Plantwise Impact

Results and lessons from Kenya

This brief is a digest of a mixed-methods evaluation report of the impacts of CABI's Plantwise programme in Kenya, undertaken by American Institutes for Research (AIR). The full report is available at www.plantwise.org/air-evaluation

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Key messages

- Results from quantitative studies show that Plantwise contributes to **improvements on yields, crop-based household incomes** and **reductions in pesticide usage** for farmers living in plant clinic catchment areas.
- Stakeholder testimonials show that Plantwise is **improving institutional coordination** in national plant health systems, generating more knowledge, and improving the likelihood of detecting and responding to pest outbreaks.
- Qualitative feedback and analysis of administrative data show that the process through which Plantwise is implemented is **innovative and comprehensive**, with intervention of the programme **improving knowledge of extension agents** and management of data providing insights into where response interventions should be targeted in order to address plant health problems.
- A benefit-cost analysis of Plantwise in Kenya shows that estimated monetary benefits outweigh the costs of implementing the programme at a **ratio of 2.9:1 and an internal rate of return of 54%**.

Background

Plantwise is a global programme, led by CABI, to increase food security and transform rural livelihoods by reducing crop losses. This is achieved by establishing networks of local plant clinics, where farmers can get actionable and science-based agricultural advice from plant doctors.

Plant clinics are reinforced by the Plantwise Knowledge Bank, a gateway to online and offline plant health information, including diagnostic resources, pest management advice, and pest data. The Knowledge Bank also collects data about the farmers, the crops and the pests affecting them, and shares this with national stakeholders. This allows Plantwise and its in-country partners to identify new plant health problems and develop targeted best-practice guidelines for managing crop losses, based on the local needs of farmers.

Working in partnership with relevant partners, Plantwise strengthens national plant health systems from within, helping to establish frameworks for in-country pest surveillance and early warning systems. This empowers countries to respond quickly to emerging plant health problems.

By giving smallholder farmers the knowledge to lose less of what they grow, Plantwise helps them become more food secure and resilient to financial and climate shocks.

Purpose

To gather evidence on the outcomes and impact of Plantwise through a comprehensive impact assessment plan based on two impact pathways: plant clinic advice adoption and plant health system change.

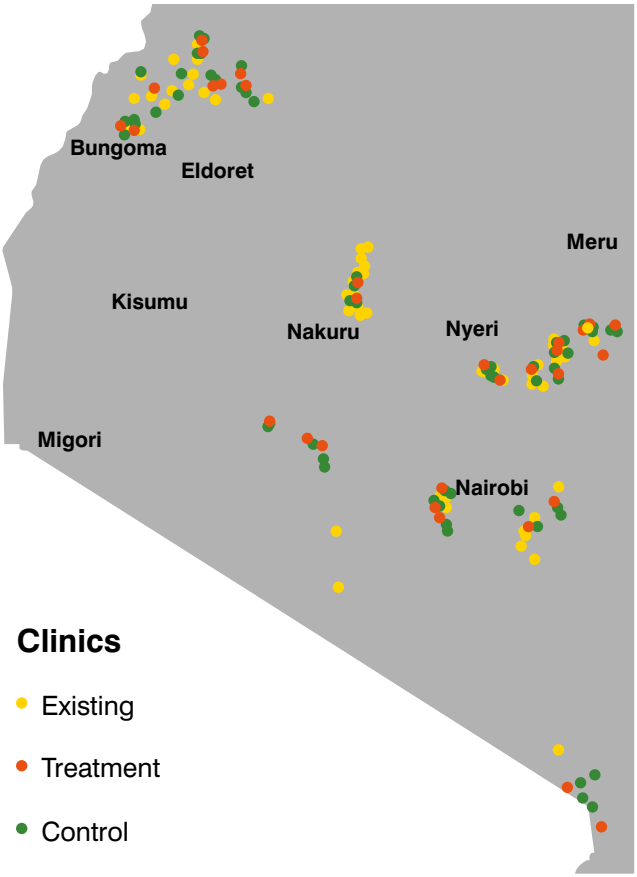
In 2014, CABI commissioned the American Institutes for Research (AIR) to conduct a mixed-methods impact assessment of Plantwise. The study was carried out between 2014 and 2018 using both quantitative and qualitative data collection methods including farmer surveys, a knowledge assessment of plant doctors, and interviews and focus group discussions at national and local levels. A randomized controlled trial was used to estimate programme impacts at the farm level. Each component of the study included a baseline and two rounds of follow-up data collection (at 12 and 36 months after the baseline).

Plantwise was launched in Kenya in 2010 and has since established a large number of plant clinics in the country (see **Figure 1**). As a result, Kenya was identified as the ideal country for a case study for AIR to assess the impact of Plantwise.

The purpose of this brief is to present results of the assessment as evidence of impact of the Plantwise programme on the farmers and plant health system in Kenya in terms of

- increased farmer productivity and incomes;
- strengthened institutional framework for managing plant health; and
- benefits of the programme relative to its costs.

Figure 1: Plant clinics in Kenya



Increased productivity and incomes

Results from the farm-level randomized controlled trial in 13 counties, which were established to eliminate confounding effects of other interventions, confirm that Plantwise contributed to improved yields and incomes and reduced pesticide usage for farmers who live in plant clinic catchment areas (within a radius of 1.5km of a clinic).

Despite the rigorous study design some farmers in the control areas attended clinics or had interactions with plant doctors outside of plant clinics. Plantwise has also had an influence outside the plant clinic catchment areas through mass extension campaigns. For example, Plantwise was involved on a national level in the response to the outbreak of fall armyworm (FAW). This means that differences found in the study could still be underestimating the impact of Plantwise.

In terms of value of production and cost per acre, a number of statistically significant differences were observed between farmers in plant clinic catchment areas and the control. Maize farmers in treatment areas experienced a 13% increase in the value of production per acre (see **Table 1**), an effect driven mostly by an increase in the quantity produced. The effect can be interpreted as either an increase in production or as a reduction in crop losses. At the same time, there appear to be no significant changes in the overall production costs of maize despite the increase in production. The estimated impacts are highly relevant given that maize is the most commonly produced crop by farmers in Kenya (e.g. 73% of farmers in the sample produce maize).

Farmers in plant clinic catchment areas are 4 percentage points more likely to practice crop rotation, check for plant health problems on a regular basis, remove volunteer crops, and remove infested or damaged material than those in the control area.

These farmers are also 8 percentage points less likely to use pesticides and 7 percentage points more likely to avoid chemical drift when spraying pesticides. Though there are variations depending on which crop they cultivate, farmers in plant clinic catchment areas are also generally more likely to use protective gear for pesticide application (such as gumboots, caps, or overcoats), more likely to wash themselves and more likely to wash the equipment used after pesticide applications.

A 97% decrease was observed in the value of pesticide used per acre for perennial crops. This finding complements the result presented above regarding farmers using pesticides more judiciously.

The study found that farmers in plant clinic catchment areas are less likely to attribute effects on production to factors such as rainfall and temperature or assume a decrease of crop yields over time. These results suggest that Plantwise may have increased farmers' sense of control over the agricultural production process.

Table 1: Impact on maize at 36 months

	Impact difference	Control median	Treatment median
Production	12%*	540 kg/ac	604 kg/ac
Value of production	13%*	16,200 $/ac	18,306 $/ac
Costs of production			
Seed	4%	2,360 $/ac	2,454 $/ac
Inorganic fertilizer	-11%	3,933 $/ac	3,500 $/ac
Pesticide	-18%	1,100 $/ac	902 $/ac
Labour	-3%	3,000 $/ac	2,910 $/ac

Note: ac = acres. Monetary values in Kenyan Shillings. Programme impacts estimated in natural logs. Treatment median calculated from impact difference and control median. N = 1,460. *p < .10

Stronger institutions

A series of key informant interviews and focus group discussions were conducted to collect qualitative data on impact of Plantwise. The results indicate that Plantwise is improving institutional coordination in the management of plant health, knowledge of both farmers and extension agents, and the likelihood of identifying and timely reporting of pest outbreaks.

According to most respondents, there is no established government system for detecting or reporting new pest invasions. As a result, plant clinics are now regarded as the primary way that stakeholders in the Kenyan plant health system use to track occurrences of pests and diseases. A cluster coordinator said:

"The only system is the plant clinics, because we receive samples from the farmers and we get to learn about new pests in the plant clinics."

The availability of data through the Plantwise Online Management System (POMS), combined with improved institutional coordination have made systemic responses to pests and diseases more effective. One county-level desk officer described:

"When we are able to analyse information from the field we are able to tell if there is an increase in a certain pest or disease in a certain area – so our officers are giving feedback. Currently we have a challenge with fall armyworm infestation, and from the reports we get from our plant clinics we are able to map out areas that are heavily infested by the pest and act very quickly. Our officers are also very fast in doing diagnosis and giving feedback to the farmers on what should be done, how it should be done and when."

The Plantwise Knowledge Bank – a tool that is used by both plant doctors and farmers – also holds a unique source of information on pests and diseases that does not exist elsewhere in the country.

However, the development of a consistent approach to employing plant clinic data in a systematised way across counties is still needed. Officials cited devolution as a variable that affects their work, the overall plant health system in Kenya, and Plantwise. Counties, as new institutions with limited experience in providing services to stakeholders, may not yet have the organisational capacity to take on the work they inherited from the national government.

Another problem stemming from Kenya's devolved government is the lack of consistency in stakeholders' messages surrounding best agricultural practices. Despite the challenges, respondents reported a synergy between their new responsibilities after devolution and the support offered by Plantwise.

According to stakeholders, Plantwise has improved the manner in which farmers interact with the Ministry of Agriculture at the local level. The improved interaction with farmers through plant clinics is viewed as being helpful in addressing farmers' plant health needs and improving their knowledge.

Between July 2016 and July 2017, 53% of farmers in treatment areas were aware of plant clinics, yet only 34% attended a plant clinic at least once in the previous 12 months. This observation is not unusual for a demand-driven programme like Plantwise, where only farmers in need of advice visit plant clinics.

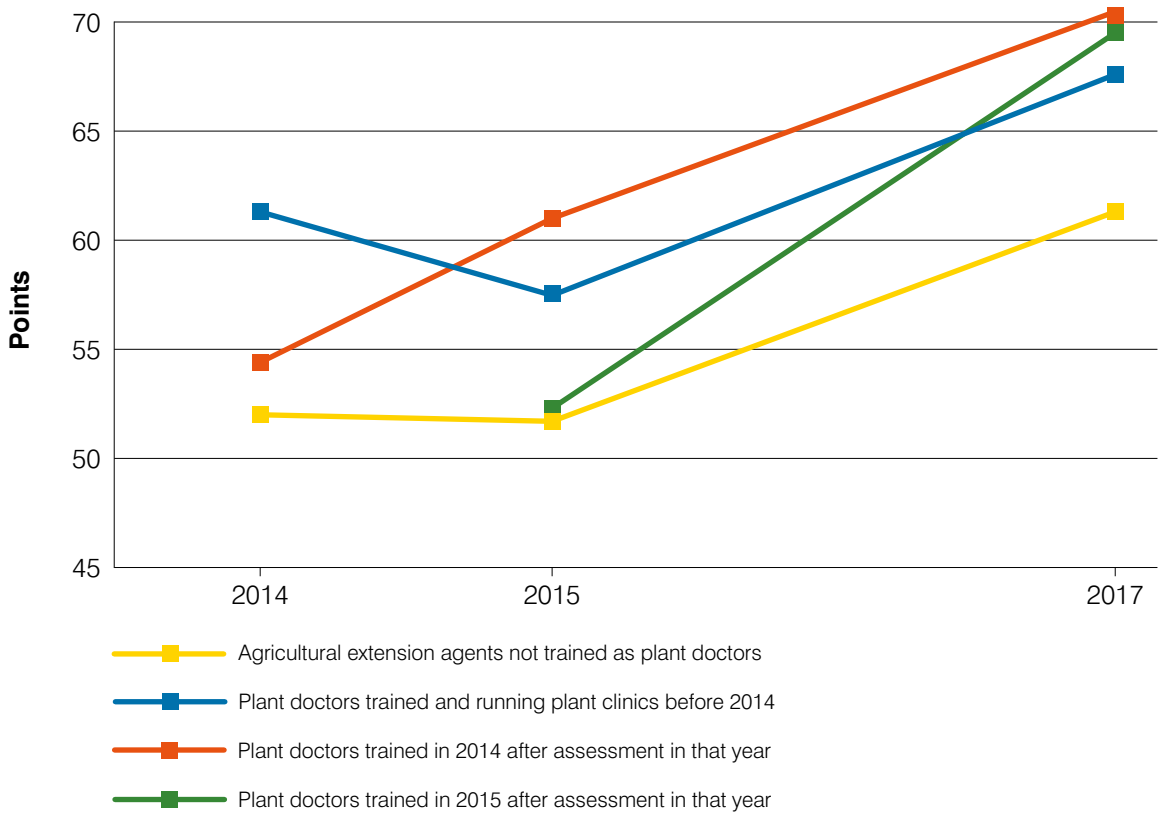
In an attempt to determine whether farmers' knowledge improved as a result of the programme's intervention (see previous section), AIR investigated if the training provided through Plantwise had an effect on plant doctors' plant health knowledge. This was measured through a series of assessments of both current and newly trained plant doctors and a comparable group of agricultural extension agents not trained in Plantwise modules.

The results (see **Figure 2**) show that Plantwise training has a large effect on knowledge of extension officers. Those trained as plant doctors in 2014 scored significantly higher (up to 7.4 more points in 2015 and 6.7 more in 2017) than the untrained extension agents. Similar differences were observed in results in 2017 for the plant doctors who were first trained in 2015.

The impact of a programme like Plantwise is ultimately a function of how it is implemented. Evaluating the implementation is therefore a critical aspect of assessing the programme. The qualitative feedback and analysis of administrative data show that the process through which Plantwise is implemented is innovative and comprehensive, particularly in the areas of data management systems which help to track diagnoses and recommendations. Nonetheless, there is still scope for improvement in addressing data management issues.

The direct contact with farmers and the general shifts in the plant health system are consistent with a strengthening of the capacity of institutions that manage plant health, as well as a reduction in damage from pests and diseases in Kenya.

Figure 2: Plant doctor knowledge assessment 2014–2017



Benefit-cost analysis

AIR used the ingredients method for benefit-cost analysis to assess whether the benefits of Plantwise in Kenya (the monetary gains created by the intervention for farmers in treatment areas) outweigh the programme costs after at least three years of programme implementation.

All costs of implementation, including those often not adequately identified in budget or expenditure data, such as opportunity costs, or those shared between the programme and other operational activities, were estimated. The costs of Plantwise in Kenya beyond the normal operating costs of the agricultural extension system include the costs of initiating programme activities and maintaining them as well as the costs of CABI and Ministry of Agriculture employees' time for running the programme. For instance, we include costs for CABI coordination, national coordination, advocacy activities, monitoring and evaluation, plant clinic operations, and POMS and Plantwise Knowledge Bank operation. The total costs in 2017 were calculated to be GBP 531,669.

Benefits in 2017 are calculated from the estimated results of the impact assessment (see **Figure 3**). As shown, the calculation of programme benefits focuses exclusively on maize outcomes as the largest amount of data was available for this crop, enabling an economically and statistically significant impact on the value of production to be determined (see **Table 1**). Detailed plot level data were only collected on plots larger than 1/32 acre. Programme benefits are estimated to be GBP 1,521,335. This gives a benefit-cost ratio of 1,521,335/531,669, approximately a ratio of 2.9:1, showing that the benefits delivered outweighed the costs of running the programme in 2017.

Moreover, AIR also calculated the associated internal rate of return (IRR) of Plantwise in Kenya to be 54%. Compared to cost-benefit analyses conducted on other agricultural extension programmes, the estimated IRR is above average. For instance, a systematic review by the International Food Policy Research Institute found that the median internal rate of return (IRR) for similar research and extension programmes to be 37%.

Programme benefits are likely to be underestimated and costs overestimated as they include CABI program level inputs. First, detailed production data was not collected for some key, high value crops such as tomatoes, kale and other horticultural crops commonly brought to clinics, as land areas on which these crops were grown were less than 1/32 acre. Second, plant health system changes have delivered other benefits in Kenya, such as being able to identify new pests at the national level. This was the case during the recent FAW outbreak, where Plantwise supported the Ministry of Agriculture's response. This may have positively affected both treatment and control areas. Lastly, as is common in other development programmes, benefits may increase relative to costs over time as knowledge gained by farmers and other stakeholders is reused without further need for direct advice on recurrent problems.

[1] The IRR is a measure used to estimate the profitability of an investment. It is calculated as the rate that makes the net present value of a project (i.e. benefits minus costs over a given period of time) equal to zero. An investment is profitable if the IRR is greater than the market rate of return (i.e. the market interest rate). The higher a project's IRR, the more desirable it is to undertake. For the evaluation of Plantwise, the IRR is estimated using the period from 2012 to 2024. The calculation makes the following assumptions: (i) The number of plant clinics will remain stable for the period 2018 to 2024; (ii) It takes two years for a plant clinic to produce the observed monetary benefits; (iii) There were no monetary benefits in 2012 and 2013. (iv) Programme benefits and costs will remain stable in real terms for the period 2018-2024. For additional details, see the full impact assessment report.

Figure 3: Benefit calculation

Benefits = (A × B) × (C × D) × E

A = % increase in yearly gross margins for maize farmers due to PW = 13%

B = Value of maize production per acre
= 540kg × KES 30/kg
= KES 16,200
= GBP 113.4

C = No. of acres cultivated in maize per farmer
= 1.33 acres/farmer

D = No. of farmers in PC catchment area who cultivate maize
= 636 farmers

E = No. of plant clinics
= 122 plant clinics

Conclusion

Evidence from the assessment of Plantwise impact in Kenya firmly establishes that

- **Plantwise interventions have improved the productivity and incomes of farmers** who live in plant clinic catchment areas in terms of higher crop yields and safer production practices;
- Plantwise **interventions have led to improved institutional coordination** in Kenya's plant health system, improving the likelihood to identify and respond to pest outbreaks; and
- the benefits outweigh the costs of implementing the programme at a benefit-cost ratio of 2.9:1.

The Plantwise framework is therefore an impactful and cost-effective approach to improving a national plant health system, making smallholder farmers more food secure with safer practices resulting also in improved crop-based household incomes.

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