Uptake of augmentative biological control solutions by extension services in Africa and Asia

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October 24, 2017

Annual Biocontrol Industry Meeting, Basel, Switzerland

KNOWLEDGE FOR LIFE

CABI

National Plantwise partners working in extension service

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CABI

- **not-for-profit** intergovernmental organisation, established by a United Nations-level agreement
- owned by **48 member countries**, which have an equal role in the organisation's governance, policies and strategic direction
- **over 450 staff worldwide** in 12 centres
- addresses issues of global concern such as **food security** and **food safety**, through research and international development cooperation
- major publisher of scientific information – books, ebooks, full text electronic resources, compendia and online information resources

Plantwise - CABI's flagship programme

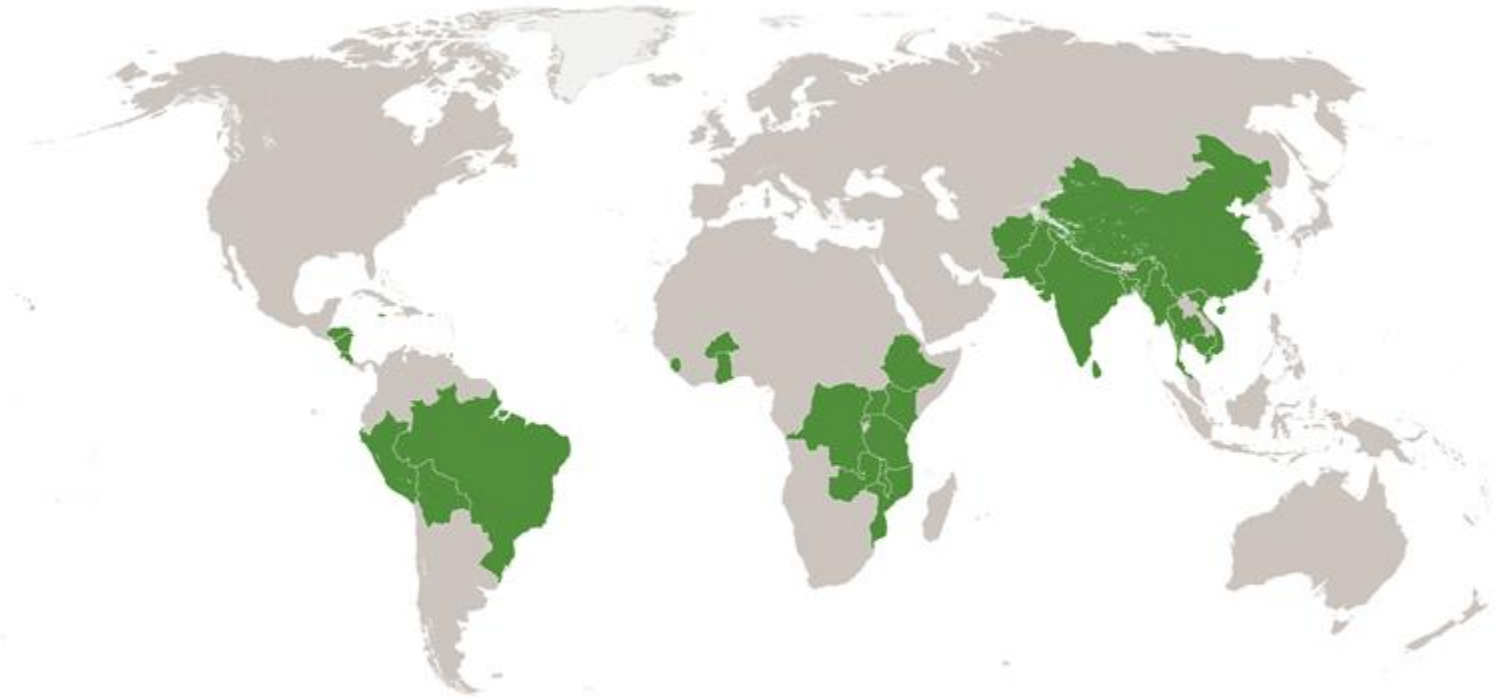
- Plantwise is a global initiative aiming to work together with national and international plant health stakeholders to increase food security and food safety, and improve rural livelihoods by reducing crop losses
- Key components of Plantwise:
  - **National networks of plant clinics**, owned by the national extension service, to give regular advice to farmers and facilitate pest surveillance
  - A **knowledge bank** to support extension workers and farmers with information tools on pest diagnosis, management and distribution
  - Innovative **linkages between key stakeholders** in a plant health system

Plantwise's beneficiaries

- Plantwise serves smallholder farmers, who can be separated into 3 categories based on their degree of commercial activity:
  - **Business-oriented**: Often grow fruit, vegetables and other high-value products for supply into formal supply chains. Required to tackle increasingly high hurdles of food safety standards and demands for traceability.
  - **Transitional**: Family farms whose production is locally-oriented and undercapitalized, with poor integration into agribusiness. Typically earn 40-60% of income from off-farm activities.
  - **Subsistence**: Marginalised and disadvantaged. Maintain precarious farm livelihoods and weak links to markets and finance.

- *Of the 450m smallholder farmers in non-OECD countries, the first category accounts for around 100m with about twice that number in the transitional group (Lowder S.K. et al, 2014)*

Countries Plantwise operates in



The Americas

Barbados
Bolivia
Brazil
Costa Rica
Grenada
Honduras
Jamaica
Nicaragua
Peru
Trinidad & Tobago

Africa

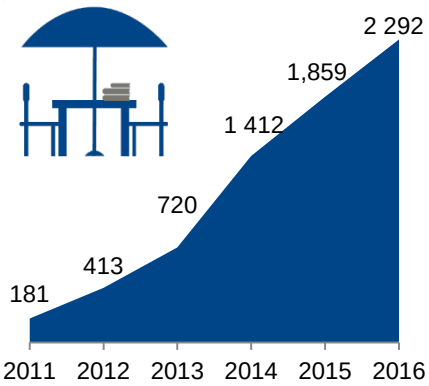
Burkina Faso
DR Congo
Ethiopia
Ghana
Kenya
Malawi
Mozambique
Rwanda
Sierra Leone
Tanzania
Uganda
Zambia

Asia

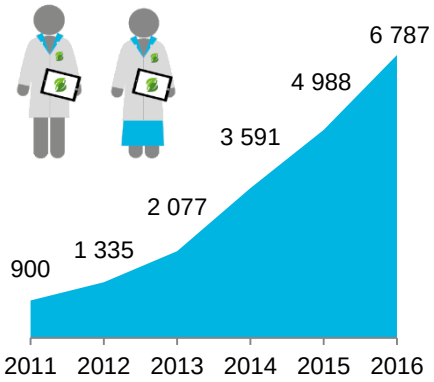
Afghanistan
Bangladesh
Cambodia
China
India
Myanmar
Nepal
Pakistan
Sri Lanka
Thailand
Vietnam

Scale of the programme

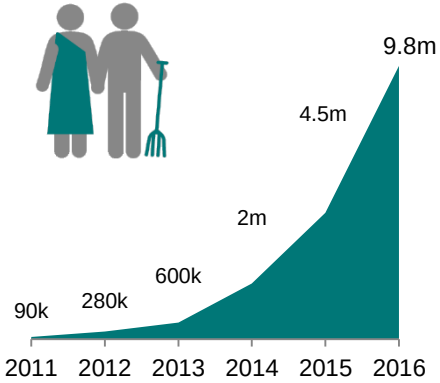
2,300 plant clinics established



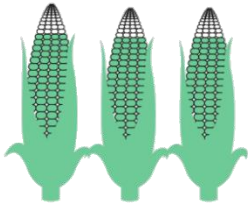
6,800 plant doctors trained



9.8 million farmers reached



Plantwise impact



79%
of farmers report yields **increased** after using advice from plant clinics

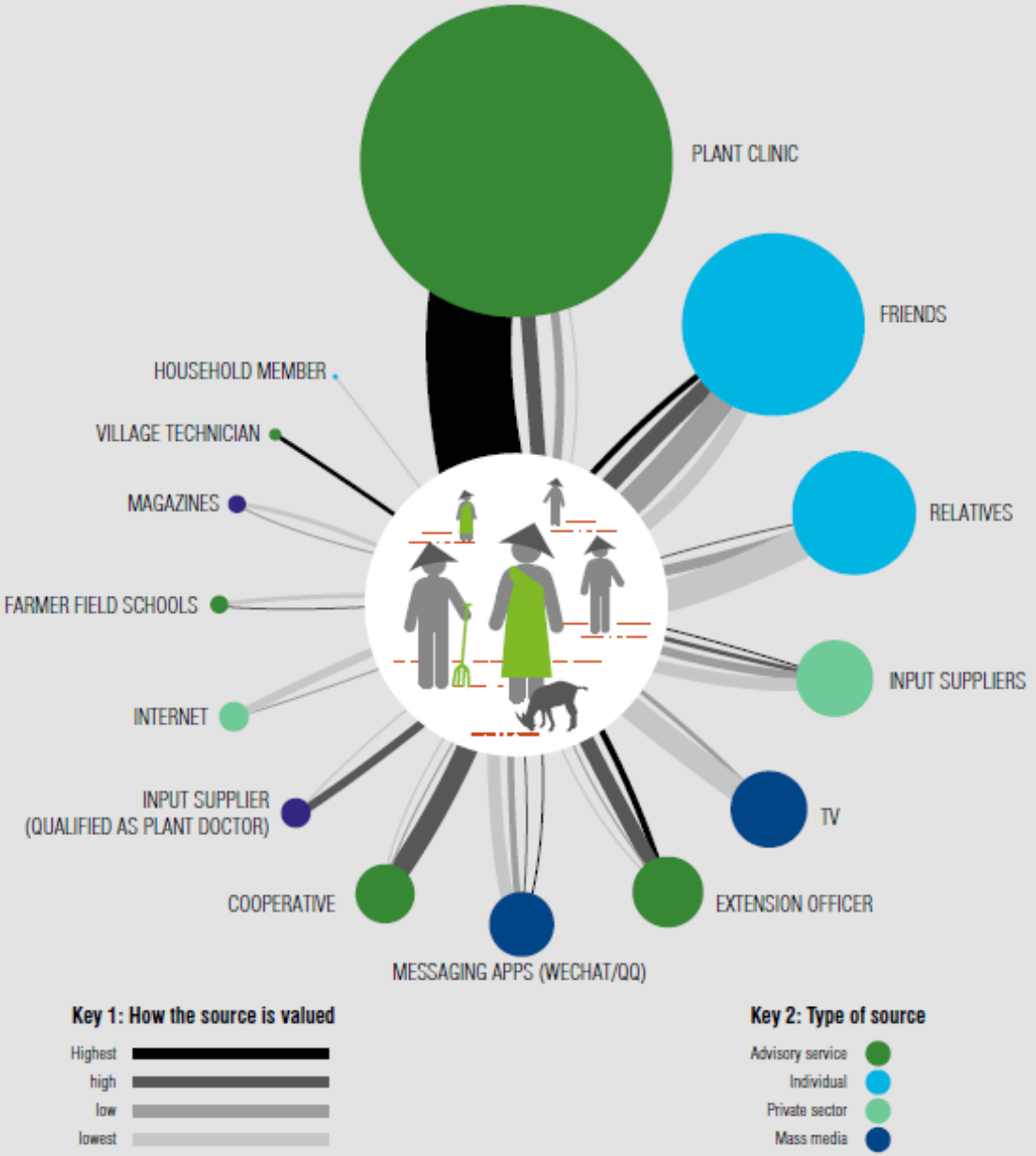
70%
of farmers report incomes **increased** after using advice from plant clinics

Farmers' reported use of pesticides **decreased by**
30%

25%
of Plantwise plant doctors **are female**

Value of plant clinic information to farmers

- Based on a survey of farmers in Changping district, China
- Results indicate that the advice received via plant clinics is the most highly valued compared to other information sources



Plantwise approach and tools

Plant clinics are channels for the 2-way flow of information to and from farmers

Diagnosis and recommendation

Extension materials and other support tools

Farmer interviews and data collection

Intelligence on pests causing problems

Recent Plantwise study to assess the contribution of the extension service to the uptake of biological control

- Baseline study in 6 low- to lower-middle-income countries analysing extension material developed within the Plantwise programme and advice given by extension workers relating to the **management of insect pests using microbial and macrobial biocontrol products** (over a one-year time period, 1 July 2015 - 30 June 2016)

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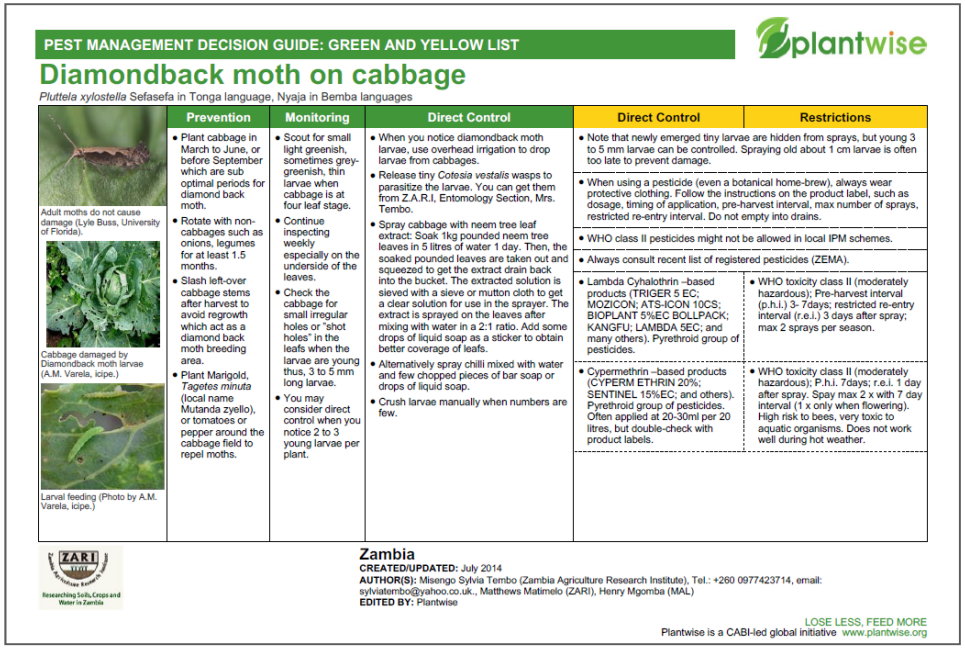

PEST MANAGEMENT DECISION GUIDE: GREEN AND YELLOW LIST

plantwise

Diamondback moth on cabbage

Pluttela xylostella Sefasefa in Tonga language, Nyaja in Bemba languages

Adult moths do not cause damage (Lyle Buss, University of Florida).

Cabbage damaged by Diamondback moth larvae (A.M. Varela, icipe.)

Larval feeding (Photo by A.M. Varela, icipe.)

Prevention	Monitoring	Direct Control	Direct Control	Restrictions
• Plant cabbage in March to June, or before September which are sub optimal periods for diamond back moth. • Rotate with non-cabbages such as onions, legumes for at least 1.5 months. • Slash left-over cabbage stems after harvest to avoid regrowth which act as a diamond back moth breeding area. • Plant Marigold, *Tagetes minuta* (local name Mutanda zyello), or tomatoes or pepper around the cabbage field to repel moths.	• Scout for small light greenish, sometimes grey-greenish, thin larvae when cabbage is at four leaf stage. • Continue inspecting weekly especially on the underside of the leaves. • Check the cabbage for small irregular holes or "shot holes" in the leafs when the larvae are young thus, 3 to 5 mm long larvae. • You may consider direct control when you notice 2 to 3 young larvae per plant.	• When you notice diamondback moth larvae, use overhead irrigation to drop larvae from cabbages. • Release tiny *Cotesia vestalis* wasps to parasitize the larvae. You can get them from Z.A.R.I, Entomology Section, Mrs. Tembo. • Spray cabbage with neem tree leaf extract: Soak 1kg pounded neem tree leaves in 5 litres of water 1 day. Then, the soaked pounded leaves are taken out and squeezed to get the extract drain back into the bucket. The extracted solution is sieved with a sieve or mutton cloth to get a clear solution for use in the sprayer. The extract is sprayed on the leaves after mixing with water in a 2:1 ratio. Add some drops of liquid soap as a sticker to obtain better coverage of leafs. • Alternatively spray chilli mixed with water and few chopped pieces of bar soap or drops of liquid soap. • Crush larvae manually when numbers are few.	• Note that newly emerged tiny larvae are hidden from sprays, but young 3 to 5 mm larvae can be controlled. Spraying old about 1 cm larvae is often too late to prevent damage. • When using a pesticide (even a botanical home-brew), always wear protective clothing. Follow the instructions on the product label, such as dosage, timing of application, pre-harvest interval, max number of sprays, restricted re-entry interval. Do not empty into drains. • WHO class II pesticides might not be allowed in local IPM schemes. • Always consult recent list of registered pesticides (ZEMA).	
			• Lambda Cyhalothrin –based products (TRIGER 5 EC; MOZICON; ATS-ICON 10CS; BIOPLANT 5%EC BOLLPACK; KANGFU; LAMBDA SEC; and many others). Pyrethroid group of pesticides.	• WHO toxicity class II (moderately hazardous); Pre-harvest interval (p.h.i.) 3- 7days; restricted re-entry interval (r.e.i.) 3 days after spray; max 2 sprays per season.
			• Cypermethrin –based products (CYPERM ETHRIN 20%; SENTINEL 15%EC; and others). Pyrethroid group of pesticides. Often applied at 20-30ml per 20 litres, but double-check with product labels.	• WHO toxicity class II (moderately hazardous); P.h.i. 7days; r.e.i. 1 day after spray. Spay max 2 x with 7 day interval (1 x only when flowering). High risk to bees, very toxic to aquatic organisms. Does not work well during hot weather.

ZARI — Researching Soils, Crops and Water in Zambia

Zambia

CREATED/UPDATED: July 2014

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EDITED BY: Plantwise

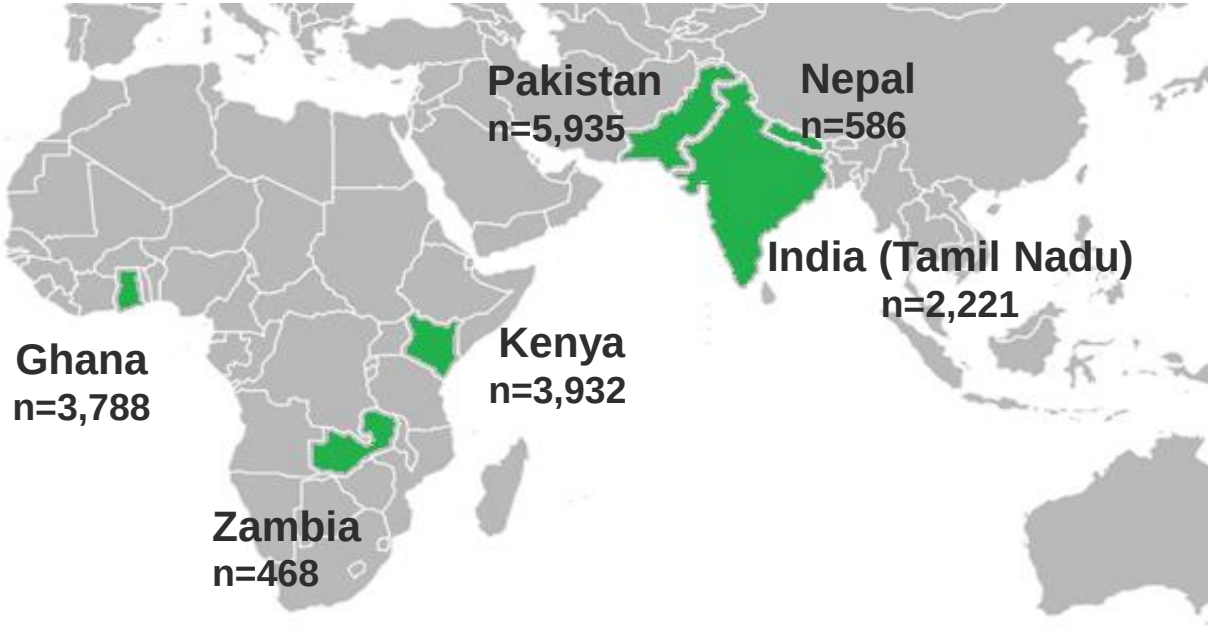
LOSE LESS, FEED MORE

Plantwise is a CABI-led global initiative www.plantwise.org

- Pest Management Decision Guides (PMDGs) - extension material produced by national extension partners in Plantwise
- They contain practical advice following the principles of Integrated Pest Management
- A total of 113 PMDGs were analysed

Recent Plantwise study to assess the contribution of the extension service to the uptake of biological control

- Baseline study in 6 low- to lower-middle-income countries analysing extension material developed within the Plantwise programme and advice given by extension workers relating to the **management of insect pests using microbial and macrobial biocontrol products** (over a one-year time period, 1 July 2015 - 30 June 2016)



- A total of 16,930 plant clinic queries were analysed

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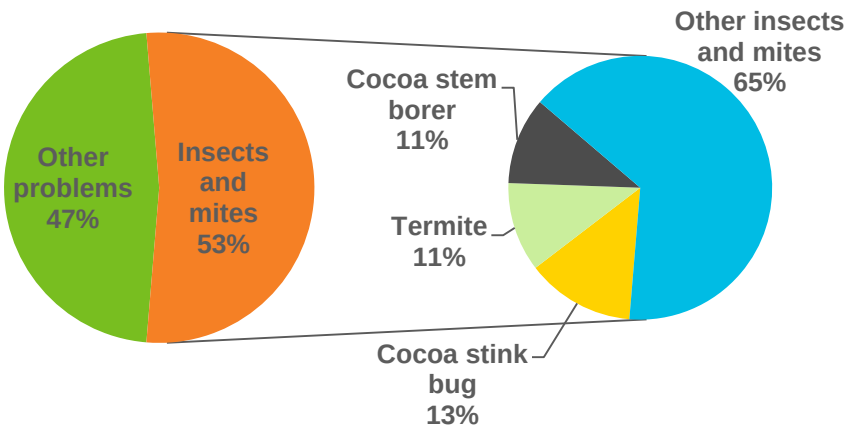
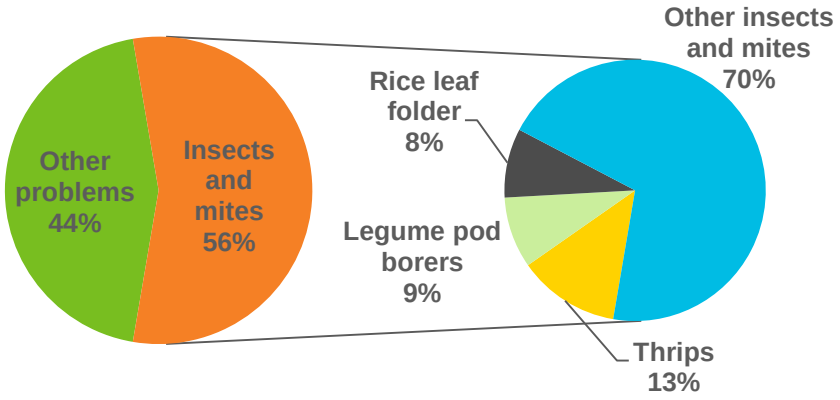
- We focussed on the following research questions:
  - What kind of pest problems are farmers bringing to the plant clinics?
  - Which macrobial and microbial biocontrol products are registered nationally?
  - Do these registered biocontrol products make it into the extension material available to the plant doctors?
  - Where extension material does include biocontrol products, how frequently are plant doctors recommending these products to farmers?

Pest problems brought to plant clinics

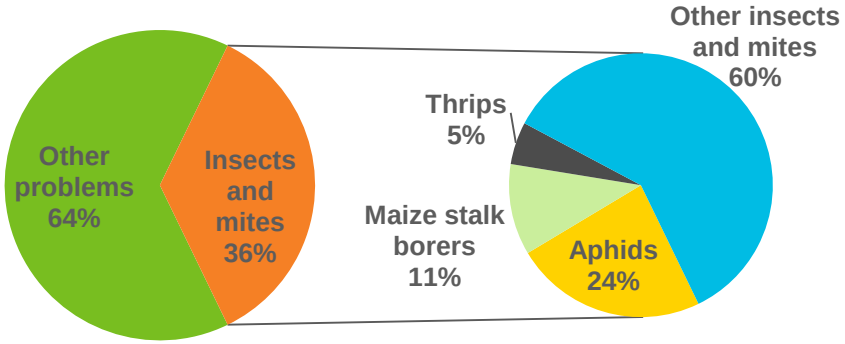
Ghana (n=7,162)



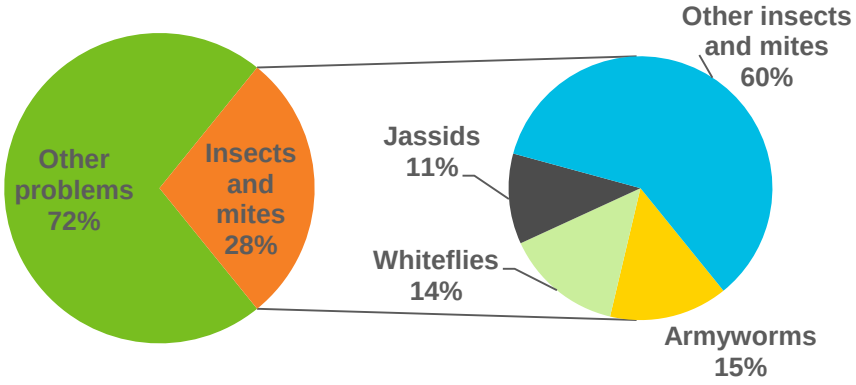
India (n=4,011)



Kenya (n=11,043)



Pakistan (n=20,948)



Number of registered macrobial and microbial biocontrol products for insect pests

Country	Number of registered biocontrol products for insect pests
Ghana	2
Kenya	19
Zambia	2
India	9
Nepal	3
Pakistan	2

- India and Kenya have adapted their registration process for biocontrol products and so more products are available (e.g. Bt, *Beauveria, Metarhizium, Lecanicillium*, etc.)
- Registration of macrobial BCAs is required only in Kenya, where 12 species of macrobial BCAs are registered
- In the other 5 countries, macrobials are available (1-8 species) but not registered

Biocontrol product recommendations for insect pests in extension material

Country	Number of PMDGs available in 2016	Number of national PMDGs on insect pests	Number (and %) of PMDGs on insect pests containing biocontrol product recommendations
Ghana	30	15	5 (33.3%)
Kenya	68	28	8 (28.6%)
Zambia	58	23	3 (13.0%)
India	25	18	11 (61.1%)
Nepal	24	14	8 (57.1%)
Pakistan	50	15	4 (26.7%)

Recommendation by plant doctors of biocontrol products when included in PMDGs

Country	Number of opportunities where a biocontrol product could have been recommended by a plant doctor*	Actual number of times that plant doctors recommended a biocontrol product to farmers (mean ± SE%)
Ghana	259	0
Kenya	1,141	40 (3.5 ± 1.5%)
Zambia	58	0
India	581	108 (18.6 ± 10.9%)
Nepal	60	23 (38.3 ± 13.5%)
Pakistan	704	21 (3.0 ± 2.8%)

* Number of plant clinic queries for which the relevant PMDG contains a biocontrol product recommendation
** % plant clinic queries for which plant doctor recommended a biocontrol product

What have we learnt from this baseline study?

- Number of registered microbial and macrobial biocontrol products for insect pests in the study countries vary from 2-19; Kenya and India have the most products available due to their adapted registration processes
- Results revealed that nationally registered biocontrol products are not always included in the extension material compiled by national experts in the Plantwise programme; India and Nepal are better in this respect
- Even if biocontrol products are mentioned in the extension material used at the plant clinics, they are only sometimes (or never – in Ghana and Zambia) recommended to farmers by extension workers

Dougoud J, Cock MJW, Edgington S and Kuhlmann U (2017). A baseline study using Plantwise information to assess the contribution of extension services to the uptake of augmentative biological control in selected low- and lower-middle-income countries. BioControl. https://doi.org/10.1007/s10526-017-9823-y

Why is the uptake of biocontrol products rather limited in low- to lower-middle income countries?

Knowledge

- Extension officers have a lack of knowledge / awareness about biocontrol products and their use

Registration

- Some registration pathways make the registration of biocontrol products lengthy and complicated

Availability / local production

- Agro-input suppliers in rural areas often do not have biocontrol products available; local production is rather limited although major efforts are being made in Kenya and India

Affordability

- Price of biocontrol products is sometimes high and only affordable for business-oriented farmers. One exception is India (support of local production and subsidy schemes)

National Plantwise partners working in extension service

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Alex Semakula

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Barriers to uptake of biocontrol products in Malawi

- No clear standards/procedures for registration of biocontrol products
- Distribution channels for biocontrol agents are lacking
- Extension staff and farmers lack information on effective use of available biocontrol products
- Lack of facilities and equipment for rearing of biocontrol agents
- Insufficient number of staff trained in the production of biocontrol agents/products
- Lack of potential models for commercialisation of biocontrol products and a lack of market development despite potential opportunities (e.g. replacement of HHP in tobacco, a key cash crop)

Barriers to uptake of biocontrol products in Uganda

- Market dominated by chemical pesticides; biocontrol product range on the market is small
- Use of biocontrol products mostly restricted to business-oriented farmers (flower producers and organic producers)
- Few input dealers market biocontrol products
- Farmers interested in quick-fix and ‘one fix for all problems’ solutions
- Awareness of biocontrol products is limited and confidence in product efficacy is low
- Many farmers use self-produced products, e.g. botanicals

How can Plantwise facilitate improved uptake?

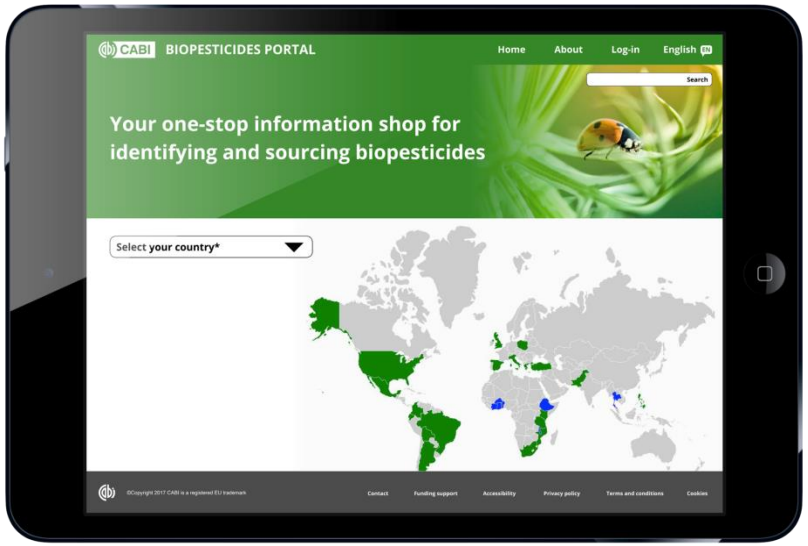
- Extension services have the potential to contribute significantly to the uptake of biocontrol products
- Plantwise should aim to facilitate:
  - Encouraging national partners to include all biocontrol products available at a national level in PMDGs
  - Increasing extension workers' awareness of biocontrol options to increase likelihood of them recommending these products to farmers
  - Training extension workers on correct application of biocontrol products to ensure maximum efficacy

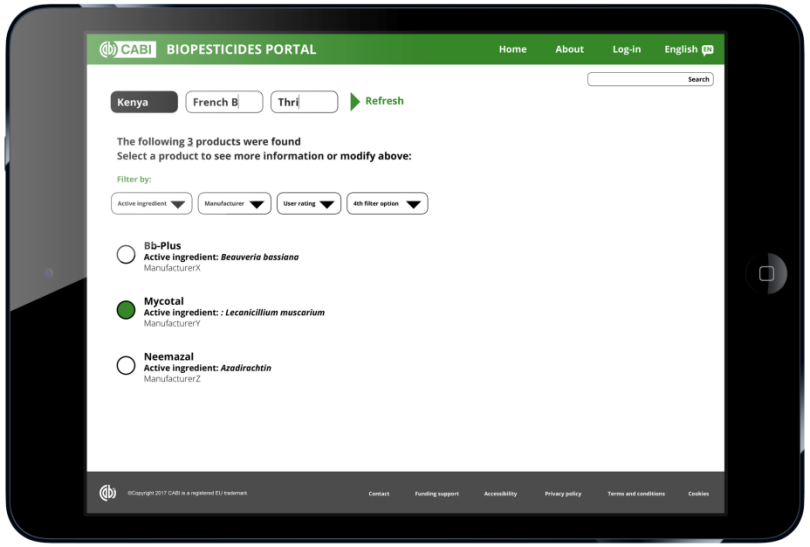
How can Plantwise facilitate improved uptake?

- Plantwise could extend its work with stakeholders:
  - *Governments:* Develop subsidy schemes for biocontrol products and an adapted registration pathway
  - *Trade sector actors:* Facilitate access of contracted farmers to biocontrol products
  - *Manufacturers and suppliers:* Facilitate farmer access to affordable and available biocontrol products through better linkages among stakeholders

How can CABI facilitate improved uptake?

- Create a database to facilitate the **identification, sourcing and application of macrobial and microbial products** for particular crop pest problems in a given country
- Develop a **mobile app and/or website** for use on smartphones, tablets and desktop computers to put information about biological pest management products, and their correct use, at the fingertips of farmers and extension workers





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merci
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ありがとう
kiitos
thank you
gracias
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tak
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urakoze
ke itumetse
danke
terima kasih
dhanyawaad

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