



KIT Royal
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Synthesis report

**An external review of the PlantwisePlus proof-of-concept
phase, 2021-2023**

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KIT Royal Tropical Institute

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Disclaimer: The views expressed in this paper are those of the authors and do not necessarily represent the views or positions of the organisations involved.

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Acronyms

CSIR	Council for Scientific and Industrial Research
DAC	Development Assistance Committee
EAC	East African Community
ECOWAS	Economic Community of West African States
EPA	Environment Protection Agency
FAW	Fall Army Worm
FGDs	Focus group discussions
FRI	Food Research Institute
HCD	Horticulture Crops Development Authority
HS	Horizon Scanning
ICT	Information and communication technology
IP	Impact pathway
IPM	Integrated pest management
KALRO	Kenya Agricultural and Livestock Research Organization
KEPHIS	Kenya Plant Health Inspectorate Service
KIIs	Key informant interviews
MRL	Maximum residue level
NGOs	Non-governmental organizations
NISSAP	National Invasive Species Strategy and Action Plan
NPPOs	National plant protection organizations
OECD	Organisation for Economic Co-operation and Development
PCPB	Pest Control Products Board
PoC	Proof of concept
POMS	Plantwise Online Management System
PPPs	Plant protection products
PPRSD	Plant Protection and Regulatory Service Directorate
PRA	Pest Risk Analysis
SOs	Specific objectives
SSARC	South Asian Association for Regional Cooperation

Executive summary

Launched in mid-2020, CABI's PlantwisePlus programme builds on the organization's previous Plantwise and Action on Invasives initiatives. It comprises new elements developed from the learnings of these two earlier programmes, which are designed to fill in any gaps and respond to identified opportunities. PlantwisePlus is striving to help sustainably produce more and safer food for the domestic markets which serve populations in six focus countries. This change is being achieved through various interventions – and, to assess the progress made so far during the programme's proof-of-concept (PoC) phase, CABI commissioned an external review.

The review highlights strengths and weaknesses of the PoC, including whether its activities align with its initial objectives and impact pathways (IPs). It also assesses the extent to which it responds to

the performance criteria set by the Organisation for Economic Co-operation and Development's (OECD) Development Assistance Committee (DAC). PlantwisePlus was judged as being highly relevant, efficient, and compatible with interventions led by other organizations, but it was noted that further work is needed in areas such as long-term sustainability and the integration of women and youth into its activities.

In light of this, a series of 25 recommendations have been made, covering aspects such as enhanced pest preparedness and management, increased outreach of plant health services with improved gender responsiveness, promotion of lower-risk plant protection products, and partnerships for increased supply of safer food. These recommendations can be used to help guide CABI during the final months of the PlantwisePlus PoC phase (concluding at the end of 2023), and ensure the programme's activities attain optimal impacts – both now and in years ahead.



Introduction

The PlantwisePlus programme is CABI's new global flagship programme, building upon the Plantwise and Action on Invasives initiatives. It consists of new elements designed to address gaps and opportunities identified through the lessons learned from these earlier programmes.

The overall goal of PlantwisePlus is to 'sustainably produce more and safer food' for the domestic markets serving populations, and has been initiated in six focus countries: Bangladesh, Ghana, Kenya, Pakistan, Uganda, and Zambia. To achieve this, the programme is following three IPs: pest preparedness, through strengthened detection of and responses to pest outbreaks; farmer advisory, by enhancing the capacity of private and public actors to support farmers; and pesticide risk reduction, by improving the use of low-risk plant protection solutions and fostering demand for safer food.

This report presents the findings and recommendations of an external review of the proof-of-concept (PoC) phase of CABI's PlantwisePlus programme, commissioned by CABI on behalf of the programme's donors. While the PoC phase of PlantwisePlus is being implemented in the six focus countries until the end of 2023 (after beginning in mid-2020), the external review looked at progress made up until the end of 2022.

The review was conducted between February and March 2023, with information obtained through three avenues: a desk study of relevant documents; key informant interviews (KIIs) with CABI programme staff at the global level; and fieldwork in three focus countries where PlantwisePlus is being implemented (Ghana, Kenya, and Pakistan). The country case studies helped to gain an understanding of how the programme was being implemented and to obtain insights into emerging early outcomes of the interventions and activities at the national and sub-national level. Qualitative in nature, the review applied different data collection methods, both virtually and in the field with the help of national consultants. These included: a document review; semi-structured KIIs with individuals and groups (51 in total); focus group interviews with farmers (20 farmer groups across the three countries); and a limited online Sprockler survey to collect personal stories related to the programme (24 respondents).

The review evaluated seven performance aspects of the PoC phase – five related to OECD-DAC criteria (relevance, coherence, efficiency, innovativeness, sustainability), and two cross-cutting approaches (gender and youth inclusion, and climate responsiveness). For instance, which interventions and activities can or are leading to positive outcomes, and which are working and to what extent? It also attempts to understand why and how interventions did or did not work in particular contexts. Following these evaluation criteria, recommendations have been made for improvements to strengthen programme components and allow them to be scaled up within the focus countries, and scaled out to other Plantwise countries and some new/fragile countries.

It is important to note that, since the review concerns the PoC phase, research questions regarding the programme's effectiveness and/or the generated impact on final beneficiaries (the other two OECD-DAC criteria) have been considered too early to raise and beyond the scope of the evaluation.



Findings

PoC progress against specific objectives (SOs) and IPs

Many activities implemented in the PoC phase focus on research, partnership development, stakeholder engagement, and policy reform. Even though these occurred in the background to 'set the scene', the number of outputs is impressive.

Several positive early outcomes were visible, especially in the **pest preparedness pathway**, which profits from CABI's newly introduced digital tools, Horizon Scanning (HS) and Pest Risk Analysis (PRA). These tools complement existing work by national plant protection organizations (NPPOs) and other stakeholders. CABI also supported the setting up of facilities for mass rearing of bio-control agents – to manage priority pests.

Results in the **farmer advisory services pathway** are somewhat mixed. Activities initiated earlier in the Plantwise programme – such as the plant doctor-plant clinic model – demonstrated impact. They have positively affected farmer-level outcomes in terms of improved yields, reducing crop losses due to pests and diseases, and/or promoting improved plant health practices. However, they have not progressed to the next stage and been streamlined into national systems, which hinders their wider influence and long-term sustainability. One exception is in Pakistan, where a significant number of plant clinics continue to run thanks to funding from national and provincial governments.

Despite this, much work has been done to upgrade digital tools, online courses, factsheets, and software updates to benefit existing and new plant doctors and other farmer advisory service providers. For instance, the initial Plantwise programme demonstrated that the Plantwise Online Management System (POMS) improved decision-making processes for monitoring pests and planning fund allocation, and enabled plant protection experts to assess the capabilities of the extension system in managing and containing the destructive impact of pests at scale. NPPOs of the countries visited are yet to streamline and update POMS as part of their regular pest data management system. Given that PlantwisePlus is in its early stages, there are less noticeable outputs targeted to end users, particularly farmers.

The **pesticide risk reduction pathway** has been more challenging. For instance, work on registration procedures for bio-protection products is slow, as not all countries have relevant procedures in place. Moreover, promotion of bio-protection products is dependent on adequate supply, affordability, and simultaneous demand creation among farmers. However, there have been some positives. Innovative business model pilots for bio-protection products, for instance, are showing promising results in Kenya. Integrated pest management (IPM) champions, most often women, are generating profits through sales of bio-protection products on commission. Similarly, sustainable service providers (usually young men) stated that their business model allows them to charge for the application (spraying) of bio-control products. Mandatory and/or voluntary food certification standards are seen as an opportunity to promote safer food, but experiences of promoting the standards are mixed.

PoC performance against the Organisation for Economic Co-operation and Development's (OECD) Development Assistance Committee (DAC) evaluation criteria

Relevance. Most stakeholders confirmed the relevance of the PlantwisePlus programme with regard to its ability to address the needs of plant health system actors; primarily in the public sector at national, provincial, and local levels. The programme's activities align with government agriculture sector policies, and its digital tools help strengthen the capacity of NPPOs. They, in turn, support Directorates of Agriculture Extension (DAEs) to advise farmers on managing pest outbreaks and risks, while also promoting sustainable agricultural practices. The strengthening of the plant health systems have also helped identify and prioritize pests, while inclusive/gender-responsive behaviour change strategies are being developed to make plant health services more relevant to all types of farmers.

Coherence. The programme successfully aligns with national policies and donor community goals in the three countries studied. Strong collaboration with government authorities, such as with the establishment of the National Forum

in Pakistan, showcases effective communication and coordination among stakeholders. However, the programme's experience of addressing and promoting food safety standards is mixed, as coherence with national stakeholders is weak. As such, there is room for improvement in certain areas, such as stakeholder engagement, private sector involvement, and capacity building.

Efficiency. The programme capitalizes on CABI's position in national plant health systems, aligning incentives and objectives among different players, and utilizing CABI's international network of experts to guide implementation. PlantwisePlus focuses on preventive measures and early detection, which are more cost-efficient than addressing pests once they are established. The use of digital tools and learning products further contributes to the programme's efficiency, although it is crucial to consider the costs of developing, testing and using these digital products. Concerns regarding resource availability and communication are likely to affect the efficiency of the programme in reaching its objectives.

Sustainability. The sustainability of PlantwisePlus depends on numerous factors: institutionalization and ownership; government commitment and funding; multi-stakeholder coordination, particularly partnerships with the private sector and civil society organisations; scalability and innovation; and, to some extent, commercialization and market integration. The programme has made progress in some countries, but further efforts are needed to strengthen local ownership, increase government investment in infrastructure development and continued service provision and develop and strengthen partnerships, scalability, and commercialization. In addition, the programme has not taken adequate steps to address sustainability to have a lasting impact on plant health systems.

Gender and youth inclusion. The PlantwisePlus programme recognizes the importance of addressing the needs of women and youth in the plant health system. Some steps have been taken to integrate women and youth in the programme – such as through the creation of women- and youth-led IPM service provision models, and strengthening the ability of call centres to reach out to female farmers. However, they do not appear to be part of a well thought out strategy focused on women and youth inclusion, and designed according to the specific needs and contexts of different countries.

Climate responsiveness. PlantwisePlus acknowledges the significance of climate change and its effects. The programme's focus on pest prevention and management, early warning systems, and plant health advisory services and campaigns indirectly helps enhance climate resilience, biodiversity, and soil health. However, although the programme promotes low-risk pesticide production systems to support climate-smart agricultural practices and technologies, it risks weakening its focus on accountability and learning in this area if it does not explicitly highlight that using low-risk pesticides is an integral component of climate smart agricultural practices.

Innovativeness. PlantwisePlus has incorporated innovative approaches – such as digitization, bio-protection, multisector collaboration, use of information and communication technology (ICT) and social media, and innovative business models – to promote resilient, socially inclusive, and safer food systems across Ghana, Kenya, and Pakistan. However, the effectiveness and scalability of these innovations remain uncertain, and challenges exist regarding their adoption, accessibility, and profitability.

Recommendations

The above findings and observations have been used as the basis to develop key recommendations for the scaling and sustainability of the PlantwisePlus programme, with a particular focus on the programme's specific IPs.

1. Pest preparedness pathway

Institutionalize routine risk assessment and prioritize this as a standard country process

R1 Preparation and implementation of pest preparedness and early response plans require leadership by, and coordination between, decision-making mechanisms across and within countries. Work with relevant stakeholders/an NPPO organization to create a multi-sectoral, multi-stakeholder committee – including government agencies, international development partners, private sector, and civil society organizations – taking into

account all expertise and funding sources available to all relevant entities. Active involvement of non-governmental stakeholders could also help monitor and prevent politicization of decision-making processes within the plant health system.

R2 Engage with regional inter-governmental agencies – such as the Economic Community of West African States (ECOWAS), East African Community (EAC), and South Asian Association for Regional Cooperation (SAARC) – to generate a roadmap or integrated action plan that can be resourced by the member country governments.

Inform surveillance and develop risk management plans

R3-1 Assess the relevance of POMS data in pest surveillance and the implementation of prevention and response management plans. The POMS platform allows Plantwise partners and coordinators to upload, store, and manage data relating to fieldwork activities in their countries.



R3-2 Reinforce the need for regular POMS updates and maintenance, and conduct a systematic review of a) barriers to data entry and usage; and b) measures needed to overcome bottlenecks so data can be used by NPPOs for improved decision-making in pest surveillance and management.

R4 Develop additional or alternative pest data entry and management systems by establishing working partnerships. These could be with relevant government agencies or other actors involved in agriculture and allied livelihood promotion programmes, such as agro-input supplier associations, private extension service providers, experts, trader/market associations, and other international development partners, civil society organizations, and farmers. Together, they can provide feedback on the perceived and associated threats of identified priority pests.

Scale biological control options available for targeting pests for the development of species management plans

R5 Assist NPPOs in assessing the feasibility of commercializing microbials and planning country-wide releases of bio-control agents, reared in centralized mass rearing facilities established under PlantwisePlus. Depending on the size and spread of the country, and variation in agro-climatic conditions leading to differences in priority pests, some countries might require support in planning for mass release to cover larger geographies.

R6 Conduct studies to understand barriers to agro-input dealers' promotion of bio-protection products and other low-risk alternatives. Studies should look beyond the need for training and technical knowledge, and include understanding of legal and regulatory barriers, market incentives, and the profitability and feasibility of promoting low-risk products. Providing individual agro-input dealers with technical knowledge to convince farmers might help in the short term, whereas engaging with agro-input dealer associations, wherever active, will help sustain their interest and engagement. In the absence of legal enforcement for the licensing and registration of agro-input dealers across PlantwisePlus countries, development of a voluntary certification scheme for agro-input dealers may be deferred.

R7 Prepare a plan to involve commercial, private sector bio-pesticide companies – both national and

international – to take on identification, research, production, and promotion of bio-protection products and other low-risk alternatives. Share lessons learned by companies already piloting such products through agro-input dealers and last-mile, bundled service delivery models (*linked to R10*).

2. Farmer advisory pathway

Make extension and advisory programmes, including digital and digitally enabled services, gender responsive and inclusive

R8 In partnership with grass-root level development organizations, design social and behavioural change strategies and activities – including mass media and e-extension programmes – to reach and benefit women, but also to empower them to sustain the outcomes by strengthening their agency over production, income, and consumption decisions, including informed choices about which plant protection methods and products to use. Developing such strategies and activities requires good understanding of social norms influencing gender dynamics at household and community levels, as well as engaging with policy-makers to ensure support through policy reforms (related to land rights, childcare, and health insurance, for instance) where necessary. To be truly gender responsive, the programme strategy must deliver benefits that these disenfranchised groups truly value.

R9 The plant clinic-plant doctor advisory service delivery model, established under the previous Plantwise programme, is in decline. Therefore, there is need to explore alternative mechanisms to increase outreach and incentivise the use of the digital tools, apps, and digital learning products developed under PlantwisePlus. Doing so will allow information dissemination to a wider audience, and also co-opt agro-input dealers to provide advisory services. PlantwisePlus should also explore last-mile delivery models involving local youth as service providers. The approach should be inclusive and enable rural women, youth, and other vulnerable groups to effectively access and benefit from the advisory services.

In the interest of long term sustainability, these alternatives require investment and long-term commitment from all stakeholders, including the respective service providers. Using digital tools

to develop a data-driven alerting system based on real time triggers requires efficient technical infrastructure, i.e., communication devices, network connectivity, training, user manuals, guidelines, well-defined data standards, etc. Providing support with PlantwisePlus resources alone might create dependency on government functionaries and affect sustainability in the longer term.

Develop effective business models that embed advisory services and agro-input supply (as bundled services), with attention to creating business opportunities for women and youth

R10 For large-scale roll out of business models, a more thorough analysis of impact and profitability of existing pilots of innovative business models is needed. Use lessons to improve existing enterprises and scale bundled, plant health extension-advisory service provision models which complement public extension services in each of the PlantwisePlus countries. For instance, appropriate pest management products could be bundled with good advice about how to use them in the broader farming system context.

3. Pesticide risk reduction pathway

Identify existing alternatives to high-risk pesticides, and make them available, affordable, and accessible to farmers

R11 Conduct systematic trials to assess the effectiveness of locally-existing biological/nature-based products per stage of crop growth and per crop, taking into account the cost of production, shelf-life, and potential to commercialize production. For example, in Ghana, along with promotion of low cost, home-scale preparation and use of neem products, exploration of the production of similar bio-pesticides – from ginger, pepper, pawpaw, garlic, etc. – is ongoing.

Generally, farmers prefer products that are ready to use and fast acting. However, farmers do not find nature-based products reliable in 'saving' their produce. These products are often cumbersome to prepare at home, and home-scale preparation processes often add to women's labour burden. But,

if found technically feasible and commercially viable, this can be explored as an income generation activity for women and youth. That said, bio-products should be registered and tested by competent authorities.

Facilitate agro-input dealers to recommend and/or sell lower-risk or nature-based protection products

R12 CABI can play a facilitating role in linking agro-input dealer associations to private sector pest management companies and associations. This can support agro-input dealers (who currently do not see any distinct business advantages in promoting nature-based bio-protection products) in their advisory role, by providing them with expert knowledge, technical backstopping, and monitoring of their activities. Involving pesticide company representatives and/or conscientious agro-input dealers in surveillance missions for priority pests could help ensure promotion and timely availability of low-risk plant protection products (PPPs) to avert losses.

Incentivise behavioural change towards the use of lower-risk PPPs and nature-based solutions

R13 Pilot and assess the feasibility of different extension-advisory service models, such as the Agri-business-based Advisory Services or the last-mile Village Based Agent model, including those supported by private sector agribusinesses, in relation to how they can influence different categories of farmers and the level to which they can promote the use of low-risk PPPs (*linked to R10 and R11*).

R14 Build partnerships with organizations that are able to incentivize behaviour change through the development of extension strategies and campaigns towards a reduction in use of high-risk pesticides (*linked to R8*).

R15 Conduct longitudinal studies to track the broader benefits of long-term bio-pesticide use, with farmers as producers and consumers. Making the business case for the use of low-risk PPPs will require evidence – such as economic benefits (in terms of price incentives for quality produce), preventing or reducing losses, and opportunity costs (such as reduced health expenses and increased labour productivities for households who switch from chemical to bio-pesticides).

In Kenya, increasing numbers of farmers are showing interest in using bio-protection products. However, farmers require time to transition from using synthetic agrochemicals to bio-protection products, as they need to experience benefits first-hand. While extension-advisory services create awareness and interest, behaviour change (i.e., change in habits and practices related to low-risk pesticide use) will have to be reinforced by clear demonstration of their advantages in ways that align with and appeal to farmers' needs.

Standards for the assurance of food safety

R16 In the context of enforcing food safety standards, CABI should only provide technical inputs for components related to pesticide use and associated risks. National certifying agencies should be responsible for facilitating and monitoring compliance and certifying produce in collaboration with the concerned government departments.

The promotion and adoption of voluntary, as well as mandatory, standards to produce safe food requires a high level of commitment and consistent support from all parties involved on either (or both) the supply and demand sides. For example, for the mandatory standard KS1758 in Kenya – which provides safety and sanitary criteria relating to the production, handling, and sale of goods such as vegetables and fruits – there is neither strict enforcement nor penalty for non-compliance by farmers. On the supply side, producers, market intermediaries, input suppliers, extension agents, and the certifying agency need to work together to support farmers in complying with these standards, and enforce sustainable market arrangements and premium prices. To abide by and meet (existing) voluntary or mandatory standards and increase the supply of safe food, farmers require both training and facilitation. Extension agents are currently taking on the role of facilitator to enrol, train, and certify farmers, and link to buyers of certified produce. However, this is adding to their high workloads and may not be sustainable in the long-term.

Promote food safety campaigns in formal, established markets

R17 During the development and design of consumer education campaigns for safe food, CABI's support should be limited to providing information and evidence regarding risks and health hazards of

excessive or incorrect use of highly toxic pesticides. This is because developing consumer awareness and education programmes with due care (to avoid social panic on food safety issues), and in response to peoples' risk perception and understanding of potential harmful consequences, is a specialized area and beyond the core strengths of CABI.

Enhancing consumer awareness about pesticide residues in fresh produce and their associated risks can contribute to increased domestic market demand for safe food. This is likely to be most feasible through consumer education programmes in formal markets (supermarkets in peri-urban and urban centres) where most certified produce is sold and bought, primarily by consumers with a higher education and higher income. However, a very large number of low-income consumers – in both CABI's six pilot focus countries and those where the PlantwisePlus will eventually be rolled out – depend on informal markets for affordable food. These markets are often unregulated and produce is not packaged or labelled, and consumers here tend to have a lower level of risk perception of, and attention to, pesticide residues in food.

To support all consumers, PlantwisePlus will therefore have to depend on development partners, private associations and companies, the media, and others who understand how both informal and formal food markets work, and how knowledge and learning is developed and exchanged between actors. However, this might divert much-needed resources and energies from the core PlantwisePlus activities of establishing sustainable plant health systems. Food safety information should be based on post-production pesticide residue analysis results of important food crops per country. The same information could be included in extension advisory services to inform farmers of the risks associated with hazardous maximum residue levels and provide advice on reducing pesticide residues in their produce (*linked to R14*).

Increase government commitment

R18 Develop a clear exit strategy, including capacity building and planning to gradually increase ownership of national agricultural systems and partners so they can integrate PlantwisePlus activities in their respective programmes. It might help to define an entry as well as exit policy. For example, CABI may support a specific number of researchers or staff involved in a research or bio-control rearing programme, and the corresponding institution could

assign a proportional number of trainee staff, and gradually replace research positions with former trainees over a certain number of years.

R19 Despite being crucial to sustainability, the commitment of governments to fund and support public agricultural extension services and related activities has been inconsistent across PlantwisePlus countries. Similar risks are becoming apparent in CABI's research and bio-control agent mass rearing activities, where public institutions are expected to assume responsibility in the long term. CABI appears to lack a clear strategy to ensure sufficient resources and knowledge are being generated and prepared in the said institutions to deliver on their mandates.

As such, along with all relevant stakeholders, a national resource mobilization plan should be developed. This must take into account potential partners and sources of funding – including government, donors, international development partners, and the private sector – that could contribute to sustaining and building on the outcomes achieved in the programme (*linked to R18 and to recommendation in KIT's 2020 evaluation report*)

R20 Formalize involvement of diverse partners within PlantwisePlus countries and regions, through memorandums of understanding and/or contracts. These should clearly delineate their respective roles, responsibilities, inputs, deliverables, and commitment of resources needed with regard to implementing PlantwisePlus components during the programme and beyond.

Institutionalize partnerships

CABI should leverage its long-standing 'trusted' partnerships with governments, private sector actors, and farmer organizations. Doing so will help strengthen commitment to the development and implementation of pest preparedness and coordinated rapid response across regions of economic cooperation, such as ECOWAS, EAC, and SAARC, in CABI member countries.

These partnerships are also vital in creating demand for bio-protection products and safer food, to complement pest-related activities with crucial aspects – such as behavioural change, gender transformation, inclusive finance, and to create an improved business environment for agro-input suppliers.

Foster innovation and learning

R21 Conduct a thorough analysis of market potential, profitability, and impact before bundled extension advisory service delivery models are promoted by agro-input dealers or as local women- or youth-led last-mile enterprises (*linked to R6, R7, and R10*).

R22 Continue improving the accessibility and effectiveness of digitalized tools for pest preparedness, such as HS and PRA. For instance, prioritization, surveillance, early response plans; digital apps and knowledge banks for increasing the outreach of plant health services; and digital learning products for capacity building, with suitable alternatives for beneficiaries who have limited or no access to digital devices (*linked to R9*).

R23 Support the research, campaigning, and scaling of new bio-protection and nature-based products through a social-behaviour change approach, in collaboration with expert development partners at local level (*linked to R10, R11, and R13*).

To make online courses offered by the CABI Academy more effective, NPPOs/DAEs will have to create mechanisms to ensure learners' participation and to assess their learning at the end of the courses. Face-to-face modules might be required to provide opportunities for participants to apply the learning in the longer term.

Scaling the PlantwisePlus programme

R24 Develop clear criteria and a scoring system to determine the readiness of existing Plantwise countries to take on the PlantwisePlus programme. This may include an appraisal of the status of the plant health system in those countries with regard to: a) integration of the capacities and systems set up during Plantwise; and b) partnerships and resources needed to implement the additional/newer components of PlantwisePlus.

The new components – including building systems and capacities of partner organizations; collaborating with new implementing partners, with a focus on the private sector; and addressing broader pest management issues through social- behavioural changes in the end use community – require a firmer commitment and willingness by the implementing partners to participate and contribute human and financial resources as needed.

R25-1 With regard to scaling in fragile states, start with existing Plantwise countries that qualify as fragile states due to myriad circumstances. Assess institutional and other shortcomings in those countries that might affect the potential achievement of sustainable outcomes for PlantwisePlus. Thereafter, a tailored programme – combining elements of the earlier Plantwise programme and the current PlantwisePlus programme – could be designed and initiated in those countries.

R25-2 Use lessons learned from implementation of the programmes in existing fragile countries to design and implement a customized PlantwisePlus programme suitable for newer fragile states. This could involve a two-year pilot phase focusing on capacity and partnership building, setting up systems, and then rolling out the other components that could be designed and initiated in those countries.



Conclusions

In the three focus countries that were evaluated, PlantwisePlus is positively contributing to the establishment of a pest preparedness and early response system at national and regional levels, including surveillance at local level.

The farmer advisory services that were once the strongest aspects of CABI's interventions now appear to be weakest, due to the decline of delivery mechanisms (plant clinics and plant doctors) established under the initial Plantwise programme. This could be modified in PlantwisePlus through stronger efforts to involve the private sector, and by piloting different community-based advisory service provision models to complement the public extension system. The least progress has been made in terms of co-opting agro-input dealers to promote low-risk and nature-based PPPs, along with making quality bio-products available. This has to be accompanied by stronger enforcement of agro-chemical input regulations, by strengthening concerned departments within NPPOs that deal with highly toxic pesticides.

Furthermore, demand creation for safer food through consumer awareness and education requires collaboration with organizations with expertise in consumer behaviour change communication/education. PlantwisePlus should contribute to this by providing information about pesticide use and pesticide residue levels to concerned partners, and support NPPOs and DAEs in coordinating interventions.

Newer components of PlantwisePlus, such as the promotion of bio-protection and nature-based products, require a more focused extension-education approach to create demand among both agro-input dealers and end users (i.e., farmers). As public extension systems are under-resourced, the programme needs to bring in more national and international private sector partners. In addition, a shift to using less toxic PPPs requires a change in attitudes and practices. Non-governmental organizations (NGOs) and development partners that have a good rapport with farmer communities will have to be involved, so they can harness their experience and expertise to bring about social and behavioural change at household and community levels. Likewise, for components out of CABI's core competencies – such as consumer education, gender transformation, facilitating market linkages

for certified produce, etc. – PlantwisePlus country programmes will have to depend on expert partners with implementation experience at national and sub-national levels.

Commitment is required not from government partners for PlantwisePlus outcomes to be sustainable, but there also needs to be a willingness among the national private sector and civil society to meaningfully contribute. While the programme is ongoing, CABI might be able to obtain this by virtue of funding support. Right from the beginning of the programme, CABI should emphasise the need for all partners to pledge long-term commitment and contributions towards post-programme mainstreaming of the systems and capacities created during the programme.

PlantwisePlus is built on the success and experience of Plantwise. As such, when scaling out to fragile countries, it is recommended to start with a thorough and nuanced assessment of the existing social-political-economic-institutional context and coping capacities of each country. In the absence of basic governance structures, resources, and infrastructure, it might be worth revisiting the appropriateness of plant health as a suitable entry point for intervening in fragile states. Thereafter, with due consideration to the type and degree of fragility, a tailored PlantwisePlus programme can be developed for each country. This would comprise a clear implementation strategy combining selected elements from Plantwise and PlantwisePlus.

Annexes

Annex 1: Setting priorities for full PlantwisePlus programme roll-out

Building on the findings, the review team suggests which PlantwisePlus activities and processes may be prioritized and/or de-prioritised, and highlights which IPs they relate to.

Activities that are working well (and can be scaled up)

- Application of HS, PRA tools, and surveillance for identifying and prioritizing new pests and existing pests, to be able to respond early to outbreaks. (IP1)
- Insight reporting based on literature/database review and experts' networks within regions. This work needs to be emphasized in regional inter-governmental forums. (IP1)
- Development of preparedness plans and early response and management plans. However, the leadership and coordination of decision-making mechanisms across and within countries needs attention. (IP1)
- Gender assessments, indicating uptake of services and inputs for women, are useful to help NPPOs and partners develop a gender strategy to overcome barriers and make implementation more gender responsive. The real challenge is how to translate the strategy into activities that lead to gender transformation (going beyond participation and benefits). (IP1)
- Digital versions of the Plantwise Toolkit, including apps and learning products, have been well received by extension agents and plant doctors using them. (IP2)
- Facilities for rearing bio-control agents; plans for mass release are so far successful, but commercialization requires further discussion. (IP3)
- Collaboration with relevant partners to obtain evidence on residue levels in fresh produce, and using this information as a basis to engage with policy-makers involved in pesticide regulation. (IP3)

Activities that need to be improved (in terms of efficiency, innovativeness)

- The POMS database for surveillance, and implementation of, pest prevention and response/management plans remains relevant for pest preparedness. However, it will need to be assessed against bottlenecks, reinforcing the need for regular updating and maintenance. In countries where plant clinics are in decline, alternative options must be researched. (IP2)
- The communications strategy to raise awareness about prioritized pests needs to be strengthened to ensure integration of messages, both intersectionality among end users and across multiple channels. (IP1)
- Not much work is being done to reach women farmers besides developing e-extension materials. To improve on this, PlantwisePlus must partner with development organizations (NGOs) that have a good understanding of the social norms influencing gender dynamics at grassroots level. (IP1)
- Better understanding of barriers to agro-input dealers' promotion of low-risk and bio-protection products is required, in collaboration with agro-input dealer associations. There needs to be a focus beyond training/knowledge needs and legal and regulatory barriers, to include market incentives, profitability, and feasibility studies. It is important to identify and work with suitable partners to help collect market intelligence information on sale/demand for bio-protection products. (IP2)
- Following identification of low-risk alternatives, there has to be a plan to involve private sector bio-pesticide companies to take on research, production, and promotion of the products. The companies could pilot such products through last-mile delivery service and input provision models. (IP2)
- Increasing the use of digital tools and apps, as well as the number of people enrolling in CABI online courses, might require formal incentivizing mechanisms to be resourced and managed by concerned partners (research, extension, education) within government agriculture ministries. (IP2)
- Maximum residue level (MRL) in produce can be incorporated as criteria for mandatory/voluntary standards. It can also be included in digital learning courses' extension material on pest management

and pesticide use to inform and educate producers about the potential risks and health hazards. Focused consumer education could also increase awareness. (IP3)

- Farmers need support to comply with all certification/standard requirements. This support needs to be facilitated by public extension-advisory services, or delegated to appropriate partners (not depend on pack houses or supermarkets alone). (IP3)
- Identifying and training youth as last mile delivery service providers needs careful planning and in-built revenue generation mechanisms. Promoting community-based, women and youth-led enterprises for production of low-tech, low-risk bio-protection solutions might not gain traction until farmers are fully convinced of their value – but, in the right environment with sufficient interaction, it may work. (IP2)

Activities that might be de-prioritized

- In the absence of legal enforcement (and potential political will) for licensing and registration of agro-input dealers, development of a voluntary certification scheme for agro-input dealers seems ambitious at this point in time. (IP3)
- Withdrawal/de-registration of high-risk pesticides from the market could be a drastic step unless it is accompanied with solid/proven low-risk alternatives that can prevent food losses with the same 'efficiency'. Moreover, currently very few alternatives are widely used or easily available. A step-by-step approach is needed. (IP3)
- Using digital tools to develop a data-driven alerting system based on real-time triggers requires efficient technical infrastructure – communication devices, network connectivity, training, user manuals, guidelines, well-defined data standards – and enough hardware nodes to cover geographies where pests are likely to be present. Support developed using programme resources might create dependency and adversely affect sustainability in the longer term. (IP1)
- Developing and designing consumer education campaigns for safe food is a huge task, and one which may not provide significant results during the remaining PlantwisePlus period. In this area, CABI should limit its involvement to providing evidence regarding MRL risks due to excessive/incorrect/toxic pesticide use – and not spend resources to fund entire campaigns, as this is well beyond the scope of CABI's expertise. (IP2)

Annex 2: Summary of country reports: external review of PlantwisePlus' PoC

Of the six focal countries under the PlantwisePlus PoC phase, three were selected by CABI for this review: Ghana, Kenya, and Pakistan. Their selection was based on the show of good progress. The following reports provide more in-depth, country-specific information relating to the review and analysis of PlantwisePlus activities in these three countries.

From 2024 onwards, CABI intends to roll out the PlantwisePlus programme in more countries, including new and fragile countries.

1. Ghana country report

Introduction

In Ghana, fieldwork was carried out from 20 February to 3 March 2023. The KIT team consisted of Mona Dhamankar as lead consultant and Prince Etwire as local consultant. The review team, in collaboration with CABI staff, prepared a 10-day programme to carry out the assessment, which comprised the following:

- KIIs – individual and groups
 - National (25): CABI team, Plant Protection and Regulatory Service Directorate (PPRSD), DAEs, Environment Protection Agency (EPA), Green Label, Eden Tree, University of Ghana, Food Research Institute, Farm Radio International.
 - Regions (48): Bono and Ashanti regions included regional directors, plant doctors, district extension agents, agro-input dealers.
- Focus group discussions (FGDs) (male/female, plant doctors):
 - Farmers supplying produce to Eden Tree
 - Ghana Green Label certified group of farmers
 - Farmers accessing plant health services
 - Access to information and services (women farmers)
 - Vegetable producers – views on synthetic versus bio-protection products
- One introductory meeting with the CABI country team
- Validation workshop with key stakeholders (approx. 30 people)
- De-briefing meeting with donor representatives

Findings

Main findings from the fieldwork in Ghana are:

IP1 (SO3), pest preparedness:

- CABI Ghana is optimally aligned with government agencies and authorities engaged in pest protection, particularly key stakeholders from the Ministry of Food and Agriculture (PPRSD), EPA, the Council for Scientific and Industrial Research (CSIR, including also the, Food Research Institute and Oil Palm Research Institute), and the University of Ghana, with expertise in pest/invasives detection, prioritization, surveillance, monitoring, and preventative action.
- At national level, relevant people are trained in digital tools (HS and PRA).
- Priority pests are identified – some candidates identified priority pests, confirmed through pest insight reports and/or surveillance.
- Template for PPPs created. First PPP for banana bunchy top disease ready for testing and surveillance.
- Bio-control agent rearing centre established within PPRSD (Fall Army Worm [FAW] and Tuta absoluta).
- Implementation of PPP requires commitment from multiple stakeholders – EPA's experience of developing the National Invasive Species Strategy and Action Plan (NISSAP) with CABI support may be considered while deciding which agency should take the lead.
- A clear strategy is needed on how to validate and make use of (historical) pest data collected by plant clinics (POMS) for pest prioritization and to determine newer pests. At present, data collection is irregular or has stopped and is not validated by PPRSD researchers.

IP2 (SO1), farmer advisory:

- Plant health services are being integrated into agriculture extension agents' portfolio of activities at regional and district levels. PPRSD's pest disease management department has committed to allocate 5-10% of their plant protection budget/external funds for plant health services.
- Most agriculture extension agents have capacity to use digital platforms, like WhatsApp or Telegram, for information dissemination. However, due to unreliable network connectivity, many extension agents also continue using printed information kits/fact sheets. Newly trained, younger plant doctors seemed more enthusiastic about using digital tools/apps.
- Agriculture extension agents (plan to) use various channels to disseminate information – such as free FM radio slots, demo farms, documentaries/videos on farmer nights, community information centres, and mobile information vans. They already make use of existing farmers groups (e.g., savings groups) to reach larger numbers.
- CABI's partnership with Farm Radio International: Farm Radio International's key strength is using radio for behavioural change. This tactic can be used to address gender aspects, but also to increase awareness about food safety and creating demand for bio-protection products.
- CABI has conducted several studies and consultations to assess gender aspects in extension-advisory service provision (GRAST), and women farmers' access to services. Partnerships with Women in Agricultural Development and NETRIGHT are in place to ensure gender-responsiveness in all activities.
- The Plantwise classic plant doctor/plant clinic model has been discontinued since 2020-2021. Although plant clinic data is not regularly updated, it can still be used as input for PPPs.
- Not all agriculture extension agents have received training in plant protection (diagnosis, solutions), and as such they still depend on those trained as plant doctors in Plantwise. However, the latter do not have resources to move beyond their operational area.
- Many farmers still prefer visiting plant clinics, as many face challenges in accessing plant doctors via phone, such as unreliable networks, old devices that might distort pictures (leading to misdiagnosis), and limited ability to use mobile phones to make pictures of pests and insects and send to extension agents/plant doctors.
- Plant doctors are reluctant to invest their own resources to provide e-extension and/or the running of vehicles for follow up visits. Tablets initially provided by CABI are now outdated, and purchasing data is expensive.
- Agro-input dealers can be biased, hence are unsuitable plant doctor-type service providers. They are perceived as business driven, not knowledgeable enough about pests and diseases, and will only push products they sell. Monitoring them is a challenge. Still, they need to be co-opted and trained because, for many farmers, they are the first point of contact.
- Only a few agriculture extension agents (those involved in Ghana Green Label certification) deliberately focus on disseminating information about bio-protection products. This needs to be mainstreamed.

IP3 (SO4), pest risk reduction:

- Needs assessments among agro-input dealers, and sensitization regarding voluntary/mandatory standards, have been conducted. Although more still needs to be done, nothing is planned for 2023.
- CABI supported EPA in developing the NISSAP for Ghana. It took two years to prepare the plan, which was finalized following stakeholder validation.
- EPA has registration procedures in place for bio-protection products. CABI actively provides expert advice and engages/lobbies with relevant stakeholders to jointly develop recommendations for the rapid registration and release of bio-pesticides and bio-control agents.
- CABI supported the establishment of a non-commercial bio-control agent rearing facility to counter FAW. These facilities need to be extended to the northern and central regions, as it is difficult to transport bio-control agents.
- It is unclear if, and how many, bio-pesticides/bio-control products are available and awaiting registration (and release). PPRSD control agents are available free of cost, but require decentralized rearing facilities.
- Commercially produced bio-protection products are expensive and are not in high demand. As such, agro-input dealers are unwilling to keep large inventories and are not forthcoming in recommending them to farmers.

- Engagement of youth and women to produce bio-products locally might be feasible. But this needs further exploration, especially in terms of time needed to prepare products (raw material-neem is abundant and free), vis-à-vis use/demand and farmers' willingness to pay. Products also need to be registered by EPA (facilitated by DAEs).

IP3 (SO2) food safety:

- CABI's collaboration with the Food Research Institute is useful in providing information/ evidence to more accurately understand the risk of using synthetic pesticides for different crops at varying cultivation stages. Analyses can be shared with PPRSD and the Food and Drugs Authority to regulate synthetic product use, and can also provide content for consumer education (without alarming consumers) and agriculture extension agents for farmer education (this is a critical input given that vegetable exports have been banned since 2015).
- Pesticide residue analysis reports can be used to trace the farmers using/over using chemicals. Likewise, the information can be used to develop extension materials, including radio programmes.
- Collaboration with Ghana Green Label to train and promote farmer groups to produce safe food (using low-risk pesticides), which is one of 10 parameters needed for Ghana Green Label certification. Ghana Green Label has also forged linkages with aggregators/pack houses to ensure certified farmers get an assured market and better prices for their produce. Certified produce is mainly sold in urban supermarkets by pack houses such as Eden Tree.
- Eden Tree provides their supplier farmers with training on quality standards, but tracing back is difficult for non-certified produce.
- Ghana Green Label certification is fee-based and has too many components. For instance, if adjacent farmers are using chemicals, this can cause the only water source to become contaminated. Parameters related to land do not apply to container gardens used by peri-urban farmers, as farmers feel the need for different quality parameters to be applied based on production methods.
- Farmers reported advantages to being certified, such as weight vs volume, fair price if quality is right, soft loans for inputs, information to improve practices, and better yields. However, problems with market linkages were established (delayed payments, rejection of produce on basis of quality [stuck with uncommon vegetables for domestic market]), as well as issues around side-selling and the prevention of chemical use, which made it difficult to manage pests such as onion thrips.
- Most niche markets for the certified produce are in Accra, and farmers are unwilling to pay the transportation costs. Produce needs to become more affordable for local consumers, so they can access Ghana Green Label food.
- Farmers reported that the cost of producing certified vegetables is 10 times more than for conventional produce! Farmers are reluctant to use low-cost and less effective local bio-pesticides (neem).

Key lessons to date

- Leadership and shared understanding about the roles and responsibilities of each stakeholder is critical for effective and coordinated implementation of pest preparedness and early response plans.
- The mainstreaming of plant health services not only depends on agriculture extension agents' knowledge and skills; their motivation also hinges on the resources and incentives available to them.
- Digital tools/ICT-based extension methods require funding and investments, but also organizational capacity (human resources/technical competence, infrastructure, and a balance between traditional/conventional methods and approaches to suit local conditions and allow for context-specific knowledge sharing and dissemination of solutions). Community information centres in Ghana are a good example of a combination of ICT and traditional channels.
- Co-opting and capacitating agro-input dealers and their shop assistants to advise on and promote low-risk and bio-protection products is critical.
- CABI Ghana could benefit by exploring partnerships with organizations other than governments and NGOs. These include private sector companies and associations, as they could influence and reinforce the agro-input dealers in their advisory role by providing them with expert knowledge, backstopping, and also monitoring of their activities.

- Farmers need time to transition from use/overuse of synthetic agrochemicals to bio-protection products and bio-pesticides.
- Production and promotion of bio-protection products, such as neem oil, might not generate business results immediately.
- Organizing certified farmers could lead to better bargaining power and market opportunities, and a consistent supply of quality produce through formal long-term supply contracts with off-takers (win-win).
- Adoption of voluntary standards, like Ghana Green Label, requires a high level of commitment and consistent support from all parties involved – including producers, market intermediaries/off-takers/retailers, input suppliers, extension agents, consumers, and the certifying agency. Farmers need support to meet all standard requirements.
- It is important for the voluntary standards to be recognized by the government.
- It could be easier for smallholder farmers, who practice rain-fed agriculture using minimum agro-chemicals, to shift to low-risk and bio-protection products, than it is for larger, commercial/capital intensive farmers, whose crops might be more susceptible to pests and diseases.

2. Kenya country report

Introduction

Fieldwork in Kenya was carried out from 20 February to 3 March 2023. The KIT team consisted of Coen Buvelot as lead consultant and Gerald Katothya as local consultant. The review team, in collaboration with CABI staff, prepared a 10-day programme to carry out the assessment, which comprised the following:

- 16 KIIs
- 9 FGDs (male/female, plant doctors/extension workers)
- 6 field/lab visits
- 1 pre-assessment workshop at CABI
- 1 validation workshop with stakeholders
- 1 de-briefing meeting with donor representatives

Findings

The main findings from the Kenya fieldwork are:

IP1 (SO3), pest preparedness:

- CABI Kenya is well aligned with key government agencies and authorities engaged in pest protection (particularly Kenya Plant Health Inspectorate Service [KEPHIS], the default lead regulator), and key collaborators (Kenya Agricultural and Livestock Research Organization [KALRO] and Pest Control Products Board [PCPB], and now some engagement with Horticulture Crops Development Authority [HCD]).
- At national level, KEPHIS is rapidly institutionalizing the HS and PRA (digital) tools (e.g., staff trained, 15 PRAs done, surveillance for prioritized pests).
- CABI is a 'go-to' partner of choice for KEPHIS in the wake of pest outbreaks, as suggested by recent experiences with papaya mealybug and golden apple snail.
- Some counties, such as Nakuru, have early warning and surveillance taskforces in place, although these are not adequately institutionalized and resourced.
- Agricultural and socio-economic surveys are conducted to understand the management practices and impacts related to specific pests and diseases.
- Pest risk information services are being expanded in collaboration with KALRO.
- A bio-control agent rearing centre has been established within KALRO Muguga.
- Mass release of biocontrol agents against papaya mealybug has been conducted in coastal areas.
- KEPHIS is well positioned (legally and technically) to lead and coordinate implementation of PPP. However, stronger alignments with county governments and neighbouring countries is still needed.
- CABI needs a clear strategy on how to validate and make use of (historical) pest data collected by plant clinics, cognizant of the ongoing decline in uptake of POMS at county level.
- The feedback loop between farmers (in signalling new pests) and plant health service players is too long.

- Agenda alignment with partners needs to, in part, be through financial compensation instead of strategic buy-ins.
- KEPHIS feels CABI is well positioned (perceived as neutral) to play a role in mediating regional alignment.

IP2 (SO1), farmer advisory:

- Nakuru County government intends to sustain the plant doctor model – e.g., plans to train 25 new and young (tech-savvy) agricultural extension workers in April 2023 (and they also agreed to integrate gender as topic in this training).
- CABI's flagship digital learning products (e.g., CABI Academy) are in the early stages of introduction in Kenya. However, mass uptake is likely to depend on institutional sponsorships, including pitching the value propositions to county governments, development programmes, and colleges.
- POMS uptake is declining at county level owing to, inter alia, a decline in plant clinic activities and the fact that not all plant doctors have access to the platform.
- Many farmers still prefer to use basic phone enabled dissemination channels to share messages and/or images via SMS, voice calls/hotlines, and WhatsApp groups.
- Agro-input dealers are the most common advisors on crop protection, except for some farmers in groups linked to on-going programmes.
- In general, farmers rarely express demand for crop protection advisories during the pre-planting season – thus rendering preventive, IPM, and bio-solutions less relevant.
- Knowledge on, and perception about, (the role of) food safety standards (e.g., KS1758) is varied among county extension staff.

IP3 (SO4) pest risk reduction:

- A roundtable was held by CABI and PCPB on the identification and requirements of low-risk PPPs.
- An impact study was conducted on the withdrawal of household PPPs.
- CABI has supported the:
 - Establishment of a non-commercial bio-control agent rearing facility at KALRO Muguga, which is currently focusing on papaya mealybug and FAW.
 - Development of draft guidelines for intentional introduction of bio-control agents, and a matrix for assessing household PPPs.
 - Engagement with agro-input dealers, initially through assessments. However, dealers consulted raised fears about limited/slow feedback (i.e., extractive engagement).
- The response on papaya mealybug in coastal counties is considered a success story ripe for replication in other regions.
- Producers are showing greater interest in bio-products, for example:
 - Leading producers of conventional products are registering bio-products every year.
 - Biological producers (Koppert Biologics and Kenya Biologics) are activating agro-input dealer networks (e.g., in Nakuru).
 - The IPM champions (and, to some extent, spray service provider) model piloted by Koppert in Nakuru is proving to be a promising last mile delivery channel. Yet, female champions cite capital and mobility issues preventing them from maximizing opportunities.
 - The growing business opportunity in local production is becoming noticeable (e.g., informant plant doctors are aware of a few (3-5) start-ups by youth groups in Nakuru).
- The youth- and women-run private extension business models (IPM, spray service provider models) piloted in Nakuru are promising (in terms of economic viability, climate-smart agricultural practices, use of digital tools, e.g., Bio-Protection Portal). The legislative and policy reforms underway provide opportunities/entry points for influence to address priority issues. For example:
 - Young farmers consulted in Subukia, Nakuru described the requirement for registration as constraining their ambition to scale and commercialize their locally-produced bio-products.
 - Farmers consulted in Mwea (Golden Apple Snail) and along the coast (papaya mealybug) perceive the process, from identification of a new pest to availability of a bio-solutions, as long and challenging.

- Demand/farmer side issues based on field consultations:
 - Adoption of bio-pesticides is knowledge intensive. It requires uptake of a suite of other complementary practices (i.e., a transformation rather than adaptation) and thus a more intense form of extension services are required.
 - Bio-pesticides are perceived as costly yet less effective (in the short term as they are slow acting). Farmers need evidence of outcomes, yet efforts to gather local comparative data and analytics are lagging.
- Supply side issues based on field consultations:
 - The market segment of bio-products is growing slowly (e.g., 2-3% for a major leading agro-input dealer in Nakuru). Therefore, it is not yet profitable enough to make a business case for green label certification to dealers targeting small-scale farmers.
 - Bio-protection producers prefer shorter supply/distribution chains, i.e., producer to larger-scale end users, mostly large farms.
 - Agro-input dealers and public and non-profit extension providers are interested in supporting a gradual transition towards low-risk products, cognizant of contextual factors (e.g., impact of pest risks in tropical agriculture, and availability and affordability of alternatives).

IP3 (SO2) food safety:

- CABI collaborated with KEPHIS to scale the monitoring of pesticide residue in local produce, to provide evidence of risks within agricultural value chains.
- Informants endorsed the choice of tomato and chilli as commodity value chains for MRL originating from Nakuru as justifiable in the Kenyan context.
- Consultations are ongoing around the most appropriate ways to disseminate and utilize findings. The key is to avoid alarming messaging by moving from maximum residue level analysis to the assessment of health impacts.
- Consulted farmers and tomato wholesalers were aware of food safety and health risks associated with the incorrect use of chemical pesticides (use of unregistered products), misuse (including use of livestock drugs on food crops), failure to observe pre-harvest intervals, and weak protective measures during spraying.
- The KS1758 domestic standard for vegetables and fruits (est. 2016) is considered a 'God-send' opportunity. However, informants rate its implementation as low and slow.
- Farmers consulted in Nakuru expressed an interest in participating in voluntary standards if assured that buyers are willing to pay a premium price for quality.
- CABI (in partnership with the Centre of Behaviour Communication Change) have developed a behaviour communication change campaign strategy dubbed 'Ukulima True' – to create awareness about food safety and enhance demand for bio-protection produce.
- CABI's collaboration with KEPHIS is well aligned, as KEPHIS is mandated to safeguard the quality of fresh produce in Kenya. KEPHIS has a well-established analytical laboratory.
- Informants feel it is more relevant (for CABI) to support the implementation of KS1758 as a mandatory standard, rather than scouting for voluntary standards to promote.
- Ideas suggested by extension agents include partnering with HCD and Fresh Produce Exporters Association of Kenya to refine the training content and tools, and roll out mass training and certification to KS1758 trainers and auditors.
- Whereas tomato wholesalers' informants in Nakuru expressed commitment to safeguarding the safety of the produce they trade, they only rely on traditional skills and organoleptic methods (e.g., smell, appearance, visiting farms) to assess quality. Their commitment was motivated by general care about the health and safety of consumers, and fear of being traced, since they trade from one physical location (Nakuru wholesalers' market, Marikiti).
- Informants were unaware of a recognizable 'green label' market for vegetables and fruits in Nakuru.

Key lessons to date

- Public sector commitment: Through PlantwisePlus, CABI works with myriad public sector partners, often taking over the role of government stakeholders or providing support (financial or otherwise) to deliver

on their mandate. To make sustainable change, public sector partners need to assume their own roles and responsibilities after CABI has delivered on an intervention.

- CABI Academy roll out: Despite modules being accessible from Kenya, none of the stakeholders interviewed had engaged in the platform. Success of the platform is generally perceived to be dependent on institutional sponsorships, including from county governments, development programmes and colleges.
- The CABI Academy provides a significant opportunity for PlantwisePlus to scale its value proposition to a wide variety of extension workers (private and public), limiting the losses of the looming disintegration of the plant doctor system.
- KS1758 support: KS1758 is the right legislative vehicle for PlantwisePlus to support the production of safe food, benefitting producers and consumers. However, public knowledge about this mandatory code is almost non-existent, similar to its enforcement. To incentivize producers to comply, agents are being trained to certify producers. CABI can support the training of trainers of certifiers and implementers, to aid the practical introduction of the certification scheme.
- Private sector disruptions: CABI has established rapport with various private sector parties (e.g., Koppert), whom they collaborate with to reach shared objectives. However, PlantwisePlus indirectly relies heavily on public funding and, as such, has a responsibility to avoid creating market disruptions and maintain a level playing field. Thus, CABI should continue to tender any project to various market players and avoid privileging its known partners.
- Crowding out: As CABI supports government organizations to deliver on their public mandate, they risk the organizations (un)knowingly and (un)willingly becoming dependent on their support. When the relevant government agency realizes that CABI intervenes for institutions to deliver on their mandate, they may divert funds, expecting CABI to deliver. In such a case, a beneficiary/supported institution may end up in a worse state than in the absence of the intervention.
- Politics in pest control: CABI strongly relies on and leverages the mandate of government institutions. This allows CABI to punch above its weight, but also makes it vulnerable. For instance, in a case where the public good is subordinate to private interest in the government, CABI may be forced to take suboptimal decisions to maintain political backing. This is especially true when not all decisions are systematically backed by factual decision-making processes. CABI could be subject to politicization of such decisions in the absence of an explicit decision-making model.

3. Pakistan country report

Introduction

In Pakistan, fieldwork was conducted from 20 February to 3 March 2023. The review team, consisting of Hans Smolders (lead expert) and Tanaza Sadaf (local consultant), in collaboration with the CABI staff, prepared a 10-day programme to carry out the assessment, which comprised the following:

- 18 KIIs
- 6 FGDs (male/female, plant doctors/extension workers)
- 2 field/lab visits
- 1 pre-assessment workshop at CABI
- 1 validation workshop with stakeholders
- 1 de-briefing meeting with donor representatives

Findings

The main findings from the Pakistan fieldwork are:

IP1 (SO3), pest preparedness:

- CABI appears to be optimally aligned with all possible stakeholders who can contribute to and influence pest preparedness and pest detection surveillance, monitoring and prioritization, surveillance, and preventative action. These include research organizations (Pakistan Agricultural Research Council, the National Agricultural Research Centre, and NPPOs); regulatory and advisory functions (provincial DPP, DEA); and academic knowledge institutes (universities). CABI has signed memorandums of understanding with six provinces and one university.

- There is a good amount of ownership of pest preparedness, exemplified by dedicated dashboard units at provincial departments, showing that integration of tools for decision-making is in progress. However, the use of POMS data is still limited and should be improved.
- Although CABI trained key people in the proper use of digital tools (HS, PRA, POMS), there is a need to include more people from the provinces to strengthen pest preparedness, surveillance, and response in the country.
- CABI is actively engaged in conducting/planning mass extension campaigns on pest control of prioritized invasive species (e.g., FAW, Parthenium).
- CABI is supporting the government in developing registration procedures for bio-pesticides and bio-control agents, and is updating key (inter)national stakeholders' companies on its progress through workshop 'roadshows'.
- The potential for bio-control agents is good, but regulatory hurdles, poor adoption, and limited awareness are constraints. CABI can play a key role on regulatory issues and in identifying alternative (biological) options. Once released, awareness among all stakeholders should be generated.

IP2 (SO1), farmer advisory:

- Plant clinics have become an integral and visible part of the Pakistan government at national and provincial level, being increasingly 'owned' by agricultural extension departments. For instance, the hosting POMS dashboards as part of performance monitoring, data system integration, surveillance, and provision of transport and tablets. Nevertheless, plant clinics are still perceived as a CABI activity ('CABI doctors'), hence they expect CABI to continue supporting them while government buy-in remains modest.
- The roll out of e-clinics is hampered by limited use of mobile phones by farmers, and old tablets. In many cases, staff at plant clinics use both online and paper-based advisories to serve farmers. Data transfer from (paper-based) plant clinics to POMS dashboard has a backlog, demonstrating that harmonization takes time.
- An enhanced PlantwisePlus Toolkit (CABI apps, CABI Academy, Plantwise Knowledge Bank, YouTube videos, Plantwise Factsheet Library) is being rolled out. It is effective and appreciated by (government) stakeholders and academics/students, who have been made aware of them. Some apps and online tools have recently been translated into Urdu, further broadening the clientele scope.
- Awareness and accessibility of digital tools and online resources to a wider audience (agro-input dealers, distributors, market operators, farmers) is, so far, limited. Open access and inclusion in campaigns, training, etc., should further improve awareness and their use.
- Farmers depend on many other sources of information (agro-input dealers, contractors, internet) for their on-farm decision-making. Plant doctors cater to only a small proportion of farmers (on average one doctor per 10,000 farmers). CABI should make use of parallel channels, exploring options with key private partners and using the plant doctors as resources in a cost effective way.
- Lack of small farmer organizations (other than informal clusters) is an impediment to crop production and distribution of farmer advisory services. Empowerment is needed for aggregate production, co-innovation, and linkages to markets.
- The use of ICT/apps and teleservices may reach out and appeal to the needs of youth and female farmers.
- Private sector advisory is amply utilized by CABI, both in the agro-input/chemicals chain and the food chain. Modalities need to be developed to efficiently work and collaborate with private and public stakeholders.

IP3 (SO4/SO2), pest risk reduction and food safety:

- Needs assessments among agro-input dealers, and sensitization regarding voluntary/mandatory standards, have been conducted. More needs to be done, but nothing is planned for 2023.
- CABI actively provides expert advice and engages/lobbies with relevant stakeholders to jointly develop recommendations for rapid registration and release of bio-pesticides and bio-control agents.
- CABI supported the establishment of a mass Trichogramma rearing facility in Mardan for vegetable growers (with another one planned in Punjab) and provided expert training, which was well appreciated.
- Agro-input dealers are a great, yet diverse, force in advising farmers. Reaching out to them on issues of maximum residue levels and food safety is essential but challenging. In the absence of any voluntary mandatory standards, re-licensing of agro-input dealers on an annual basis (instead of every three years), along with undergoing CABI online courses, can be an essential step to improve their knowledge.

- Several bio-pesticides/bio-control products (globally and domestically) are awaiting registration and release, including AflaPak™.
- Commercial feasibility of bio-protection products depends on mass awareness and adoption among farmers. Regarding the Trichogramma rearing facility, a clear business plan will need to be worked out with stakeholders. Evidently, commercial production and distribution of bio-control products should come with promotional benefits from the government (tax exemption, subsidies).
- Engagement of youth and females in the use and promotion of biological agents appears feasible, but plans need to be further elaborated.

IP3 (SO2), food safety:

- CABI is well on track to study maximum residue levels and increase consumers' awareness on the consumption of safe food. A consumer awareness campaign is planned for 2023.
- CABI is conducting a range of programmes/projects on food safety issues, other than PlantwisePlus. These can function as PoC for further development of elements in PlantwisePlus (such as marketplace ICT, Global Gap, voluntary/mandatory certification standards – in other countries).
- CABI actively focuses on women and youth farmer empowerment by conducting surveys, holding workshops, and creating platforms and campaigns. This gives well-deserved attention to their socio-economic situation and empowerment.
- We have some doubt whether consumer demands link directly to farmer awareness on maximum residue levels, except for certain apps: Farm to Fork, etc.
- Many capable actors work on food safety in Pakistan's food value chains. CABI should establish modalities in which they can work together (Scaling Up Nutrition networks, market operators, food authorities) to enhance impact at farmer level and in the (fresh) value chain.
- Lack of knowledge regarding, as well as negative attitudes and practices towards, voluntary or mandatory food safety standards is evident among farmers, plant doctors, and agro-input dealers. Discussion on this issue should be prioritized in collaboration with stakeholders.
- Women have little options in rural areas to become active in the marketplace (illiteracy, social cultural norms and constraints, no access to finances), yet modalities need to be found.
- Younger farmer members are seen to be more tech-savvy hence are more inclined to use ICT-based services such as apps, WhatsApp groups, and other online learning options.

Key findings to date

- The role of plant clinics in advising farmers is challenging (and limited) compared to private service providers, but remains vital in the context of Pakistan.
- CABI partnerships in plant health and food safety should extend beyond the government to include private sector partners.
- Voluntary standards for private agro-input dealer advisory is non-existent. They may be an option in addition to the existing mandatory licensing system, but many challenges remain.
- Improving safe food production at farmer level can be enhanced by introducing a certification standard for the domestic fresh fruit and vegetable market. For this, a public-private platform, including key food chain operators, would need to be established to identify requirements in terms of organization, training, etc.
- The role of bio-protection products is an emerging market. It has potential, but also faces many challenges in terms of regulation, research, awareness creation and, eventually, mass production and commercialization.