors recording data and providing farmers with recommendations on paper rather than digitally. Furthermore, external organizations (such as other MoAF agencies and IICA) are not able to access data on POMS themselves. Instead, a RADA employee with access to POMS has been given the role as a 'data intermediary'. This person is responsible for data harmonization, and retrieves and circulates data summaries upon request for information from outside parties. However, the static and inflexible nature of the POMS system can prove challenging at times, preventing people from receiving all the information they require. For example, the POMS dashboard features pre-determined data summaries with insufficient possibility for the users to select the data they need.

In conclusion

Improvements need to be made to data collection systems. The data collected by plant doctors is greatly valued, and could be maximized if actors such as RADA were to take ownership of and create data collection platforms of their own. This would provide independence from CABI – crucial as the official Plantwise programme comes to an end – and allow them to improve systems as farmers and plant doctors' requirements evolve.

The reliability issues around POMS eroded trust in the systems. Enhancing data systems and platforms is a necessity in order to rebuild trust and confidence in their use. In addition, improved digital services would ensure that recommendations are provided to farmers electronically rather than in hand-written form. While older farmers tend to prefer paper-based notes, there is a large number of young farmers joining the workforce who are technically savvy and more open to receiving digital communications. Digitally recorded data is also easier and faster for MoAF to replicate and distribute.

It is crucial that training, particularly for new plant doctors, continues. Many existing plant doctors are nearing retirement age, meaning there is potential for their numbers to sharply decline in the near future. However, with ongoing training being conducted in places such as CASE, it is hoped that numbers can be retained.

Thanks to the Ministry of Agriculture and RADA's enthusiastic and continued support for Plantwise from the outset, along with a government structure that's conducive for supporting agriculture, many of the programme's associated activities continue to date. The installation of a new government cabinet is a potential concern, as this may lead to a change in priorities and result in less support for plant health incentives. That said, such a shift could lead to the development of opportunities with new actors, especially those in the private sector.

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Money matters: funding restrictions hinder plant health progress in Ghana

Birgitta Oppong-Mensah, Victor Attuquaye Clottey, Copperfield Banini and Peter Ketting

Year Plantwise started: 2012

Active partners and roles:

- Plant Protection and Regulatory Services Directorate (PPRSD) of the Ministry of Food and Agriculture (MoFA) – National responsible organization and local implementing organization
- Local Department of Agriculture implementing plant clinics

Active plant clinics:

- 2021: 32
- 2022: 18
- Clinics established 2012-2019: 248

Uptake of Plantwise elements in policy, strategy, procedures:

• Plant clinics included in 'Investing for Food and Jobs 2018-2021: An Agenda for Transforming Ghana's Agriculture 2018-2021'

National investments in PW activities 2021-2022:

 Bono Region Department of Agriculture provided GBP 800 in 2021 for monitoring and backstopping of plant clinic activities

Plantwise in Ghana

Plantwise started in Ghana in 2012. The Ministry of Food and Agriculture's (MoFA) Plant Protection and Regulatory Services Directorate (PPRSD) – the country's national plant protection organization (NPPO) – became the national responsible organization for the programme. PPRSD and the Directorate of Extension Services (DAES) jointly became the local implementing organization, with DAES field staff in the districts and regions being trained as plant doctors. Major Plantwise funding for the running of plant clinics ended in 2020 – although some financial support was provided after 2020 for staff training in surveillance and pest prevention, rather than the running of clinics themselves.

Although plant clinics were included as a tool for surveillance and pest prevention in the governments' National Agricultural Investment Plan for 2018-2021, 'Investing for Food and Jobs' (MoFA, 2018), there was no specific budget for clinic implementation.

In the last two years, whilst the PPRSD/MoFA allocated some funds (GBP 800) to support the monitoring and backstopping of plant clinic activities, there has been a steady decline in Plantwise activities. This is mainly due to a lack of sufficient funding from the government and other implementing partners – primarily Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), who had been providing support to clinics via PPRSD since 2017. Consequently, plant clinics have only been run by the most active plant doctors as part of their normal extension activities; in 2021/22, only about 5% of plant doctors still continued to run traditional plant clinics.

Nevertheless, it is acknowledged that Plantwise has left a significant legacy in Ghana by increasing awareness of and prioritizing plant health issues – not only in PPRSD/MoFA, but

also across academic institutions. Prior to working with Plantwise, PPRSD had few districtlevel staff and generally low recognition among extension staff (e.g. frontline staff operating the clinics). However, following the partnership, extension workers became more aware of PPRSD's value – and came to appreciate the training and support for day-to-day plant health issues it provided.

Within the academic sphere, agriculture was previously taught mainly in terms of agronomy, soil fertility, and varieties, and their contribution to crop productivity. Little consideration was given to the role of plant health in attaining high productivity and quality of produce for the market. However, in implementing Plantwise, staff at both The Council for Scientific and Industrial Research and universities were trained to help provide diagnostic services. For example, at the University for Development Studies, located in the north of the country, Plantwise influenced a restructuring of the curriculum at the Faculty of Agribusiness and Communication Science. In the training of extensionists at the institution, greater emphasis was put on plant health education through a strengthened focus on entomology and pathology. Currently in Ghana, food safety is given higher priority at a national level in addition to plant health issues, and forecasting services are also seen as important.

What has worked well

Plant clinics have played a key role in the community pest and disease surveillance that has been vital to the plant health system of the country. For example, fall armyworm (FAW) in Ghana was initially identified as an issue by a plant doctor in 2016 (CABI, 2017). As part of the response to tackle the pest, a multi-stakeholder FAW National Taskforce was created, and charged with advising the MoFA and coordinating the FAW response with support from Plantwise and CABI's Action on Invasives programme (Kansiime *et al.*, 2020; Williams *et al.*, 2021). This, in turn, led to the re-evaluation and updating of the old invasive pest strategy, to become the National Invasive Species Strategy and Action Plan for 2020–2030 (Republic of Ghana, 2020) leading to the disbanding of the FAW National Taskforce.

Many other plant health developments, including initiatives to increase use of low-risk pesticides and biocontrol methods have been evident in recent years. While these were not all directly a result of Plantwise, the programme opened the door and led to greater collaboration between agriculture and environmental agencies. For example, guidelines were developed, with input from CABI, for a regulatory framework for procurement and use of biocontrol agents (Ghana News Agency, 2020).

Another off-shoot of the collaborative environment created during the FAW outbreak was the development of forecasting services – with CABI's Pest Risk Information SErvice (PRISE) project, launched in Ghana in 2017, providing pest alerts to farmers. Backing from MoFA helped raise the profile of this initiative and encouraged the joining of other organizations not originally involved in Plantwise – such as Farmer Line, the Ghana Meteorological Agency, and the Cocoa Institute of Ghana. Although PRISE has now officially ended, the monthly forecasts of selected pest incidences are still sent via the Telegram platform to plant doctors and other extension stakeholders, who relay the messages to farmers. Information alerts are broadcast through community information centres via megaphones, while messages are also delivered to extension workers' phones (CABI News, 2022).

Over the years, around 600 extension agents have been trained as plant doctors. The demand for training in plant health issues by non-plant doctor staff has been evident, as plant doctors'

increased confidence is recognized and valued, and other extension staff refer to plant clinic materials, particularly the Plantwise Factsheet Library app. The recognition of plant doctors was expressed by one District Director as follows: "*The plant doctors are exceptional in the way they carry out pest and disease management programmes in the districts compared to their colleague extension agents*" (Oppong-Mensah, 2020). Some plant doctors have also served as a resource for further capacity building, as explained by another District Director: "*During District meetings, the plant doctors were given the platform to train their colleague extension agents on pest problems and their management. This has gone a long way to help us as Directors, since it has taken a heavy load off our shoulders. More precisely, we use them as experts during trainings on pest issues*" (Oppong-Mensah, 2020).

Thus, despite the demise of most traditional plant clinics, plant doctors' knowledge and skills continue to be deployed in different ways. For example, plant doctors have embedded plant health extension activities into their regular farmer field visits. In that way, farmers are still benefitting from plant doctors' expertise, albeit outside a clinic setting. Some plant doctors do, however, continue to request extra financial support to run mobile clinics, since their services are sought beyond the communities in their operational areas. The number of plant clinics run in the traditional way in 2022 was 18.

Social media platforms, such as WhatsApp and Telegram, remain a critical tool for supporting pest diagnosis and knowledge sharing amongst plant doctors. Meanwhile, the Plantwise Factsheet Library is the preferred reference option for pest and disease information, with some even using it on their personal phones when they had not updated their tablets.

In some regions, plant doctors also provide weekly advice through community radio stations to raise farmers' awareness to particular pest problems. Slots are given to MoFA, who encourage plant doctors to use these as an opportunity to talk about pest and disease-related issues. Depending on the radio station, between 1,000-20,000 listeners are reached in local languages during each broadcast. However, with no monitoring of what is said during the sessions, there is a challenge of how to maintain the quality of the information provided in order to avoid wrong or poor advice being given to farmers.

Challenges encountered

As in other Plantwise countries, Ghana has struggled with data collection and management. The need for data is recognized, but plant doctors find it a drudgery to fill in the paperwork. For instance, if 10 farmers come with the same issue, it takes considerable time to fill in the query form for each one. To overcome the issue, plant doctors innovated by providing group advice and only filling in one form for a particular issue.

Problems have also been experienced with using tablets. Internet data is no longer paid for as part of the Plantwise support, meaning that some plant doctors struggled to update their tablets with the latest software. Lack of digital storage space is also an issue, which becomes an additional disincentive to collect data. In a 2021 field survey, it was found that almost all plant doctors were no longer using the DCA. Most plant doctors are not keen on using their personal phones for work purposes, and internet data has to be paid for by them in order to submit plant health data, irrespective of the device on which data is submitted.

In essence, there is no incentive for plant doctors to continue to collect farmers' plant health queries and submit them to POMS. While plant clinics operations were funded by Plantwise, the task of collecting and submitting data was part of what the plant doctors were paid for.

However, neither the plant doctors nor the district managers made much use of the data due to no formal structure being in place through which to share it. The result was that the PPRSD became the main users of the data with infrequent data sharing and use beyond national level organizations. Once Plantwise ended, the funding gap for clinic implementation immediately ceased the entry of data into POMS. Yet, even if funds had been available to run clinics, PPRSD would likely not have continued with data collection as introduced by Plantwise: the process was deemed to be too laborious and not fitting with the purpose and structure of PPRSD. Instead, the plant clinics were valued for the opportunities they created for close interactions between farmers and plant doctors on plant health issues.

Whilst District Directors were reported by plant doctors to be supportive, in reality they have found it difficult to allocate funds from their operational budgets to finance plant clinic activities. A 2021 study led by CABI (unpublished) came across two District Directors who use their vehicles to send plant doctors to communities to conduct clinic activities; one of these Directors was a previously trained plant doctor and the other was not. But these are exceptions more than the rule.

In conclusion

An essential issue at field level is how to maintain the quality of information being provided to farmers. There is a demand for new/refresher plant doctor training, but funds are required. Interest remains high among extension officers in Plantwise plant doctor training. Pest and disease management is a key area, but is one that extension officers often feel uncomfortable discussing for fear of inadvertently passing on incorrect information. As such, they have a constant demand for training and information to avoid such scenarios. To support ongoing training, there is a need to find other agencies, such as GIZ and the Food and Agricultural Organization of the United Nations (FAO), who can fund this as part of their support to extension delivery in the country. Some trained plant doctors have now risen to senior positions within their districts and are using the knowledge they acquired to train new extension agents who have joined the service. Bono Region took the initiative to train new plant doctors using a low-cost approach, whereby the district footed part of the bill, with facilitation support from PlantwisePlus.

At the beginning of Plantwise, PPRSD had very little representation in the districts. However, in 2019, PPRSD began a massive recruitment of district plant health officers – 373 as of now, who in many cases work together with the district extension staff. PPRSD staff have been brought into district offices as young recruits – whereas it is the older district extension officers, trained as plant doctors, that have the plant health knowledge. In hindsight, as stated by a CABI team member, we missed the opportunity to train these new PPRSD officers as plant doctors while Plantwise was still running. This would have ensured a cadre of young PPRSD officers with the necessary knowledge and skills to operate plant clinics, either on their own or in collaboration with district extension officers.

Plant doctors close to border areas have suggested that extension officers at border entry points be trained to diagnose pests and diseases, as they often come into close contact with plant materials crossing the borders. This suggestion can be taken up under the surveillance activities under the PlantwisePlus programme.

However, for new and existing plant doctors, there needs to be a review and adjustments made to how data is collected to simplify the process and facilitate more proactive data use.

One suggestion was for a weekly tally to be provided to senior staff for reporting/surveillance purposes, rather than uploading each individual query form. It would also be helpful if free internet services were available at district level to PPRSD and extension staff.

For plant clinics to be taken forward in any form, plant doctors need to be involved: they know what is needed and could suggest ways to make them work. There is a need for more agile, interactive ways of working. For example, plant doctors are used to sharing images on social media (WhatsApp) – and if many were sharing images of the same plant health problem, then it could be flagged as an issue. Record keeping is critical, as this enables PPRSD and CABI to assess how many farmers are being reached by plant doctors. However, plant doctors also need to retain a copy of the data for their own purposes to monitor responses and follow up with farmers. Once submitted digitally, data is currently not available to plant doctors.

Overall, the government retains an interest in improving plant health systems, but insufficient funds are available, given other competing priorities. The district level also lacks funds to update devices and run clinic activities. The clinics are recognized as being incredibly useful and actors within the plant health sector don't want to see them disappear. But, to ensure their survival, procedures need to be simpler and less costly to implement, and local systems are required for training and re-training extension officers and plant doctors.

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A hard reality: policy intention vs practice in Kenya

Florence Chege, Willis Ochilo, Linda Likoko and Chantelle Pattemore

Year Plantwise started: 2012 (pre-Plantwise pilot from 2010)

Active partners and roles:

- Ministry of Agriculture, Livestock, Fisheries and Co-operatives (MoALF&C) National responsible organization
- County governments running plant clinics
- Kenya Agricultural and Livestock Research Organization (KALRO) funding support for plant doctor trainings (ongoing)
- Kenya Plant Health Inspectorate Service (KEPHIS) staff running clinics (ongoing)

Active plant clinics:

- 2021: 45 according to clinic records, could be more
- 2022: irregular clinic operations, number not known
- Clinics established 2012-2022: 312

Uptake of Plantwise elements in policy, strategy, procedures:

- Plant clinics are included in at least 13 county governments' Integrated Development Plans (albeit differently). This may change following the installation of the new government
- Performance contracts of some senior staff (few counties)
- Plant clinics mentioned in Kenya Agricultural Sector Extension Policy (2022)
- Plant clinics included in the revised Plant Protection Bill (2021) and Plant Protection (General) Regulations (2021)
- Plant doctor training and plant clinics included in KALRO's Strategic Plan 2017-2021

National investments in PW activities 2021–2022:

- 2021: GBP 33,566 allocated by KALRO to plant doctor training by national trainers; GBP 5,705.46 provided by Self Help Africa for clinic operations in Kwale County; GBP 3,868 provided by KEPHIS for their own work/research projects which incorporate Plantwise activities, such as plant doctor training and running of plant clinics
- 2022: KALRO provided funding for training (amount not known); Self Help Africa continued to support a number of clinics (number and amount not known)

Plantwise in Kenya

In Kenya, the Plantwise programme was launched in 2012 by the Ministry of Agriculture, Livestock, Fisheries and Co-operatives (MoALF&C) after two years of piloting under the Global Plant Clinic (Murithi *et al.*, 2013). Plantwise began with grand geographical ambitions, eventually reaching 27 counties (out of 47) and 65 sub-counties in total.

Between 2012 and 2020 (when CABI funding for the programme ended), a total of 301 clinics were established – and, by 2020, 295 were still officially in operation, run by the 709 trained plant doctors. Funding for the set-up of plant clinics was mainly provided by CABI, with finances covering several key areas: training of plant doctors, obtaining materials for the clinics, and providing plants doctors with money for lunches (safari day allowance) and mobile data bundles. Over the years, a number of institutions also supported building of the clinic network, including Self Help Africa, Kenya Agricultural and Livestock Research Organization (KALRO), Kenya Plant Health Inspection Service (KEPHIS), Biovision Trust, GIZ, and some county governments, among others.

However, the onset of the COVID-19 pandemic, as well as budget constraints at the counties, disrupted much of the good work that was being achieved by plant clinics and doctors. Their routine schedules still have not returned to pre-pandemic status. In spite of challenges, there are lasting legacy elements from Plantwise. For instance, the data that was collected by plant doctors and recorded through POMS can be utilized and reflected on for years to come. Furthermore, reference materials, such as factsheets and Pest Management Decision Guides (PMDG), were developed and distributed as part of Plantwise, and these are still being used today.

What has worked well

Plantwise played an important role in improving institutional coordination within the national plant health systems under the leadership of MoALF&C (Bonilla *et al.*, 2018). The idea of applying a systems approach to plant health resonated with partners and has inspired a number of additional initiatives to respond to plant health threats; for example, when FAW and *Tuta absoluta* hit Kenya. A concrete sign that plant clinics are accepted as a relevant service, both for plant protection and extension, is the inclusion of plant clinics in both the Plant Protection Bill and General Regulations (Republic of Kenya, 2021a,b) and the Kenya Agricultural Sector Extension Policy (MoALF&C, 2022). However, the Extension Policy appears ambiguous in its support, regarding plant clinics as responsive, timely, and helpful in reducing pesticide risks and crop losses, but costly and time-consuming to run.

In order to support the scaling out and institutionalization of plant clinics, CABI and MoALF&C spearheaded the development of Standard Operating Procedures (SOPs) to guide partners as they came on board. The SOPs document, developed in 2018, laid out clinic operations and quality assurance measures to ensure that plant doctors provide good quality services to farmers (Chege *et al.*, 2020).

Training has been a crucial element to Plantwise's success in Kenya. Over the course of the programme, over 700 individuals were trained as plant doctors, with many reporting that they regularly use their plant health skills and knowledge obtained during teaching sessions (Bonilla *et al.*, 2018). Even though CABI's funding and Plantwise have officially ended, farmers and external actors continue to look to Plantwise-trained plant doctors for guidance and advice as they are viewed as knowledgeable and trusted experts.

Plant doctor training has been a key part of the programme's success in Kenya, and still continues today through government organizations such as KALRO. Plant doctor training and clinic operations were included and budgeted for in KALRO's Strategic Plan for 2017–2021 (KALRO, 2017).

Multiple factsheets and reference materials were created during Plantwise, many of which are still used today. However, several of these require updating. The PMDGs and photosheets – used on-site to help advise farmers – were highlighted by extension officers as being particularly beneficial. That said, it has been noted that while factsheets and other information resources were kept up-to-date during the course of the programme, these edits and changes often took a while to be made and rolled out to extension staff. The biggest hold ups were getting feedback from the authors of the factsheets on the problems identified by the CABI review team. Going forward, it is crucial that materials continue to be modified (as is currently being done under PlantwisePlus) to reflect new and emerging pests and diseases, as well as new management practices, for example on low-risk pesticides or biocontrol. The use of

biocontrol products in Kenya remains very low (Constantine *et al.*, 2020). KALRO, who continue to produce their own factsheets ('information brochures'), inspired by the Plantwise format, are not reliant on CABI for review anymore, meaning their amendments and rollouts can occur in a timelier manner. A collection of information brochures is being built on the KALRO website⁴.

Challenges

One of the main issues experienced was around the collection of data which is a valuable commodity: the information collected during Plantwise was unlike anything the county governments had access to before. The data aided them in making decisions, specifically in areas such as funding and training, during agricultural meetings. Additionally, it enabled them to highlight the importance of plant clinics. KALRO and the KEPHIS also accessed data to use for surveillance and to recognize emerging trends. Yet, despite valuable data being recorded for POMS during the Plantwise programme, far more could have been collected if better processes and technology had been in place.

Many plant doctors felt frustrated that they were not able to efficiently and effectively enter or retrieve data from provided tablets and POMS. For example, some were unable to turn on their tablets, while others were unable to submit data for a number of reasons, including technical errors and lack of resources to procure data bundles. In some instances, plant doctors also working for other projects and organizations had alternative tablets they were able to use for uploading data to POMS.

Another issue was incentivizing plant doctors who *were* able to submit data. There was no system in place for accountability around posting data on POMS, and even though many were aware of how their data could be used, there was no direct incentive to keep uploading the data. The fact that plant doctors did not need to review or retrieve information from POMS once submitted to the system was another key deterrent. Instead, they used paper to take notes as these were easy to refer to later. Furthermore, only some plant doctors were required to sign performance contracts, which posed another issue for accountability in relation to their overall activities.

Another technology-focused issue centred on the use of WhatsApp. Many farmers are signed up to county-led WhatsApp groups, which allow them to ask questions and troubleshoot issues. While some plant doctors are involved in these groups, the number of farmers asking questions makes it hard for them to provide tailored responses – and record any associated information/data. Furthermore, these chats are also open to sellers and dealers, who offer unsolicited advice and product recommendations to farmers to try to make sales – even though their wares may be unsuitable in managing the problem. CABI was not involved in these groups, meaning they could not intervene and ensure their moderation.

Decentralization has been another major challenge, causing CABI to review and change the way the Plantwise programme was implemented. Initially, the Plantwise team only had to work with one central government. However, following decentralization, they also had to begin working with 14 autonomous local governments – making it more challenging to build good relationships and streamline operations. In essence, each county is a separate government.

⁴ KALRO information brochures on plant health and cropping practices: <u>https://www.kalro.org/information-resources/information-brochures/</u>

Prior to decentralization, extension workers were funded by central government. Yet, after the change in governance in 2013 – during which funding decisions were passed to local governments – the value of these extension workers was not recognized. Finances for extension workers were cut entirely for over a year, and they had to fight to show why their roles were necessary. The work of the plant clinics provided an exemplary example of the importance of extension staff and their activities, and played a key part in re-activating funding for them in some counties (Chege *et al.*, 2020). While some county governments (~13) included plant clinics in their Integrated Development Plans, this is no guarantee that funds are allocated due to the high competition for county resources.

In conclusion

A significant concern during Plantwise – and one that has continued since – is around the capacity of plant doctors and extension officers. Although many extension officers were trained, by the end of the programme, a large number had either retired or were reaching retirement age.

Thus, it is crucial that new plant doctors are trained to replace them. While CABI is no longer involved in plant doctor training activities, government organizations – such as KALRO and KEPHIS – are continuing to train both their own staff members and external individuals, and to run clinics in connection with their own project activities. However, it has been noted that this training is often conducted through project funding, and not as a means to replace or cover the shortfall from existing retiring county staff, which is the responsibility of county governments. Currently, the extension worker-to-farmer ratio in Kenya is highly imbalanced, with around 1 extension officer for every 4,000 farmers. This is far from the target ratio of 1 extension personnel against 600 famers by the year 2029, according to the Agriculture Sector Transformation and Growth Strategy (2019–2029) (MoALFI, 2019).

More support is required from the government and development partners to help get plant clinics back on track and re-establish consistent schedules. A reduction in clinics has also resulted in a significant decline in data being recorded on POMS.

A critical area for improvement is data collection procedures. Extension officers need to be provided with easy but effective means through which to record, and subsequently access, data – and, in turn, this should incentivize them to do so on a regular basis, particularly if it is made a requirement in their job descriptions. Discussions held with institutions following Plantwise's conclusion revealed that the programme has encouraged a positive change in mindsets about the role of data in decision making. They also highlighted the importance of having a coordinated system through which to provide farmers information. However, despite the fact that improved data systems are high on the government's agenda, there are currently no concrete plans to revise or establish a system for plant clinic data. Other agricultural data systems seem to take priority, for example the Big Data Platform⁵ being developed with MoALFI, KALRO and World Bank. Although, POMS data is still accessible, few people post new data to this and there has been no conclusive discussion between CABI and MoALFI on database ownership.

⁵ Scaling up disruptive technologies for agricultural productivity in Kenya: <u>https://reliefweb.int/report/kenya/scaling-disruptive-technologies-agricultural-productivity-kenya</u>

A lack of funding, particularly from the government, was and remains a significant issue. Competition for financial resources means that extension activities – not only in agriculture – remain overlooked. As such, in one county, for example, 80% of funding for agricultural extension activities (currently) comes from external sources. However, the new government cabinet following the 2022 elections is currently looking at prioritizing the strengthening of extension systems, exploring new opportunities and recruiting new extension officers.

Despite the challenging governance and funding situation for agricultural extension in Kenya, the inclusion of plant clinics in key policy documents and the existence of SOPs for clinic operations, provide a tangible platform for leveraging the achievements gained through Plantwise.

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Passion and perseverance: the power behind Malawi's plant clinics

Noah Phiri, Francis Mwale and Chantelle Pattemore

Year Plantwise started: 2013

Active partners and roles:

- Department of Agricultural Extension Services (DAES), Ministry of Agriculture (MoA) national responsible organization, plant clinic implementation
- Department of Crop Development, MoA plant doctor supervision
- Department of Agricultural Research Services, MoA diagnostic support
- Agricultural Development Divisions backstopping and plant doctor training
- Lilongwe University of Agriculture and Natural Resources (LUANAR) plant doctor training
- Mwimba Agriculture College plant doctor training
- Pesticide Control Board plant doctor training, and providing a list of registered pesticides (synthetic pesticides and plant based and biocontrol agents)
- Mzuzu University plant doctor training
- One Acre Fund plant clinic implementation

Active plant clinics:

- 2021: 125
- 2022: 125
- Clinics established in total: 155

Uptake of Plantwise elements in policy, strategy, procedures:

- Plant clinics have been included in:
 - The National Agriculture Policy (2016) promotion of plant clinics as an innovative extension approach
 - The Malawi Growth and Development Strategy (MGDS) III 2017-2022 promotion of plant clinics as an innovative extension approach
 - National Agricultural Investment Plan 2018 plan for establishing 100 plant clinics between 2017/18 and 2022/23

Country investment 2021-2022:

• Agriculture Sector-Wide Approach Support Project II: GBP 210,988 in 2022 for Plantwise activities – training, clinic furniture

Plantwise in Malawi

Launched in Malawi in 2013, the Plantwise programme was led by the Department of Agricultural Extension Services (DAES) and the Ministry of Agriculture (MoA). Funding and support for Plantwise was provided by the MoA from very early in the programme, through the Agriculture Sector Wide Approach Support Project II (ASWAP) (Government of Malawi, 2017a). Additional funding was provided by organizations such as Self Help Africa, World Vision, and Concern Universal – now known as United Purpose.

It's believed the way in which the government was introduced to Plantwise played a key role in its acceptance of the programme. Plantwise ambassadors went directly to the Permanent Secretary – the head of MoA – who, after learning about the initiative, assigned her deputy to present the Plantwise/plant clinic approach to all Departmental Directors and Agricultural Development Division Programme Managers within the Ministry. After deciding as a team that it was something they would like to be involved with, the DAES were tasked with leading the programme. The serious level of commitment shown by the MoA during the early days of Plantwise in Malawi cemented the importance of the programme and helped build a solid foundation.

Although Plantwise funding ended in 2020, many activities are ongoing and the country remains engaged in the process as a whole. The government continues to provide financial resources - including for new plant doctor training – and information and data collected during the programme are still used. In addition, plant clinics have been incorporated into several government policy documents. Of the 583 plant doctors trained during Plantwise, 250 are still working. In total, 125 of the 155 plant clinics established during the programme continue to run. This exceeds the target of 100 plant clinics set out in the National Agricultural Investment Plan for 2017/18 and 2022/23.

What worked well

As noted, strong government engagement with Plantwise was key to its success – particularly in terms of funding and policy support. Since 2016, when plant clinics were first included in the National Agriculture Policy (MoA, 2016), policy support was subsequently reflected in development strategies and investment plans (Government of Malawi, 2017a,b, 2018). Financial resources were (and continue to be) provided annually, with the majority of money from ASWAP going towards plant doctor training. However, some ASWAP funding – alongside that from donors – was also used to run plant clinics.

As well as providing financial support, the government also embraced plant clinics as an extension method. A key tactic of the government extension system has been the development of several 'model villages' in target districts. Supported by ASWAP funding through DAES, model villages are provided with agricultural technologies and approaches (including plant clinics) to deliver extension messages to farmers. Other villages can also visit and learn from the model village activities. The close alignment between plant clinics and model villages has been crucial for the institutional embedding of plant clinics in the extension system.

Plant doctors have been key to Plantwise's success in Malawi – quickly earning their place as trusted and esteemed individuals within communities and the wider agricultural sector. These trained individuals are highly enthusiastic about their roles, and use their knowledge to a great extent – providing advice to farmers through field visits, mobile clinics, and even at Farmer Field Schools. Farmers are also able to contact plant doctors through WhatsApp, where they share crop photos to receive diagnoses and 'treatment' recommendations (CABI, 2019). Other extension staff also turn to plant doctors for advice and consultations on plant health. In one district, the District Commissioner even invited plant doctors to talk to local government staff on specific plant health subjects.

In addition to plant health training, plant doctors were also trained on how to cultivate good working relationships with agro-dealers. This has proven critical as, in doing so, agro-dealers have been made aware of the main plant health problems in their area so that products and services are more tailored and beneficial to farmers. While it has been noted that some agro-dealers go against what plant doctors have 'prescribed' to farmers, the majority have welcomed their input. In fact, a number of agro-dealers even advise farmers to speak with plant doctors before selling products to them.

Alongside plant doctor training, elements of the Plantwise curriculum – Modules 1 (plant health diagnostics) and 2 (how to give plant health advice) and Biological Control – are being taught at Lilongwe University of Agriculture and Natural Resources (LUANAR). The university has two campuses: Bunda educates students working at BSc level and up, while the Natural Resources College trains diploma students who go on to become frontline extension staff. The university cannot officially include Plantwise materials in their curriculum until the next curriculum review in five years' time. However, the university staff are so impressed by the modules that they have incorporated elements into their classes on an 'unofficial' basis, which is allowed by the university. While graduating students might not become plant doctors, the course provides them with valuable plant health knowledge that – particularly among those training to become extension staff – can be used in future to advise farmers.

The approaches taken to help raise farmer awareness about plant clinics also proved particularly effective. Plant doctors were given slots on local radio to discuss plant health matters, and banners were created in local languages to advertise plant clinics as 'crop hospitals.' Plant clinics were also set up at sub-district and district level events attended by farmers. At these events, plant doctors – wearing their plant doctor uniforms (green labcoats with Plantwise Plant Doctor logo and a MoA logo) – tell attendees about the benefits of plant clinics and how they can be accessed.

Finally, farming communities themselves can also contribute to upholding local services – and farmers in Ntcheu district, for example, have demonstrated a commitment to sustaining their much-valued plant clinic. As a means to create a permanent, all-weather-proof facility, a group of farmers clubbed together to fund a purpose-built permanent plant clinic. The farmers and local community managed to raise the money required to build the new facility thanks to increased profits from improved yields – a result of the advice given at the plant clinic (Bentley *et al.*, 2018; Plantwise blog, 2019).

Challenges

While the Plantwise programme in Malawi has proved successful in many ways, it has not been without its challenges.

Over the years, the plant clinic approach has evolved as many plant doctors found that the original plan – to have 'fixed' plant clinic locations, including markets – did not really work. Some farmers were too far away, while market-based clinics were held at times when farmers were not actually there. Instead, the plant doctors established mobile clinics, visiting farmers in their fields – and this is still the approach most used today. Nevertheless, transportation and fuel has been noted as an issue by some plant doctors, especially in visiting those who live in remote areas.

As the programme progressed, getting some farmers to return to plant clinics on a regular basis also proved challenging. In Malawi, human hospitals are known to provide a variety of medicines for free, such as paracetamol. With plant clinics advertised as 'crop hospitals', farmers also expected to receive crop treatments, such as pesticides, for free. Yet, when they realized this would not be the case, enthusiasm levels among some farmers waned, and they stopped visiting the clinics as often. Ironically, some of the plant clinics' successes have ultimately worked against the venture. For instance, when farmers received plant health advice that they found to be helpful, they simply followed the same guidance in subsequent seasons – meaning they did not make return visits to the clinics.

The most significant challenge faced by various actors in the Plantwise programme, however, relates to data. At the start of Plantwise, CABI provided plant doctors with tablets on which they could upload clinic records to POMS via the DCA. Yet, it was quickly discovered that some of these older devices were incompatible with the updated version of the DCA, meaning certain plant doctors were unable to access it. As such, plant doctors took notes in handwritten form – which made it far more difficult for data to be passed on to the MoA. Plant doctors also stated that they favoured handwritten notes as this allowed them to refer to data to check on recommendations provided to farmers as, once data is input and submitted to the DCA, it cannot be re-accessed by the plant doctors. While national ownership of plant clinics is strong, the same is not the case with the data management system. Only a few people have logged into POMS since 2021 and knowledge about POMS and data use is scattered among cluster coordinators.

In conclusion

One of the biggest risks to the sustainability of plant clinics is the availability of plant doctors. While they are passionate about their work, many are coming up to retirement age and others simply do not have their level of knowledge to take over. The government are working to train people, but this is not occurring at a sufficient rate to replace outgoing plant doctors – for instance, only 19 new plant doctors were trained in 2021. In addition, while funding for plant doctor training is provided by ASWAP, this is not always disseminated fast enough. There is hope that the ongoing teachings at LUANAR of frontline extension staff will be beneficial to the sustainability of Plantwise activities in the country.

Improved data collection and management is also vital. To aid plant doctors in their recording of information, a proposal has been submitted to PlantwisePlus that they be given updated tablets. Having the DCA on their phones is an option, except the majority of plant doctors do not have access to a smart mobile phone – and, if they do, access to internet data and connectivity remains an issue. Meanwhile, some have smart phones with limited memory, making it challenging for the DCA to be installed. During a recent CABI survey (unpublished), plant doctors stated that having an overall access point at district level, at which they could input data and guarantee better connectivity, would be preferred – and is an approach that could be explored in the future.

There is also scope to improve access to previously collected data and materials. For instance, POMS data is considered useful for actors such as MoA, Mzuzu and LUANAR university students, and clinic coordinators – but many report difficulties in gaining access to the system. Plant doctors have expressed a desire to access POMS data, and this could be granted.

The Plantwise Knowledge Bank also has potential for greater utilization. While the online Knowledge Bank is currently accessed by some people, mostly coordinators, more could be using the service. Many plant doctors report the Factsheet Library app (offline) as useful, and have installed it on their phones. Enhanced advertising of the app could not only increase uptake, but also be used to highlight the benefit that, once the app has been installed and country packs downloaded, internet access is not required to read and review the information.

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Synthesis and broader lessons

Solveig Danielsen and Susanna Cartmell



Plant doctor Violet Lekadala at work. Mlomba, Lilongwe District, Malawi (Photo: $\ensuremath{\textcircled{}}$ Homeline Media, with permission).

Country ownership

Government engagement and ownership of Plantwise activities has naturally varied across the six study countries and was much stronger in some than others – which has impacted the sustainability of plant clinics and other related activities.

The strongest engagement and ownership was demonstrated in Jamaica. Plantwise started later in Jamaica (2015) than other study countries and, from the start, co-financing was required, which resulted in greater ownership and support from partners. Jamaica's commitment to sustaining the Plantwise approach also extends to the multi-stakeholder steering committee which evolved from a project unit to a permanent, country-owned, high-level coordination and oversight body, not only for plant health but also wider agricultural matters. Strong ownership of the programme also led the MoAF and RADA to institutionalize its components into their Strategic Business Plans for 2018–2021 and 2022–2025 (MoAF, 2020).

Steadfast engagement and support were also evident in Malawi, with funding for activities provided by the MoA from very early on in the Plantwise programme (launched in 2013), through the ASWAP, which was predominantly used to fund plant clinics. The early involvement of key MoA senior managers in shaping the programme turned out to be essential to government ownership. The Malawi government embraced plant clinics as an extension method through its 'model villages' approach and included them in several policy documents. The commitment shown by the MoA during the early days of Plantwise in Malawi cemented the importance of the programme and helped build a solid foundation. Consequently, 125 of the 155 plant clinics established during the Plantwise programme were still running in 2022.

Government engagement has also been strong since the start of the Plantwise programme in Pakistan – particularly in Punjab – where 665 clinics out of the more than 1,000 clinics across the country were established as part of the country's national extension system. Whilst CABI initially trained master trainers in all provinces, since then, all plant doctor training has been funded by provincial governments and all clinics are run by district agriculture extension staff. However, the number of plant clinics has dwindled over the last couple of years while a new MoU with CABI (for PlantwisePlus) was being developed. Despite firm national commitment to plant clinics and data management, the continuing collaboration with CABI is still seen as crucial by country partners.

Decentralization

In Kenya and Nepal, decentralization of the central government impacted Plantwise engagement during the course of the programme and subsequently the sustainability of activities. In Kenya, decentralization, which started to take effect in 2013, meant the Plantwise programme had to interact with 14 autonomous county governments directly, instead of through MoALF&C – making it more challenging to build good relationships and streamline operations. Support and funding for extension staff subsequently varied across counties. During the transition, finances for extension workers were cut entirely for over a year, impacting the number and regularity of plant clinics. As of today, the number of active plant clinics in the country is unknown.

In Nepal, a federal system established in 2015, with the adoption of a new constitution, created a three-tier governance system. This major restructuring proved challenging to effect, and

progress was further hindered by natural and economic crises. As a result, the new devolved structure took some years to implement and become functional, affecting delivery of agricultural extension services – and issues with coordination between the governance levels remain (Tamang *et al.*, 2020). Nevertheless, despite these challenges, the Plantwise initiative has proven remarkably resilient in Nepal, and plant clinics continue to be run as part of all seven provincial government's extension systems. These clinics are staffed by agricultural extension officers trained as plant doctors.

National policies and strategies

Inclusion of Plantwise elements in policy and other official documents has been crucial to sustainability in some countries. In Malawi, the inclusion of plant clinics in national policy and investment plans has ensured continued funding, year after year through ASWAP. The alignment of plant clinics with the 'model villages' approach to extension was essential to the embedding of clinics into the extension system. In Jamaica, plant clinics have become an integral part of how agricultural extension is delivered, and every trained plant doctor has clinic-related performance targets written into their job description.

However, the inclusion of plant clinics in official policy documents is no guarantee for sustainability. Although plant clinics were included as a tool for surveillance and pest prevention in Ghana's National Agricultural Investment Plan for 2018–2021, 'Investing for Food and Jobs' (MoFA, 2018), there was no specific budget for clinic implementation. In Kenya, plant clinics were included in the Kenya Agricultural Sector Extension Policy and plant protection regulations (Republic of Kenya, 2021; MoALF&C, 2022). This has, nonetheless, not prevented plant clinics from declining in numbers. The scarcity of extension staff and funding, as well as unsolved governance issues following decentralization, are likely to affect policy implementation. Also, the ambiguity expressed in the extension policy – i.e. plant clinics are responsive and effective, but costly and time-consuming (paraphrased) – may discourage the uptake of the plant clinic approach by county governments. So far, plant clinics have been included in at least 13 county governments' integrated development plans. However, this may change following the high priority given to agricultural extension by the new government in Kenya, as expressed in the 2022 Agricultural Sector Extension Policy.

Pakistan and Nepal differ from the other countries in that national commitment and investment has largely stayed intact, although plant clinics are more loosely integrated in national policy. Inclusion of plant clinic operations and plant doctor training in annual budgets is happening in spite of this, and in Punjab (Pakistan), running plant clinics is part of plant doctors' key performance indicators. In these two countries, however, continued reliance on CABI as an enabler of stakeholder interactions (e.g. funding of national forum) and for backstop support is evident.

Extension vs. plant health

Whilst agricultural extension departments and NPPOs both contribute to managing crop health, these agencies have different roles, mandates, and ways of operating, which are not always easy to align (Danielsen *et al.*, 2014).

In Ghana, at the start of Plantwise in 2012, the PPRSD, the country's NPPO, and the DAES, jointly became the local implementing organization, with DAES field staff in the districts and regions being trained as plant doctors. PPRSD was the national coordinating body and

conducted backstopping (e.g. diagnostic support) and monitoring, and organized plant doctor training. At the time, PPRSD had very little representation in the districts. However, in 2019, PPRSD recruited a significant number of district plant health officers. These, mostly young, recruits work together with the district extension staff, although it is the older district extension officers, trained as plant doctors, who have the plant health knowledge. In hindsight, it was acknowledged that Plantwise missed an opportunity to train the young PPRSD officers as plant doctors while the programme was still running. Doing so would have provided a new cadre of young PPRSD officers with the necessary knowledge and skills to operate plant clinics, either on their own or in collaboration with district extension officers. Few plant clinics are operational today.

In Nepal, the PQPMC, the country's NPPO, was the Plantwise national coordinator and keen to promote plant clinics. However, PQPMC does not deliver extension services. The extension mandate lies with the provinces, which have become increasingly autonomous following decentralization. Thus, PQPMC relies on well-functioning working relationships with the provinces to stay engaged with plant clinic implementation. Despite the complexities of the federal system in Nepal, the legacy of plant clinics in providing plant health advice to farmers as part of the government's extension system has been encouraging. The development of a policy guidance document (in progress) to set out and provide provision for plant protection across the provinces is expected to strengthen the collaboration between the provinces (extension) and the central ministry (NPPO) – even if it takes some time to be formalized.

Plant clinic data management

Since 2018, there has been a drastic reduction – between 76% and 99% – in the number of plant clinic queries uploaded to POMS, especially from 2020 onwards (see Table 3). Jamaica, where data entry has almost tripled since 2018, is the only exception.

Country	2018	2019	2020	2021	2022	Difference 2018-2022
Ghana	11,922	10,452	1,949	652	90	-99%
Kenya	8,129	2,679	253	190	150	-98%
Malawi	2,766	2,456	881	670	261	-91%
Nepal	1,665	1,730	57	240	80	-95%
Pakistan	76,879	78,292	54,103	32,446	18,500	-76%
Jamaica	1,276	2,894	1,738	3,046	3,403	167%
Total	102,637	98,503	58,981	37,244	22,484	-78%

Table 3. Plant clinic queries recorded in POMS for selected countries, 2018–2022. Green and red figures indicate countries' highest and lowest number of annual records, respectively.

Source: POMS data 2018–2022 (downloaded 16.01.2023)

The decline in clinic operations is only part of the explanation. Many plant doctors experienced problems with the DCA, outdated devices, and connectivity. Tedious procedures and lack of incentives to collect data were reported as common obstacles. However, in Nepal and Pakistan, it is expected that data collection will be revitalized with the approval of formal agreements that will make data collection compulsory for plant doctors.

When Plantwise began transitioning from paper-based to digital forms (e-clinics), it was with the intention to speed up and harmonize the data collection process, and make paper redundant. However, once submitted digitally on their tablet, plant doctors cannot access their own data. Many plant doctors still value paper forms because they allow them to retain a copy of the data for their own purposes. This enables them to monitor responses, follow up with farmers, and prepare monthly reports effectively.

Jamaica and Pakistan, the two countries with the clearest commitment to continued use of clinic data post-2020, have put in place their own data management procedures to sustain their data systems. The establishment of a National Data Centre, hosted at the Department of Plant Protection in Karachi, also demonstrates Pakistan's ownership of their data and commitment to data use for further strengthening its plant health system.

The idea of using plant clinic data to support monitoring and decision-making was widely accepted across Plantwise countries. In reality, though, the clinic data has been under-used in most countries. So far, it is mainly people at the national levels and CABI, who have used the data. Some of the data procedures may need to be reviewed to make sure they are feasible and functional, and that they match roles and work flows within the existing system. POMS could be more user-friendly and flexible, with more options for users to edit, navigate, and analyse their data.

Prioritization of plant health

Whilst, in Ghana, a steady decline in plant clinics and related activities has been observed since the end of the Plantwise programme, a significant legacy remains in the form of increased awareness and prioritization of plant health issues – not only in PPRSD, but also across academic institutions. For example, over time, extension workers have become more aware of PPRSD's value and come to appreciate the training and support it provides for day-to-day plant health issues. During implementation of the programme, Plantwise also influenced a restructuring of the curriculum at the Faculty of Agribusiness and Communication Science at the University for Development Studies. In the training of extensionists at the institution, greater emphasis was put on plant health education through a strengthened focus on entomology and pathology.

In Jamaica, previously those involved with plant health in the country – such as farmers, extension workers, researchers, and input providers – rarely communicated with each other. However, as a result of Plantwise, these parties now communicate and work together to initiate approaches to effectively tackle plant health issues. For instance, these groups collaborate to run Plant Health Rallies: event campaigns which bring together many farmers so they can be efficiently informed on a specific issue at scale (Plantwise blog, 2018).

In Malawi, plant doctors have been key to Plantwise's success – quickly earning their place as trusted and esteemed individuals within communities and the wider agricultural sector. Other extension staff also turn to plant doctors for advice and consultations on plant health. Another notable development in Malawi was that plant doctors were trained on how to cultivate good working relationships with agro-dealers. In doing so, agro-dealers have been made aware of the main plant health problems in their area, so that products and services are more tailored and beneficial to farmers. A number of agro-dealers even advise farmers to speak with plant doctors before they will sell products to them.

At an academic level in Malawi, Plantwise materials – plant doctor training modules and Biological Control training – have been incorporated into lectures at the Lilongwe University of

Agriculture and Natural Resources (LUANAR), and provide valuable plant health knowledge to graduates, particularly those training to become extension staff.

In Kenya, KALRO has begun to produce its own plant health factsheets ('information brochures'), inspired by the Plantwise format. As KALRO is no longer reliant on CABI to review the plant health information, amendments and rollouts can occur in a timelier manner than was the case for Plantwise materials.

In Pakistan, the establishment of a national Plantwise stakeholder forum for plant health in 2020 can be seen as a commitment to plant health. Forum members – including key Plantwise partners such as Pakistan Agriculture Research Council, the Department of Plant Protection, Agricultural Extension Departments from across Pakistan, and representatives of different agriculture universities – meet twice a year to plan, review Plantwise progress, and share experiences in plant health matters. In addition, a national data centre in Karachi was established in 2021 to collate clinic data to further strengthen the plant health system.

Plant clinics vs. plant doctors

Whilst Plantwise initially focused on fixed plant clinics for providing plant health services to farmers, the approach has evolved and been adapted over the years – and plant doctors now interact with farmers in various ways to provide advice. In Malawi, 'fixed' plant clinic locations – including at markets – did not really work. Some farmers were too far away, while market-based clinics were held at times when farmers were not available. Instead, the plant doctors established mobile clinics, visiting farmers in their fields – and this is still the approach most used today.

A similar approach is used in Jamaica, where they are called 'Plant Doctor Clinics'; indicating that the actions of the plant doctors define them. As of 2022, most plant clinics are mobile and run by individual plant doctors ('mobile plant doctors'), which explains the continuing high number; during Plantwise, a total of 122 plant clinics were established in Jamaica, with 121 still running.

In Ghana, with the lack of funding for plant clinics, only about 5% of the most active plant doctors continued running traditional plant clinics as part of their normal extension activities in 2021/22. Nevertheless, plant doctors have embedded plant health extension activities into their regular farmer field visits. Some plant doctors also continue to request extra financial support to run mobile clinics, since their services are sought beyond the communities in their operational areas.

In Malawi and Ghana, plant doctors have used community/local radio to communicate about pest and disease-related issues in local languages. The reach of each radio station varies, but can be up to 20,000 listeners. Whilst this approach increases the access of local communities to plant health advice, there is a challenge of how to maintain the quality of the information provided by plant doctors in order to avoid wrong or poor advice being given to farmers.

A similar challenge exists with the use of social media – for example, WhatsApp and/or Telegram – by plant doctors. In Ghana and Pakistan, these platforms provide a critical tool for supporting pest diagnosis and knowledge sharing amongst plant doctors, and their use could be further developed to support pest and disease surveillance. In Malawi, farmers are also able to contact plant doctors through WhatsApp, where they share crop photos to receive diagnoses and 'treatment' recommendations – but, again, monitoring the advice provided remains an issue. In Kenya, the challenge is even greater, as many farmers are signed up to

county-led WhatsApp groups. Whilst some plant doctors are involved in the groups, the large number of farmers asking questions makes it difficult for plant doctors to provide tailored responses and record any associated information/data. Furthermore, these chats are also open to sellers and dealers, who offer unsolicited advice and product recommendations to farmers to try to make sales.

Capacity

In several countries, even where clinics are no longer run, trained plant doctors are seen as knowledgeable and trusted experts, and farmers and other extension staff look to them for plant health guidance and advice (e.g. as noted in Kenya). In Ghana, district directors have requested plant doctors to provide training to colleague extension agents on pest problems and their management. Similarly, in Malawi, extension staff turn to plant doctors for advice and consultations on plant health and, in one district, the District Commissioner invited plant doctors to talk to local government staff on specific plant health subjects. In Jamaica, a national televised awards event was held by RADA in 2021 to recognize the achievements of the best plant doctors and as a means to incentivize others.

However, one of the biggest risks to the sustainability of plant clinics and plant health provision is the continuing availability of plant doctors in the absence of sustained training. There is a real concern that capacity will erode over time due to high staff turnover and insufficient up-skilling. In Malawi, of the 583 plant doctors trained during Plantwise, 250 remain – yet many are approaching retirement age and other extension workers simply do not have the level of knowledge to take over. The government is working to train people, but this is not occurring at a sufficient rate to replace outgoing plant doctors – for instance, only 19 new plant doctors were trained in 2021.

In Kenya, whilst a significant number of plant doctors were trained during Plantwise, by the end of the programme, a large number had either retired or were reaching retirement age. Government organizations – such as KALRO and KEPHIS – are conducting training to run clinics. However, this is for their own purposes and not as a means to replace or cover the shortfall from retiring county extension staff.

Plant doctors nearing retirement is also an issue in Jamaica – although it is hoped the training of faculty members and students at the College of Agriculture Science and Education on various Plantwise components will help to sustain the numbers. The demand for training in plant health issues by non-plant doctor staff in Ghana has been observed, along with other extension staff referring to plant clinic materials, particularly the Plantwise Factsheet Library app.

Roles of individuals

As with any initiative, successful outcomes are, in part, derived from the passion/commitment of individuals who believe in the approach and strive to make a difference. Plantwise has been no different, and its legacy is evident from those plant doctors who continue to provide their services, at times with little support (such as in Ghana). Those exposed to the Plantwise approach and who witnessed its impacts have also helped in continuing or even upscaling the approach.

In Malawi, for example, the way in which the Plantwise programme was introduced directly to the Permanent Secretary – the head of MoA – resulted in a serious level of commitment shown

by the Ministry during the early days of Plantwise in the country, which helped build a solid foundation for Plantwise activities. Since the programme's ending, the government has continued to provide financial resources, including for new plant doctor training.

The influence of personalities was also evident on the impact of Plantwise activities in Pakistan. The CABI staff leading the programme knew people at every level and were well respected, which resulted in broad, high-level stakeholder representation at key events. In Nepal, despite the constant restructuring of ministries and the relocation of staff, it is evident that the prioritization of training is a result of Directors of Agriculture having previously been trained as plant doctors and involved in Plantwise activities.

Conclusion

The 2020 Plantwise sustainability assessment concluded that: "Plant clinics are very likely to continue to run in most Plantwise countries" (Cartmell, 2021). This follow-up assessment proves this statement to be true for four of the six study countries (Jamaica, Malawi, Nepal, and Pakistan), albeit to varying degrees. In contrast, Ghana and Kenya show how quickly prospects of good sustainability can change due to a shortage of staff and funding and a dwindling priority and lack of resources for agricultural extension.

Recording the number of active plant clinics as the only measure of sustainability would be a mistake. Trained plant doctors use their knowledge and skills in different ways; as part of their extension work, and as plant health experts and trainers in their localities, thus helping to build capacity locally. Plantwise has helped to raise the profile of extension officers and plant health. The 'plant health system' concept promoted by Plantwise, is broadly understood and accepted across Plantwise countries as an organizing principle to guide action on plant health. This is evidenced by the many different ways that plant health stakeholders have collaborated to strengthen ties within the system, as well as the uptake of the plant health system term in country policy documents, proposals, reports, and communication products etc. Over the ten years or more of Plantwise, there has been a distinct change in mindset with regard to looking at plant health management from a systems perspective.

Which is the best 'institutional home' for plant clinics - within the NPPO, responsible for plant protection regulation and disease reporting? Or within the extension department, responsible for delivering advice to farmers? These questions were debated intensely at the beginning of Plantwise and there is no simple answer; the experiences have been mixed, and highly context specific. Making plant clinics part of the existing extension system in Jamaica, Malawi, and Pakistan, gave them a well-defined, stable base. However, in Kenya, the decentralization reform had severe consequences for extension service delivery, including plant clinics. In contrast, placing the national Plantwise coordination within the NPPO in Ghana had consequences for plant clinic sustainability due to the staffing gap between PPRSD and extension. Sadly, the recent, massive recruitment of young PPRSD officers in the districts happened too late for Plantwise to benefit from this boost of human resources. In Nepal, the NPPO-extension link that worked well in the beginning of the Plantwise programme was disrupted by decentralization reform, and is still recovering. Which organizational arrangement works best depends on the specific country context, as well as timing and momentum.

The country cases show that policy can influence sustainability in different ways. Policy support to Plantwise was crucial in Jamaica and Malawi where plant clinic targets, specified in the national agricultural strategies, were well-aligned with the governments' multi-year investment plans. In Pakistan, however, the strong commitment to Plantwise by government partners resulted in the integration of Plantwise activities into the operational budgets of the provincial governments without explicit inclusion in national policy. The opposite was the case in Ghana and Kenya, where the inclusion of plant clinics in national policy documents has, so far, not resulted in the necessary commitment and investment to implement the policy. Furthermore, in Kenya and Nepal, decentralization reforms created protracted uncertainty about funding, staffing, and governance procedures. In such settings, effective policy implementation is severely challenged.

Although country partners acknowledge the value of a clinic data management system, in reality it has proven difficult to establish sustainable, workable procedures in the majority of

countries. The rollout of Plantwise's data management system as a one-size-fits-all solution for all countries did not take specific user needs, organizational structures, roles, and incentives sufficiently into account. Jamaica stands out as one of the few countries with an unchanged commitment to keeping both their plant clinics and data management system active. While all other countries have seen a stark fall in data recorded in POMS, Jamaica has seen an increase and the clinic data are highly valued. Despite the rigidity of POMS and recurring problems with the DCA, they have found a way to make the system work. A clear incentive system for collecting data, with performance targets and rewards for the top performing plant doctors has been part of the solution.

Despite the recent decline in data entry, Pakistan also shows unwavering commitment to upholding their plant clinic data management system. The National Data Centre currently being established in Karachi, is a step towards enhanced country ownership, although CABI's backstop support will be required for quite some time. Any attempt to re-activate data collection in countries where it has not worked, needs to be addressed, with a re-think of the purpose and processes of the system, including roles and incentives along the entire data chain.

Building plant health capacity of extension officers was a major focus area of Plantwise and an anchor point contributing to Plantwise's success. Significant effort by CABI and country partners was invested in training plant doctors and master trainers: in total, over 13,000 plant doctors were trained during the lifetime of Plantwise (CABI, 2021). The challenges of maintaining that capacity have been greater than expected. Loss of plant doctors, as well as data managers, due to retirement and transfer to other positions, is a real concern, and a threat to sustainability. Continued training of master trainers and integration of course modules into national training institutes need further attention.

CABI's continuing support is seen as important to further building and maintaining capacity. The backstopping provided through PlantwisePlus is largely targeted via refresher training, training of new master trainers, stakeholder meetings, and supporting the revision of teaching materials. With the ongoing development of digital support tools and an increasing portfolio of e-learning modules, it is hoped PlantwisePlus will further support countries with relevant knowledge and information.

Each of the country cases show that knowledge on national policy, institutional mandates, mode of operation, and available resources, is paramount to ensure that interventions fit with existing structures and capacities. Sustainability is highly contextual. These country assessments show the different ways in which a particular circumstance, or combination of circumstances, helped or hindered sustainability in one country, while a different set of circumstances was influential in another country. Sudden changes can undermine partnerships and achievements made. This makes it difficult to engineer or promote sustainability. Using a flexible, adaptive approach, in which opportunities are spotted and seized, is vital in such settings.

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Annex: Summary of findings from 2020 sustainability assessment

(Cartmell, 2021)

- Increased levels of linkages between stakeholders will remain, though it is more likely that they will remain on an informal basis.
- Plant clinics are likely to continue to run in most Plantwise countries, though the scale and frequency of the clinics will depend on how the governments are able to fund them.
- Complementary extension methods will also continue with varying methods used in different countries, depending on which method (plant health rally, radio, etc.) fits better with the country's general approach to extension delivery.
- The sustainability of the data management system and use of data is more challenging. While some countries see the value of the data for pest and disease surveillance, there is limited enthusiasm for continued data entry into POMS, or data harmonization or validation, which is seen as time consuming, and little funding is available for harmonization or validation work.
- The information resources developed within the Plantwise programme are highly valued across all programme countries and will continue to be used. There is strong demand for further resource development, but funding and staff capacity mean it is unclear whether further information resource development will take place.
- M&E has had the lowest uptake of the five Plantwise programme areas, as it was a new concept within the extension arena in many countries. It is possible some basic monitoring will continue, such as plant doctor validation at cluster meetings, but it is unlikely that monitoring of plant clinics, training courses, and mass extension campaigns will continue.



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