Second generation plant health clinics in Uganda

Danielsen, Solveig; Matsiko, Frank; Mutebi, Emmanuel; Karubanga, Gabriel

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Second Generation
Plant Health Clinics in Uganda

Measuring clinic performance from a plant health system perspective
2010 – 2011

UNIVERSITY OF COPENHAGEN • MAKERERE UNIVERSITY • CABI

WORK PAPER 2

Solveig Danielsen

Frank Matsiko

Emmanuel Mutebi

Gabriel Karubanga

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Plant health systems – A novel approach to plant healthcare in Uganda (2010-2011)

PARTNERS:

- Centre for Health Research and Development, Department of Veterinary Disease Biology Faculty of Health and Medical Sciences, University of Copenhagen, Denmark
- Department of Extension and Innovation Studies, College of Agricultural and Environmental Sciences, Makerere University, Uganda
- CABI, UK and Africa Centres

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CONTACT:

Assoc. Prof. Solveig Danielsen, University of Copenhagen;
Email sodan@life.ku.dk *or* soldanielsen@gmail.com; *Tel* +45 4220 5769

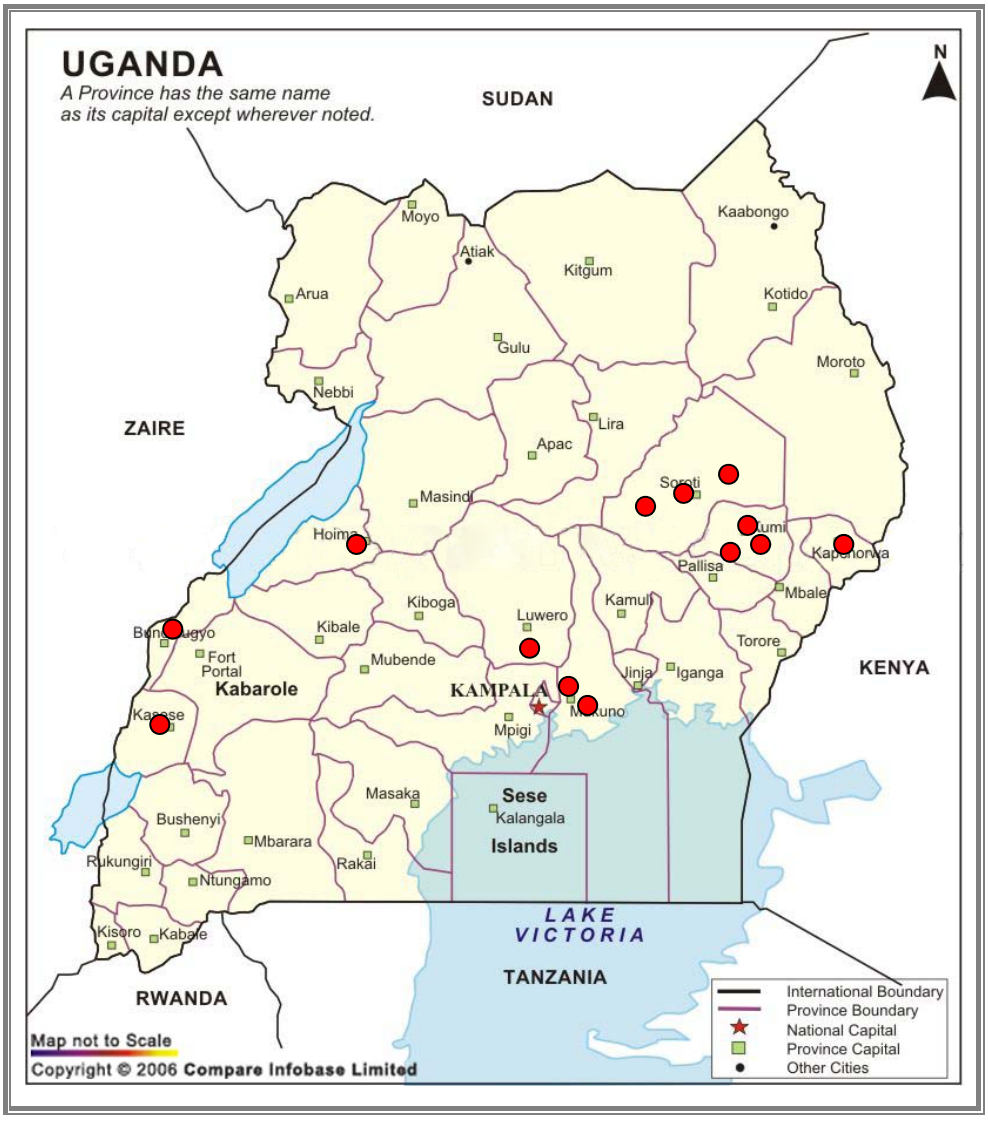
Cover page: Plant clinic held at Butema market (Buhanika sub-county, Hoima district) by Local Government staff, October 2010. Approximately 40 farmers turned up with problems on cocoa (**back cover**), cassava, maize, banana, citrus, groundnut, bean, tomato, papaya and mango.

CONTENT

ACRONYMS

AAO	Assistant Agricultural Officer
AASP	Agricultural Advisory Service Provider
AFAAS	African Forum for Agricultural Advisory Services
AI	Agricultural Inspector
AII	Africa Innovation Institute
AO	Agricultural Officer
ATAAS	Agricultural Technology and Agribusiness Advisory Services
BBW	Banana Bacterial Wilt
BUZARDI	Bulindi Zonal Agricultural Research and Development Institute
CAAPD	Comprehensive Africa Agriculture Development Programme
CABI	Centre for Agricultural Bioscience International
CAEC	Continuing Agricultural Education Center
CAES	College of Agricultural and Environmental Sciences
CAO	Chief Administrative Officer
CBF	Community Based Facilitator
CBSD	Cassava Brown Streak Disease
CGIAR	Consultative Group on International Agricultural Research
CMD	Cassava Mosaic Disease
CWD	Coffee Wilt Disease
DAO	District Agricultural Officer
DNC	District NAADS Coordinator
DPMO	District Marketing and Production Officer
EAPIC	East African Phytosanitary Information Committee
GPC	Global Plant Clinic (CABI)
GPS	Global Positioning System
HH	Household
IPDN	International Plant Diagnostic Network
IPM CRSP	Integrated Pest Management Collaborative Research Support Program
LC	Local Council
LG	Local Government
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MAFACOS	Mairirwe Farmers Cooperative Society Ltd
NAADS	National Agricultural Advisory Services
NARO	National Agricultural Research Organisation
NGO	Non-Governmental Organisation
PMA	Plan for Modernisation of Agriculture
PMG	Production and Marketing Grant
SAARI	Serere Agricultural and Animal Research Institute
S/C	Sub-county
SHA	Self Help Africa
SNC	Sub-county NAADS Coordinator
SOCADIDO	Soroti Catholic Diocese Integrated Development Organisation
SPSS	Statistical Package for Social Sciences
ToT	Training of trainers
UBOS	Uganda Bureau of Statistics
UNADA	Uganda National Agro-input Dealers Association
USH	Ugandan Shilling (1 US dollar = ~2300 USH)
VPC	Village Procurement Committee
WHO	World Health Organisation
ZARDI	Zonal Agricultural Research and Development Institute

PLANT HEALTH CLINICS IN UGANDA



Districts with plant clinic activity during 2010-2011: Buikwe, Bukedea, Bukwo, Bundibugyo, Hoima, Kasese, Katakwi, Kayunga, Kumi, Mukono, Ngora, Serere, Soroti

Summary

In 2005 and 2006, plant health clinics were established in Mukono, Iganga and Soroti districts as a new way to provide plant health advice to farmers in Uganda. Early results showed that the plant clinics have the potential to enhance the outreach of agricultural extension, capture wider farmer demand and improve disease vigilance. Recognising this potential, the Ministry of Agriculture, Animal Industry and Fishery (MAAIF) included plant clinics in the 5-year Development Strategy and Investment Plan (DSIP) as part of the Pest and Disease Control sub-programme.

After a period of inactivity, the plant clinics were reactivated in 2010 under the guidance of MAAIF and CABI. During 2010 and 2011, plant clinics were run in 13 districts by Local Governments (LG) and non-governmental organisations (NGO), and more districts started to show interest in joining. There was a growing commitment among implementers and policy makers to expand and consolidate these services. The focus shifted towards viewing the clinics as part of a wider 'plant health system' where plant clinics, diagnostic laboratories, disease surveillance, research and input supply were better connected than had hitherto been the case.

The present study was carried out by University of Copenhagen and Makerere University with the purpose of describing the development and measuring performance of plant clinics in Uganda following their revival in 2010 and 2011. Our analytical framework was derived from the health system model of World Health Organisation (WHO), designed to measure performance and health outcomes. The modified plant health system model was based on six system components: *Service delivery, Plant health workforce, Plant health information, Input supply, Finance*, and *Policy, governance and leadership*. As plant clinic performance indicators we used *Clinic coverage, Regularity/timeliness* and *Quality of plant healthcare*.

Field work was carried out over 15 months between July 2010 and September 2011 in 13 districts in the eastern, central and western parts of Uganda. A total of 205 plant clinic sessions were held in the period. For a variety of reasons, compliance with the planned clinic schedules fluctuated over time. During the last quarter of 2010 and the first quarter of 2011, LG activities were heavily constrained by the district reform, electoral campaigns and the prolonged initiation of the second phase of NAADS. Staff scarcity, work overload, emergence of unplanned activities and inadequate funds for clinic operations also limited clinic execution, both for LGs and NGOs.

The plant clinics received 2,598 queries from 2,069 clients during the study period. The clients came from 20 districts, 107 sub-counties, 392 parishes and 851 villages. Despite the short period the plant clinics have been running in Uganda and the modest funds put into them, our findings clearly point out the potential of clinics to enhance the coverage of existing extension services.

While the basic aspects of clinic operation were well understood by all organisations, there were no common standards for record keeping, data management, monitoring and reporting, either internally in the clinic organisations or externally from the backstopping institutions. There was also no functional system to refer samples from the clinics to the laboratories of MAAIF, Makerere University and National Agricultural Research Organisation (NARO).

Although the plant clinics have become part of MAAIF policy and the districts show increasing interest and commitment, there are some structural barriers that made it difficult for the districts to institutionalise the clinics and for MAAIF to play their leading role. A mismatch between institutional mandates/authority and allocated resources limited the scope of the actions both at district and national level. MAAIF and LGs have the legal mandate, but few resources, to regulate pests and diseases. NAADS have the mandate and resources to deliver extension services. Yet, there is a perceived misfit between NAADS' commodity orientation and the broader mandate of plant clinics ('any problem in any crop'). The clinics risk 'falling between the two chairs' of extension and pest and disease control.

One of the key motives for MAAIF to support the plant clinics is to improve surveillance and enrich the national pest information system by tapping into the clinics as a source of 'pest and disease intelligence' at community level. For this to become reality the issues of ownership of data, reporting and information management must be solved between MAAIF and LGs.

Many factors influenced the performance of plant health clinics, from practical, everyday concerns of clinic staff to the policy framework that shapes public sector activities and relationships with the NGO and private sectors. We introduced a plant health system framework derived from human health to analyse events, enabling us to organise the issues and identify key features that affect plant clinics and their surroundings. The initial results are encouraging since the framework gives a structure to the analysis of human behaviour and outcomes and to the identification of interventional needs. The preliminary results presented here have helped to understand what works and why. In general we found a good correlation between plant health system attributes and clinic performance.

Both NGOs and LGs have a useful role to play in running plant clinics and the potential synergies are significant. The joint model for running clinics used by SHA Kumi, through secondment of LG staff, combined the best of both worlds: the flexibility and resources of the NGO and the technical capacity and anchoring in the public system of the LG.

The plant health clinics in Uganda experienced a noteworthy revival in the study period. Wider stakeholder engagement created momentum for a new generation of the plant clinic initiative with more focus on expansion, consolidation and integration with key actors in plant health. Ownership was strengthened and clinic management improved with stronger local leadership. It was nonetheless evident that the clinic initiative expanded in a loose and unregulated way. MAAIF and CABI had spearheaded the initiative by giving plant doctor training and initial guidance but none of them provided the overall leadership to guarantee that basic standards and procedures were in place and followed up on. Many of the observed clinic weaknesses were products of missing coordination, follow up and communication.

The current policy framework in Uganda supports plant clinics and this is a major step forward. However, the existing governance structures, institutional mandates and resources make it difficult to institutionalise the mixed-mandated clinics. Finding a solid institutional base for the 'orphaned' clinics will be a major challenge. The sustainability of plant clinics is still uncertain. Funds are limited and skilled human resources to man the clinics have yet to reach a critical mass. Nevertheless, the recent expressions of commitment from the major players suggest that the evolution of stronger links between components of a plant health system is a real possibility.

1. Introduction

In 2005 and 2006, plant health clinics were established in Mukono, Iganga and Soroti districts as a new way to provide plant health advice to farmers in Uganda. The plant clinics have since spread to new districts. There is a growing commitment among implementers and policy makers to expand and consolidate these services.

An assessment of results and experiences from the five year pilot phase (2005-2010) was carried out in 2010 and documented in a previous work paper (Danielsen and Mutebi, 2010). The assessment showed that the plant clinics have the potential to enhance the outreach of agricultural extension, capture wider farmer demand, and target plant health problems more directly. In the words of one of the plant doctors: "*the plant clinics can do things that no other extension method can*". It also indicated that plant clinics can help improve disease vigilance on the ground and in this way complement the limited surveillance resources and capacity of the Ministry of Agriculture, Animal Industry and Fishery (MAAIF).

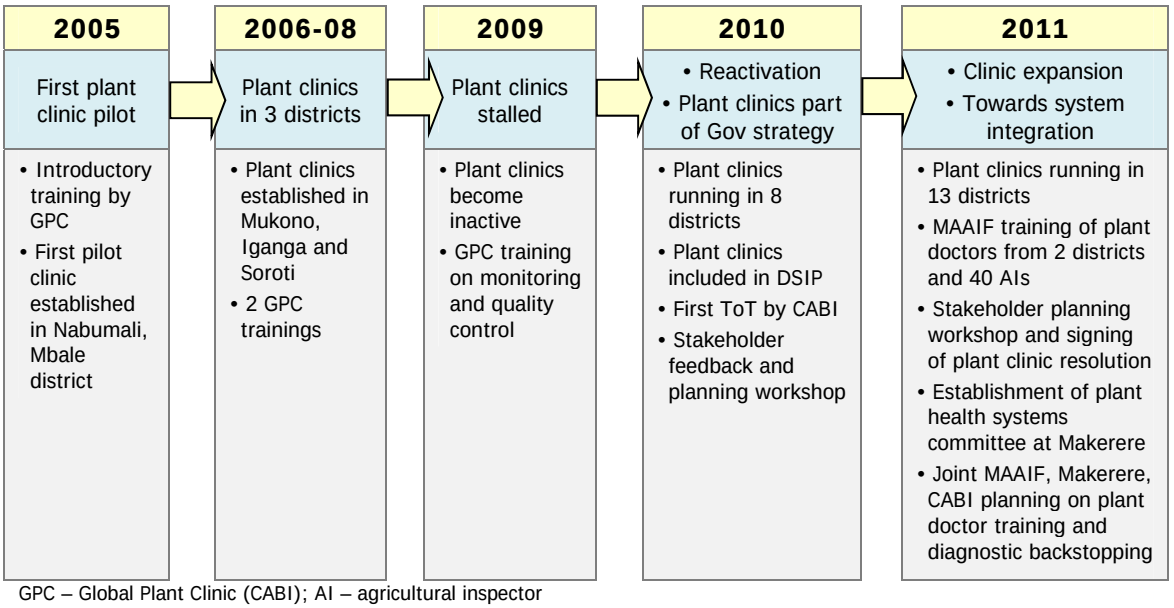
MAAIF recognised that plant clinics were an innovative farmer service and a valuable complementary entity to existing structures within the plant health system and incorporated them in 2010 in its 5-year Development Strategy and Investment Plan (DSIP) for 2010/11–2015/16 MAAIF (2010a). The Department of Crop Protection of MAAIF explicitly stressed the need to do something different in order to cope with the serious pest and disease problems Ugandan farmers face. More political and technical leaders in the districts became aware of the potential value of plant clinics and they started to support them.

The plant clinic initiative faced a number of challenges in the pilot phase. The clinics, for example, had not moved beyond their initial status as an experiment or a 'CABI project'[1]. They were not yet institutionalised, the sense of ownership by the clinic organisations was weak, regularity of clinic sessions was limited by high staff turnover, and there was no systematic follow-up, supervision and technical backstopping. The funding of clinic activities largely depended on support from the Centre for Agricultural Bioscience International (CABI). All the above contributed to the cessation of plant clinic activities during the second half of 2009.

The plant clinic initiative was reactivated in 2010 with renewed commitment from key players including MAAIF, Makerere University, several new districts and non-governmental organisations (NGOs). A workshop, facilitated by MAAIF, University of Copenhagen and CABI, was held in Mukono in March 2010 as a first step towards defining a new path for the clinics (MAAIF, 2010b). Following CABI and MAAIF-led plant doctor courses, including training of trainers (ToT), more districts took up the initiative. During 2010 and 2011, plant clinics were run in 13 districts while more districts showed interest in joining. A second stakeholder workshop was held in May 2011 by MAAIF (MAAIF, 2011a) with support from University of Copenhagen and CABI to further discuss and plan actions for expansion and mainstreaming of plant clinics into the decentralised extension services and MAAIF's pest and disease control programme. Among the key issues covered were how to institutionalise the clinics and make them sustainable, and how to upscale plant doctor training and formalise technical backstopping.

From 2010 onwards, focus shifted towards viewing the clinics as part of a wider 'plant health system' where plant clinics, diagnostic laboratories, disease surveillance, research and input supply were better connected than had hitherto been the case. Figure 1 illustrates the evolution of the plant clinic initiative in Uganda from 2005 until the second half of 2011.

[1] The support was provided by the Global Plant Clinic (GPC), a CABI managed alliance operating until 2010.



GPC – Global Plant Clinic (CABI); AI – agricultural inspector

Figure 1. Plant clinic timeline: The evolution of the plant clinic initiative in Uganda 2005 – 2011.

This study

The plant health system concept as defined by Danielsen *et al.* (2011) is largely based on experiences and lessons from human health where different sources of expertise, knowledge and technology are combined to provide healthcare. Different types of health systems have been developed, tested and studied in depth over many decades. Much is known about what is required to make human health systems work. In contrast, we know little about health systems for farmers' crops and what is required to establish effective plant healthcare services.

In 2007, the World Health Organisation (WHO) developed a six component framework for assessing health system performance and outcomes (WHO, 2007). For this study we adapted the framework (Figure 2) to describe and analyse the development and performance of the plant health clinics in Uganda following the revival of the initiative in 2010 and 2011. We used the modified WHO framework on the assumption that the six system components are equally basic and critical to attaining performance outcomes in plant health. Coverage, regularity and quality of plant healthcare were used as plant clinic performance criteria. These are in line with recognised performance features of human healthcare services and build on previous research on performance assessment of plant clinics (Danielsen and Kelly, 2010).

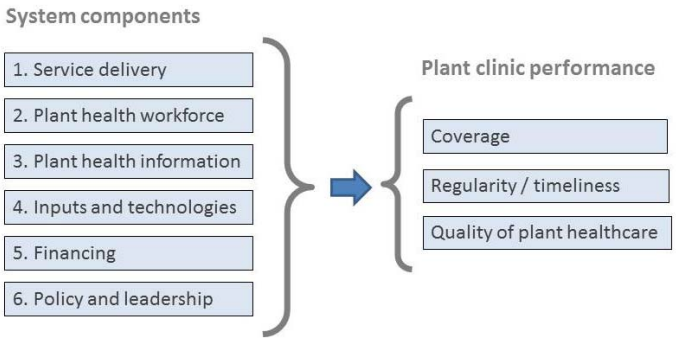


Figure 2. Plant health system analytical framework (modified from WHO, 2007).

In this work paper we analyse how the six system components relate to plant clinic performance and we discuss the implications for further plant health system development and sustainability in Uganda.

2. Methods

Field work was carried out in the 13 districts where plant clinic activities took place: Mukono, Bukwo and Kayunga (central region), Soroti, Serere, Katakwi, Kumi, Ngora, Bukedea and Bukwo (eastern region) and Hoima, Kasese and Bundibugyo (western region) over 15 months between July 2010 and September 2011. The study focused on the plant health clinics as providers of primary plant healthcare and their relationship with other relevant actors within plant health. Qualitative and quantitative data were collected at clinic, district and national levels. The following methods were used for data collection:

Method	Target
1. Questionnaire survey of plant clinic staff and coordinators	47 respondents All districts except Hoima and Bukwo
2. Key-informant interviews	34 respondents
3. Review of plant clinic registers	2,598 queries All districts
4. Direct observation	16 field visits 6 clinic observations
5. Exit interviews with clinic users	125 respondents Mukono and Buikwe districts
6. Collection of GPS coordinates of parishes of clinic users	All districts except Bukwo

The key informants included: Plant clinic staff and coordinators; Political, administrative and technical leaders from Mukono, Buikwe, Soroti and Hoima Local Government (LG); Senior officials from MAAIF, National Agricultural Advisory Services (NAADS), Bulindi Zonal Agricultural Research and Development Institute (BUZARDI) and NGOs; Senior researchers from Makerere University; Representatives from CABI, international organisations and donor agencies.

The key-informant interviews from Mukono and Buikwe districts were done in connection with a complementary MSc study under the same research project on farmer's perception of plant health clinics, which also included focus group discussions and household interviews.

The variables used to describe and assess the system components and performance indicators are listed in Tables 1 and 2.

The data were analysed by type using the following methods:

- Content analysis was carried out for qualitative interviews.
- Quantitative data were analysed using SPSS (Statistical Package for Social Science Version 16.0) and Microsoft Office Excel 2007.
- ArcGIS Desktop 10 was used for GPS mapping of parishes where clinic users came from.
- 'Spider web' diagrams of plant health system components and clinic performance were created for each clinic organisation based on a 5-point scale: 1–poor; 2–inadequate; 3–fair; 4–good; 5–excellent.

Table 1. Plant health system components and variables used to describe and assess them. Modified after WHO (2007).

System component	Variable
1. Service delivery	• materials and equipment • logistics • publicity • record keeping • monitoring and quality control • organisation and reporting • technical backstopping
2. Plant health workforce	• clinic manning • skills, level of training • work load • retention • incentives and motivation
3. Plant health information	• sources • access and use • information and surveillance systems
4. Input supply and technologies	• access • availability • quality
5. Financing	• available funds • sources of funding • funding policies/ level of self-funding
6. Policy and leadership	• policy and governance framework • local level support/ leadership • central level support/ leadership

Table 2. Clinic performance indicators and variables used to describe and assess them.

Performance indicator	Variables
Coverage	• Number of crops, problems, clinic clients, % women • Clinic catchment area (sub-counties, parishes and villages reached)
Regularity / timeliness	• Compliance with clinic schedule • Time keeping
Quality of plant healthcare	• Validity of diagnosis • Efficacy and feasibility of advice

3. Plant health system components

3.1 Service delivery

3.1.1 Plant health clinics

DELIVERY MODELS

The plant clinic host organisations included five LGs and three NGOs covering 13 districts in eastern, central and western Uganda (Table 3). The LGs of Mukono and Soroti and Soroti Catholic Diocese Integrated Development Organisation (SOCADIDO, an NGO) were part of the pilot phase. Bukwo LG was the latest organisation to join. With the exception of Soroti and Serere, where the LGs worked alongside SOCADIDO, there was one clinic organisation in each district. During the study period a total of 25 plant clinics were active at some point (Table 3). These plant clinics were started or re-activated between July 2010 and August 2011.

The NGOs operated in more than one district and viewed plant clinics as furthering their mandates on local development. Rwenzori Information Center Network (RicNet) for example, joined the plant clinic initiative because they saw it as a means to expand and strengthen local services through existing information networks which are the basis of the RicNet development strategy*: "RicNet is an indigenous network of information centers situated in the Rwenzori region. RicNet has led a holistic approach to development that entails an integral approach geared towards the transformation of social–economic spheres within the Rwenzori region*"[2].

Table 3. Plant clinic organisations and delivery modalities in 13 districts of Uganda.

District	Host organisation	No. of clinics	Scheduled regularity	Delivery mode	Clinic venue	Date started
1 Mukono	Local Government	3	Fortnightly	Fixed venues	Markets	April 2011
2 Buikwe	Local Government	3	Fortnightly	Fixed venues and mobile scheme	Markets	Nov. 2010
3 Kayunga	Self Help Africa	1	Fortnightly	Mobile scheme	Markets	Jan. 2011
4 Kumi	Self Help Africa	1	Fortnightly	Fixed venue	Market	Jan. 2011
5 Bukedea	Self Help Africa	1	Fortnightly	Fixed venue	Market	April 2011
6 Ngora	Self Help Africa	2	Fortnightly	Fixed venues	Markets	Sept. 2010
7 Bukwo	Local Government	2	Fortnightly	Fixed venues	S/C offices	Aug. 2011
8 Soroti	SOCADIDO Local Government	2	Fortnightly	Fixed venues	Markets	Aug. 2010
9 Serere	SOCADIDO Local Government	2	Fortnightly	Fixed venues	Markets	July 2010
10 Katakwi	SOCADIDO	1	Fortnightly	Fixed venue	Market	Oct. 2010
11 Hoima	Local Government	2	Fortnightly Every day	Mobile scheme Fixed clinic	Markets Farmer coop	Aug. 2010
12 Kasese	RicNet	3	Fortnightly	Fixed venue	Farmer coop Input shop Information centre	Sept. 2010
13 Bundibugyo	RicNet	2	Fortnightly	Fixed venue	Information centre Market	Aug. 2010

[2] http://www.ricnet.info/

The two other NGOs, Self Help Africa (SHA) and SOCADIDO, both have a mandate to support small scale farmers in achieving food security and economic independence. The plant clinics presented an opportunity to strengthen local service provision and thereby support community development. The LGs are mandated to deliver agricultural advisory services through NAADS and to control pests and diseases in their districts. Plant clinics were seen as an opportunity to extend existing services. As one of the district NAADS coordinators explained, "*The plant clinics could provide a strong contribution to extension. There is need to do something new about pests and diseases*".

All the clinics were scheduled to operate fortnightly, mostly from a specific market place (Table 3). This schedule was introduced in the pilot phase and had since become the standard delivery mode. In Hoima and Kayunga a mobile scheme was being used to cover more sub-counties, and recently the clinic in Nkokonjeru (Buikwe district) extended its area of operation to include Ssii sub-county as an alternate clinic location.

The Mairirwe plant clinic (Hoima district) was run from a farmer cooperative's premises and was unique in that it operated on a daily basis. When Hoima LG began organising plant clinics in 2010, it sought and obtained the collaboration of Mairirwe Farmers Cooperative Society Ltd (MAFACOS) to have a plant clinic as part of the services it offers its members. In Kisinga (Kasese District, Rwenzori) one of the clinic venues was an agro-input shop owned by a plant nurse that had been trained and certified by the Uganda National Agro-input Dealers Association (UNADA) as an input supplier. The rest of the plant clinics in the Rwenzoris operated from markets or local information centers supported by RicNet.

The metal sign post placed by the road gives the plant clinic in Mairirwe (Hoima district) permanent visibility. The clinic is run by a farmer coop and supported by the Local Government.

Eighty five percent (85%) of the interviewed clinic users from Mukono and Buikwe deemed the clinic venues appropriate. The rest thought that the clinics were obstructed by market activities Twenty seven percent (27%) believed that the distance to the clinics held farmers back. Discussions continue on whether more flexibility should be considered in choosing clinic venues. Some clinic coordinators observed that relying on a market place as a fixed venue may not always be the best option (Box 1). One of them explained: "*Nakifuma market (Mukono district) is increasingly being dominated by traders so it is no longer an appropriate venue for the clinic. We are planning to move it to Mayangayanga, still in Nakifuma sub-county*". Similar concerns informed Hoima LG and SHA Kayunga's deliberate choice to use a mobile scheme as the standard delivery mode for reaching as many sub-counties as possible. SHA Kumi used a mixed model under which the clinic team rotated at fixed intervals among four different market places in Kumi, Ngora and Bukedea districts.

Box 1. Choosing plant clinic venues.

"*The clinics shouldn't necessarily only be at markets. The NAADS service providers could also set them up in the villages as part of their routine and in connection with farmer training activities. This should help enhance visibility and accountability.*"

District NAADS Coordinator, Teso region

CLINIC MATERIALS AND EQUIPMENT

Each of the plant clinics had some simple materials including a banner, registration books and forms, a table and chairs. Some in addition had a tent or other shed, while others operated in the shade of a tree.

In Ngora district the plant clinic operated from a mobile tent and photo sheets were used as a diagnostic aid.

One of the conclusions from the pilot phase was that the clinics staff's ability to diagnose and give advice was limited by scarcity of examination tools and reference materials on symptoms and control measures. While there were some improvements from the previous year, fact sheets on pests and diseases, reference manuals, photos sheets with symptoms and examination tools remained scarce (Table 4).

Table 4. Plant clinic materials and equipment available at the clinic organisations[1] (38 respondents[2]). Brackets indicate limited availability of items at plant clinics.

Material	Mu-LG	Bu-LG	SHA-Ka	SHA-Ku	Se-LG	So-LG	Soca	RicNet	No. org.
Equipment									
Table	X	X	X	X	X	X	X	X	**8**
Chairs	X	X	X	X	X	X	X	X	**8**
Banner	X		X	X	X	X	X	(X)	**(7)**
Uniform		X	X	X	X	X	X	(X)	**(7)**
Tent	X	X	X	X		X	X		**6**
Camera	(X)		X		X	X			**(4)**
Handlens	(X)			X	X				**(3)**
Knife		(X)			X			X	**(3)**
Sample packing material						X	X		**2**
Scissors			X						**1**
Materials									
Photo sheets	(X)	X	X	X	X	X	X	(X)	**(8)**
Pets/disease manual	(X)	X	X	X	X		X	(X)	**(7)**
Fact sheets	(X)		X	(X)	X	X		(X)	**(6)**
Registration book	X	X	X	X	X	X		(X)	**(7)**
Query form	X	X	X		X	X	X	(X)	**(7)**
Input display	(X)	(X)		X		X	X	(X)	**(6)**
Plant phamarcy (input sale)							X	(X)	**(2)**
Total	**(12)**	**(10)**	**12**	**(11)**	**12**	**12**	**11**	**(12)**	

[1] **Mu-LG**–Mukono LG; **Bu-LG**–Buikwe LG; **SHA-Ka**–SHA Kayunga; **SHA-Ku**–SHA Kumi; **Se-LG**–Serere LG; **So-LG**–Soroti LG; **Soca**–Socadido
[2] Multiple responses

Sixteen factsheets on pests and diseases were produced at a course delivered by CABI in 2006[3] and in 2010-2011 six additional factsheets were made by staff from MAAIF, Makerere University and Mukono LG. None of these, however, had been reproduced and distributed for wider use

[3] Module 3 of the course 'How to Become a Plant Doctor' (CABI)

by the clinics. The majority of clinic staff acknowledged that fact sheets and other visual aids are crucial to convey a clear and understandable message to the clients.

We found an increased interest in linking agro-inputs directly to the clinic. Several clinics had included an input display or sale although the range of products was still limited (see Section 3.4).

Box 2. Basic plant clinic materials provided by MAAIF.

3 tables	60 laminated reference photos
10 chairs	60 fact sheets
Clinic banner	8 visual symptom guides
Shade	Prescription pads
Plastic disposal bin	2 pens
2 knives	Note books
2 hand lenses	Toner for photo copies
3 aprons	3 reams of paper

As part of the DSIP implementation plan for 2011, MAAIF had committed funds to support five new districts, among these Bukwo and Hoima, with a provision for basic packages ('starter kits') of materials and tools (Box 2). The package has a value of about 1 million Ugandan Shilling (USH)[4]. However, due to delays in the release of DSIP funds and MAAIF's bureaucratic procurement system, the starter kits had not yet been delivered by February 2012 (Senior Official, MAAIF) thus preventing the new clinics from operating at the desired standard.

LOGISTICS

Running a clinic involves transportation of staff and materials, setting up the tent, chairs and tables, and in some cases storing materials in between clinic events. SHA and SOCADIDO used an institutional pick-up truck to transport staff and materials to the clinic venues. They also used space at their own premises to store clinic equipment and materials. In Soroti, the clinic staff sometimes used the NAADS transport. Other LG staff, in contrast, used their own means to transport materials and themselves. This typically meant using a motor cycle or a taxi or walking. Materials were stored locally with a nursing aid, a residence neighbouring the clinic or at the Town Council premises.

SHA and SOCADIDO had more flexibility in organising transportation compared to LGs due to the availability of the institutional truck. Yet, the dependency on the truck sometimes created bottlenecks. In the case of SHA Kumi, clinic regularity was hampered because the truck broke down on one occasion while it had to be used for other project activities on several others (see Section 4.2).

Storage of clinic materials was also an issue in some cases. As one of the clinic coordinators explained, "*The materials are supposed to be stored near the clinic but we still haven't found a proper place. The logistics and transport make the clinics not easy*". In Hoima, district extension staff initially moved to the sub-counties with the mobile clinic. One of the sub-counties, however, was 60 km away; so the staff needed to sleep there adding further to the costs. Faced with this challenge, Hoima LG decided to re-plan their mode of operation so that the clinics would be managed by sub-county staff, occasionally supported by district staff.

Clinic staff considered logistics a major challenge and a constraint to clinic regularity. Given the scarcity of funds that arrived late or never, the practical organisation of clinic activities became difficult (see Section 3.5).

[4] 1 US dollar = approx. 2,300USH

PUBLICITY

The clinic organisations used various means to publicise the clinics. Most common were banners, community meetings, radio and farmers' networks (Table 5). SHA in Kumi and Kayunga used 10 and 7 different methods, respectively. Mukono LG and RicNet used 6 methods each, while Buikwe LG, Soroti LG, Serere LG and Socadido only used 3 to 4 methods.

Table 5. Means of publicity used by the plant clinic organisations[1] (38 respondents[2]).

Means of publicity	Mu-LG	Bu-LG	SHA-Ka	SHA-Ku	Se-LG	So-LG	Soca	RicNet	No. org.
Clinic banner	X	X	X	X	X	X	X	X	**8**
Community/stakeholder meetings	X	X	X	X	X	X		X	**7**
Radio			X	X	X	X	X	X	**6**
Farmer groups			X	X	X	X	X	X	**6**
At church	X		X	X				X	**4**
Megaphone	X		X	X				X	**4**
Through extension workers	X	X	X						**3**
Through lead farmers	X		X						**2**
Sign post			X	X					**2**
At the hospital			X						**1**
Total	**6**	**3**	**10**	**7**	**4**	**4**	**3**	**6**	

[1] Abbreviations of clinic organisations, see Table 4 footnote
[2] Multiple responses

The level and regularity of clinic publicity was often mentioned a weak point (43% of clinic staff respondents). Some informants explained that sometimes they couldn't carry out any publicity at all because of limited funding. Others indicated that they had tried to take advantage of established means to publicise the clinics, i.e. through NAADS farmer groups and church gatherings. As one plant doctor said, "*The NAADS and the NGO mobilise the same clients as for the clinic so we can complement each other*".

Table 6. How clinic users in Mukono and Buikwe knew about clinics (125 respondents).

How they got to know	%
Saw the clinic banner/ tent, from market people	51,1
From extension worker	16,5
Community meeting or farmer group	11,4
Megaphone	8,0
From a neighbour or household member	6,3
From radio	3,4
From lead farmer	3,4

Clinic users in Mukono and Buikwe received information about the clinics from different sources (Table 6). In most cases the physical presence of the clinic at the market was the only publicity made and clients only became aware of the clinic on arrival at the market. The lack of prior warning meant that many clinic users did not have samples and ended up giving oral descriptions of the problems they had. This is likely to have affected the quality of the diagnoses made (see Section 4.3).

In Buikwe it was realised that publicity was weak. "*So far we have done very little*", a coordinator said, "*that's why so few farmers turn up, they don't know about the clinics. Good publicity and consistency in operation are key to attract more people*". Similar feelings about the need to improve public awareness of the plant clinics were stressed by one of the Local Council 5 (LC5) Chairpersons from central Uganda. "*The plant clinics are still a new kind of service and it requires an effort to create*

demand for it," he said. There were also a few instances where the plant clinics were mistaken for something else. As a nursing aid from Kumi explained: "*When people saw the white plant clinic tent in the market they shied away from it because they thought we were carrying out HIV tests!*"

SHA experienced high turnout in response to more intensive publicity. Clinic staff cited the use of radio and a megaphone as having been particularly effective. One of the coordinators told: "*Before we go, we do a radio talk show to alert the farmers as to where and when the clinic will be held. We have a radio space every Monday. With that we even reach farmers from outside the program area*".

In the pilot phase local leaders were not involved in the plant clinic initiative. In this new phase several clinic organisations highlighted the importance of involving local leaders to get their buy-in and help to spread the word.

SHA found the megaphone a useful tool to attract people to the plant clinics (Mukura market, *left*).
In other districts, the clinic tent and banner were the only means of publicity at hand (Nkonkonjeru market, *right*).

CLINIC RECORD KEEPING

Plant clinic data are a unique source of systematically collected information on plant health problems and farmer demand. Record keeping was identified as a major weakness of the plant clinic operations in the pilot phase; data collected were underused, incomplete and the quality questionable (Danielsen and Mutebi, 2010). These findings alerted clinic partners to the necessity to improve record keeping. In the current phase, there is growing awareness that well managed clinic records are a powerful tool for strengthening decision making at technical, operational and strategic levels (Boxes 3 and 5).

Box 3. What plant clinic records can help achieve.

- document clinic activities (accountability)
- document incidence of plant health problems
- identify themes for collective action on major problems
- identify demand for research and technology
- identify demand for expert support and further training
- support internal quality control
- provide supportive evidence for advocacy

We observed improvements in record keeping compared to the pilot phase, e.g. several clinics used carbonated books instead of lose paper sheets and the information recorded was generally more complete than in the past. Four different forms were used to record the queries at the clinics. These included the old form from the pilot phase (RicNet (partially), Soroti and Serere LGs), a modified version of the old form (SHA), a 3-query sheet previously introduced by CABI (Bukwo LG), and a new 1-query sheet introduced to Mukono and Buikwe LGs by CABI in early 2010 for testing. In Hoima, the queries were recorded

in a notebook in a handmade form. Handmade forms had also occasionally been used in other districts whenever copies of the original form were out of stock (RicNet, SHA Kumi). Consequently, clinic data gathered across districts were unstandardized and of mixed quality.

Although we observed several wrong entries and omissions in the filled forms, the majority of clinic staff interviewed (19 of 33) reported having had no problem filling them (Table 7). Some plant doctors, however, said that it took too long to fill out the form, especially when there were clients waiting. Some of the difficulties encountered are mentioned in Box 4.

Table 7. Difficulty of filling the query form as perceived by clinic staff (33 respondents[1]).

District	Yes	No	Total
Mukono	4	2	**6**
Buikwe	1	2	**3**
Rwenzori	3	5	**8**
Kayunga	4	3	**7**
Kumi	0	4	**4**
Soroti	1	2	**3**
Serere	1	1	**2**
Total	**14**	**19**	**33**

[1] Half of the respondents had not received any guidance on how to fill the clinic records

Responses from clinic staff and coordinators indicated that not everyone was sure about what to do with copies of the query form. The clients apparently each received a copy but many implementers were uncertain about the fate of the other copies. Some were reported to have been kept at the clinics or with the plant doctors and others sent to the clinic coordinators or in a few cases, to MAAIF. Our own observations confirmed that there is a general lack of clarity and guidance on record management.

Box 4. Comments from clinic staff on difficulties with filling the query forms.

- The language used in the printed form is too technical (*Mukono LG*)
- Limited space for the details, too lengthy to fill (*RicNet*)
- Age of the plant cannot be remembered by the farmer since they don't keep records (*Mukono LG*)
- The explanations given by the farmers are in Luganda but the advice given is in English (*SHA Kayunga)*
- When the client presents various cases to the clinic, coding becomes complicated (*Soroti LG*)

The majority of the clinic organisations received none or limited guidance on the use of Excel for clinic data management. Electronic recording was also hampered by lack of computers and computer skills. Recording in Excel was only done by SHA and SOCADIDO whose staff had received targeted training by the research team. The RicNet coordinator mentioned that they intended to ask the information officers at the information centers to enter clinic data and submit them by email to RicNet. Although the information officers were already doing this with several other projects, this was not yet being implemented for the clinics. To strengthen data management skills, MAAIF included some Excel exercises in the basic plant doctor course that was provided to SHA and Bukwo LG in 2011 (see Section 3.2).

Our general assessment of the status of record keeping was that it remains a major weakness, from filling the query forms to managing and using the data. There were no standard procedures and little clarity about data management roles and responsibilities at sub-county, district and national levels. Accordingly, collection of clinic records for this study was time-consuming requiring several visits to the clinic organisations.

To improve data management and make recording easier for the plant doctors, CABI began piloting automated data capture in collaboration with LG of Mukono in early 2010. The scheme involved using a new query form and the clinic coordinator scanning the form and subsequently submitting the pdf files by email to CABI. CABI was charged with transferring the data into a database using specialised software and returning the data in Excel to the clinic organisation thereafter. Unfortunately, there was little follow up on the trial and the software was never put to use.

Box 5. The power of plant clinic data.

SHA have made an effort to create and maintain good electronic clinic registers using Excel. They assigned secretarial assistance to the task and incorporated it into their work procedures. SHA held several stakeholder meetings in 2011 to get wider buy-in from local organisations and leaders. At all these meetings the presentation of clinic data was crucial to create interest and awareness about the potential of the plant clinics to improve plant health services and disease vigilance.

One and a half years later, there still were no conclusive results on the usefulness of the data capture system. Mukono LG had made initial progress in typing up the data in Excel during the plant clinic pilot phase. This was put to a halt when the new system was introduced. "W*hy type up the queries when CABI captures the data*?" argued the district clinic coordinator. Additional problems were introduced by the split up of Mukono into two districts (Mukono and Buikwe) in 2010. The scanner that had been given to the old Mukono district at the onset of the trial remained in the new Mukono cutting off Buikwe from the trial and the attendant scanning services. The Buikwe clinics continued to use the new query form but, since the staff were new and were never given training on how to handle the forms, the clinic records remained unused. Consequently none of the clinic data were recorded electronically in Mukono and Buikwe during the period of this study. In the event this well-intentioned effort at improving working procedures inadvertently undermined some of the progress previously made.

MONITORING AND QUALITY CONTROL

In the previous clinic phase monitoring and quality control were sporadic and fragmented, and the information gathered was under-used. This situation had not changed much in the new phase. There still was no well-defined monitoring system and there were no common standards, either internally in the clinic organisations or externally from the backstopping institutions.

The interviews with clinic staff and coordinators included questions about *who* does the monitoring, *what* they monitor and *how*. The responses showed considerable discrepancy even within the same clinic organisation revealing limited awareness and/or understanding of what was actually being done in monitoring and the purposes that were meant to be served. It may also reflect inadequate communication within and among the clinic organisations.

Clinic staff and coordinators cited plant clinic coordinators, CABI and MAAIF staff, the plant doctors themselves and in one case the LC Chairman as taking lead in monitoring activities. In some cases the District Agricultural Officer (DAO) or District Production and Marketing Officer (DPMO) acted as clinic coordinator. The number of criteria mentioned as having been used to monitor the clinics varied among and within organisations (Table 8). Different information gathering methods were named: clinic visits, review of clinic records, team meetings, feedback

from users, expert visits and phone calls. But again, we noted several inconsistencies in the responses. The coordinators reported that supervision took place at a weekly (SHA), bi-weekly (Soroti LG, Serere LG), monthly (Buikwe LG, RicNet) or quarterly basis (SOCADIDO). We were not able to verify the frequencies of supervision. No monitoring visits were carried out by MAAIF or CABI over the study period.

Table 8. Monitoring criteria used to supervise plant clinics[1] (35 respondents[2]).

Monitoring criterion	Mu-LG	Bu-LG	SHA-Ka	SHA-Ku	Se-LG	So-LG	Soca	RicNet	No. org.
Quality of advice		X	X	X	X		X	X	**6**
Physical setup	X			X	X		X	X	**5**
Publicity made	X	X					X	X	**4**
Outreach achieved	X				X	X	X		**4**
Staff attitude	X	X		X					**3**
Storage of materials	X		X			X			**3**
No. of samples brought	X		X			X			**3**
Regularity of operations	X			X					**2**
Adherence to procedures	X				X				**2**
Creativity shown by staff	X					X			**2**
Client satisfaction	X			X					**2**
Total # criteria used	**10**	**3**	**3**	**5**	**4**	**4**	**4**	**3**	

[1] Abbreviations of clinic organisations, see Table 4 footnote
[2] Multiple responses

The monitoring criteria and methods mentioned by the respondents closely mirror some of the concepts, principles and methods taught at the monitoring course[5] given by CABI in 2009. Since we were not able to access monitoring reports from any of the organisations, it was not possible to verify the extent to which monitoring had been internalised and embedded in the operational procedures.

Table 9. Degree of clinic staff satisfaction with monitoring and feedback (37 respondents).

District	Satisfied	Partially satisfied	Not satisfied
Mukono LG	3	3	1
Buikwe LG	2	1	0
SHA Kayunga	0	7	0
SHA Kumi	4	2	0
Serere LG	1	2	0
Soroti LG	1	1	0
SOCADIDO	0	1	0
RicNet	2	2	4
Total	**13**	**19**	**5**

Supervision and follow up were viewed as positive ingredients of clinic work helping to improve performance and maintain motivation, yet, most clinic staff were unhappy with the lack of follow up and feedback from their coordinators/supervisors (Table 9, Box 6). They wanted to belong to a forum where they could meet and discuss clinic related issues, and exchange and learn from each other. Without more contact the clinic staff would easily feel isolated and lose motivation. A clinic coordinator from Soroti also suggested carrying out regular review meetings with farmers as part of clinic monitoring.

Establishment of an appropriate monitoring and evaluation system was identified as a key priority by participants at the 2011 stakeholder workshop (MAAIF, 2011a). 'Appropriate' was

[5] 'Monitoring Progress and Quality of Plant Health Clinics', Module 4 of the course 'How to Become a Plant Doctor', CABI.

described by participants as meaning a system that helps not only document and assess what the clinics do, but one that also considers the performance of the wider system, i.e. how well the clinics are connected to diagnostic labs, research, input supply and other relevant actors.

Box 6. Clinic staff comments about plant clinic monitoring and follow up.

- Monitoring improves the clinic staffs' performance and motivation
- Sometimes we need backup and advice on how to improve our work
- Regular supervision is important to improve staff performance and confidence
- Monitoring should involve other stakeholders, such as CABI, MAAIF and Makerere University
- With no supervision, there is no clear feedback
- The supervisor has only visited the clinic once
- It is difficult for the DAO to carry out effective monitoring because of too much work load
- There is need for field follow up by the supervisors

ORGANISATION AND REPORTING

The clinic organisations planned clinic activities according to their own working procedures. MAAIF and CABI provided the initial plant doctor training and general guidelines on clinic operation. Subsequent limited contact with clinic organisations created uncertainty among several of them on how to organise the work effectively. While the basic aspects of clinic operation were rather well understood by all, several coordinators requested more guidance and standardization. As one of them pointed out, "*We need to harmonise our way of working, to integrate better*". Similar sentiments were expressed by another clinic coordinator who confessed, "*The planning is a bit floating*" and a RicNet coordinator who stated: "*The clinics are a new concept; we need clearer directions on how to operate"*. RicNet had a particular organisational challenge due to the geographical spread of their activities and staff. Their staff members were all based in Fort Portal while the clinics were run by lead farmers in distant sub-counties.

We found no common reporting system, whether in terms of frequency, content or recipients. Reporting was most often done either monthly or quarterly and mainly for internal purposes. MAAIF and CABI were only sporadic recipients of reports. The formats ranged from short 1-2 page summaries and pest lists, to more extensive narratives including achievements, challenges and ways forward (SHA Kayunga). In some cases only the query forms were forwarded to the coordinators. Despite several attempts, we only received a few reports from some of the clinic organisations so it was not possible to make a general assessment of the regularity and quality of reporting.

3.1.2 Technical backstopping

During the pilot phase, the scope and quality of the services offered by the plant clinics were limited by their detachment from expert institutions. Institutional barriers made it difficult to create a referral system to send plant samples from the clinic to diagnostic labs (Danielsen and Matsiko, 2010). It was nevertheless widely recognised by the organisations involved that plant clinics cannot work in isolation and that back up by specialists was needed to solve more complex problems. "*Effective backstopping helps improve staff skills and confidence in the service*", said one of the plant doctors.

In 2011 MAAIF and Makerere University made an effort to engage more closely with the plant clinics. At the 2011 stakeholder workshop (MAAIF, 2011a), both institutions urged clinics to send samples and stay connected to expert services by any other available means. MAAIF also used their plant doctor course to invite people to send samples to its core diagnostic facilities, the National Plant Health Laboratory and Quarantine Services, based at Namalere. The physical infrastructure is in place but the laboratories are still not fully functional due to limited equipment, regents and qualified staff, yet, as a senior MAAIF official noted, "*we have enough to start with*". Makerere University, for her part, is a partner of the International Plant Diagnostic Network (IPDN) under the Integrated Pest Management Collaborative Research Support Program (IPM CRSP). IPDN was set up to build diagnostic capacity and strengthen the linkages between diagnostic labs and potential users, i.e. farmers and extension workers. As part of the IPDN activities, Makerere offers diagnostic tests to the plant clinics at no cost.

Despite the clear commitment by MAAIF and Makerere, there was limited progress in the on-going effort to establish a formal referral system. Few samples were sent by clinics to the labs (Box 7). For the period January to August 2011, the Namalere lab received a total of 104 samples most of which were from border points and had been collected by agricultural inspectors (AI) employed by MAAIF. Only one sample was from a Soroti plant clinic. Six plant samples were sent to Makerere University by SHA Kayunga via MAAIF in the second half of 2011. No samples were referred to the laboratories of National Agricultural Research Organisation (NARO), the Zonal Agricultural Research and Development Institutes (ZARDI), or CABI. One of the clinic coordinators requested for more clarity about CABI's role.

Box 7. The hard way from clinic to lab.

"*We have not received many samples from the clinics this year. They don't know how to send them. We are looking at using the post buses to refer samples from the clinics to us. MAAIF would pay the costs from the DSIP budget. We need to teach the clinic organisations how to handle and send the samples. The referral system needs to be operationalised.*"

Senior Official, MAAIF

Photo: Sample reception desk, Namalere Laboratory

More than half of the clinic staff mentioned that they did not know how to engage with backstopping institutions. This need for better orientation was emphasised by one of the plant doctors who referred to the lack of a tradition for information seeking: "*We have never asked for any additional information. There is a limited culture of seeking additional information and expert advice.*" Some of the trainees from MAAIF's plant doctor course highlighted the advantage of holding the course at MAAIF's premises in Namalere. There was broad consensus that the location of such training helped participants become familiar with the place, and broke down mental barriers; subsequently making it easier for staff to phone, visit or send samples.

Table 10. Sources of technical backstopping reported by clinic staff and coordinators (36 respondents[1]).

Organisation	No. responses[1]
MAAIF	17
CABI	12
NAADS/LG	10
ZARDI/NARO	7
NGO	6
University	1
None	4

[1] Multiple responses

MAAIF, CABI and NAADS/LG were the main sources of technical backstopping according to clinic staff and coordinators by (Table 10). NARO/ZARDI and universities were only mentioned by a few respondents. Of the 7 who cited 'NARO/ZARDI', 6 were from Soroti and Serere clinics, located near Serere Agricultural and Animal Research Institute (SAARI). The contact between the clinics and NARO/ZARDI was mainly restricted to informal contact between individuals. Linkages between clinics and ZARDIs in other locations were even less developed as implied by a senior official from Hoima LG who stated: "*We want to connect closer to BUZARDI so they can help with expert advice, training and lab tests. So far we haven't been in contact but we intend to do so soon*". SHA Kumi officials also expressed their wish to connect better with SAARI, not only to strengthen the backstopping but also to improve dissemination of improved varieties.

While receiving plant samples from farmers and extension workers for analysis is within the mandate of the ZARDIs, in reality it does not happen often due to weak linkages between research and extension in general and limited budgets for lab consumables. The NAADS-NARO component of the Agricultural Technology and Agribusiness Advisory Services Project (ATAAS) is designed to make up for this by creating new mechanisms to allow research and extension to engage in a more direct and targeted manner (see Section 3.4). A member of the technical staff of BUZARDI referred to their future plans: "*Under the ATAAS we have budgeted for a simple laboratory for entomology, pathology, animal and soil. We have the space, we just need the equipment. Only when we can't cope, would we send the samples to Kawanda or Namulonge* [the national research institutes]. *We are in frequent contact*".

Box 8. Comments by clinic staff and coordinators on technical backstopping and communication.

- Effective backstopping improves the staff skills
- There is a need for more collaboration between Makerere, MAAIF, CABI, NARO and the plant clinics.
- The distance between the clinics and MAAIF makes seeking for technical expertise difficult
- The interaction is irregular, communication is difficult
- We have no means to make use of the labs at MAAIF and NARO

About half of the clinic respondents found the technical backstopping and communication with expert institutions partially effective or ineffective as suggested by some of their comments highlighted in Box 8.

Makerere University and MAAIF both expressed their willingness to find ways to improve and formalise diagnostic backstopping (see Section 3.2). As a senior lecturer from Makerere explained, "*Diagnostic backstopping of the plant clinics should be a tri-partite relationship between MAAIF, Makerere and NARO. We have good working relationships with NARO; they are also involved in the IPDN project. Traditionally, collaboration with MAAIF has been slow, but we will make an effort to make it work*".

Late 2011, MAAIF trained 40 AIs in the principles of plant clinic operation and field diagnostics with a view to improving their linkages with the clinics. The training sought to strengthen the AIs' capacity to play their backstopping, monitoring and reporting roles, apart from gathering clinic data, providing on-the-spot diagnostic support and carrying back samples to the labs. A senior MAAIF official explained that the AI's would also have a more strategic role of supporting the setup of clinics in new districts and using the network of clinics to identify disease outbreaks more effectively.

The establishment of a functional backstopping system is a challenge, both in terms of diagnostic capacity (skills, equipment and personnel) and organisation (procedures, logistics, communication). A partial assessment of diagnostic capacity in Uganda and other East African countries in 2009 showed that "*there was a 'reasonable number' of institutions working on infectious diseases of plants in Uganda. The same was the case for human resource capacity, but important gaps were found*" (AII, 2010a). The majority of experts were affiliated to academic and research institutions. This partly explains the difficulties with creating effective links with extension. Laboratories at academic and research institutions are mainly set up to support research and teaching, not extension. The IPDN found low levels of self-sufficiency in plant disease diagnostic capacity in terms of personnel, physical infrastructure, equipment, and basic taxonomic literature among East African institutions (Kinuya *et al.,* 2008). Despite the recognised capacity gaps, Uganda and other countries face the paradox of low utilisation of existing laboratory services.

In 2010 a regional stakeholder workshop on Infectious Disease Surveillance in Eastern Africa was held by Africa Innovation Institute (AII) in order to discuss the establishment of a system to strengthen disease surveillance in humans, animals and plants (AII, 2010b). The workshop identified several issues that prevent the existing diagnostic capacity from being fully used, including aspects of organisation, communication, attitude and policy (Box 9). These challenges need to be addressed for an effective plant clinic backstopping and information system to become reality.

Box 9. Challenges in plant health diagnostics and surveillance *(AII workshop, 2010).*

- There are no mechanisms to capitalise on existing capacity
- People work in a compartmentalised manner
- We don't know what capacity exists where
- We don't have a mechanism for assessing needs
- Plant health services don't respond to client demand as in human and animal clinics – structure doesn't exist.
- Priorities in policy have been a barrier
- If there are policies, implementation is difficult

3.2 Plant health workforce

CHARACTERISTICS OF PLANT CLINIC STAFF

The clinic staff were selected based mainly on their knowledge, skills and availability. Personal interest, positive attitude and reputation, and proximity to clinic venue were also mentioned by plant clinic coordinators as selection criteria.

The plant doctors came from different occupational backgrounds (Table 11), mostly at sub-county and grassroots levels. There were seven LG staff [Agricultural Officer (AO), Assistant Agricultural Officer (AAO)], eight NAADS staff [Sub-county NAADS Coordinator (SNC), Agricultural Advisory Service Provider (AASP)] and four NGO extension workers. The five SNC were all from Soroti and Serere. SHA in Kumi did not have their own technical staff so they ran clinics with the help of seconded LG staff.

About half of all the clinic staff, represented in all the three clinic staff categories, were farmers, half of them from Rwenzori. The farmers were volunteers, Community Based Facilitators under NAADS (CBFs) or local information officers. One farmer was also a certified agro-input dealer. The plant nurses were lead farmers collaborating with SHA.

Table 11. Occupation of people working at plant clinics (38 respondents).

Main occupation	Plant doctor	Plant nurse	Nursing aid	Total no.
District				
AO	2	0	0	**2**
Sub-county				
SNC	5	0	0	**5**
AASP	3	1	0	**4**
AAO	5	0	0	**5**
Extension worker (NGO)	4	0	0	**4**
Grassroots				
Farmer	7	4	6	**17**
Parish chief	0	1	0	**1**
Total	**26**	**6**	**6**	**38**

AAO – Assistant Agricultural Officer; **SNC** – Sub-county NAADS Coordinator; **AASP** – Agricultural Advisory Service Provider (NAADS); **AO** – Agricultural Officer

The minimum staff qualifications for each category were unclear. The original clinic staff titles were based on level of formal education and status of position held in the local administration hierarchy (plant doctors – district level extension staff; plant nurses – S/C (Sub-county) level extension staff; nursing aids – farmers). Staff titles were, however, used somewhat loosely. S/C extension staff were often addressed as plant doctors, and in the Rwenzoris where all clinics were run by lead farmers, the clinic staff were referred to as plant nurses and in some cases as plant doctors.

The use of these titles has been the subject of some discussion. Several stakeholders have expressed concern about people calling themselves plant doctors even where they don't have the necessary formal qualifications. There is a need for more consistency and clarity of plant clinic staff roles and skills. Clinic users need to know who they are consulting.

Clinic staff were mostly middle aged to older adults: 55% were between 31-50 years, 32% were >50 years, with only five (13%) below 30 years (Table 12). Approximately 25% were women. Clinic staff on the whole were well educated: 63% had tertiary education and 29% secondary. All but four plant doctors had tertiary education.

Table 12. Characteristics of interviewed plant clinic staff (38 respondents).

Clinic staff category	Total no.	No. in age group (year intervals)			Gender (No.)		highest level of education (No.)			
		<30y	31-50y	>50y	M	F	T	S	P	No
Plant doctors	27	3	16	7	22	4	22	4	0	0
Plant nurses	6	2	3	1	2	4	2	3	1	0
Nursing aids	5	0	2	4	5	1	0	4	1	1
Total	**38**	**5**	**21**	**12**	**29**	**9**	**24**	**11**	**2**	**1**

M – Male; **F** – Female; **P** – Primary education; **S** – Secondary education; **T** – Tertiary education (university or other)

SKILLS AND TRAINING

Almost all the interviewed clinic staff had received plant doctor training (Table 13). Between April 2010 and December 2011, CABI and MAAIF provided plant doctor training to a total of 63 plant clinic staff, 5 national trainers and 40 AIs (Table 14).

Table 13. Plant doctor training received by clinic staff (38 respondents).

Clinic staff category	Plant doctor training received[1, 2]	
	Yes	No
Plant doctors	25	1
Plant nurses	4	2
Nursing aids	4	2
Total	**33**	**5**

[1] Minimum Module 1 of basic plant doctor course provided either by CABI or MAAIF

[2] Does not include information from Hoima where no training had been conducted. By end of the study period Hoima LG was planning their first plant doctor training with MAAIF

During 2011 the Ministry took on more responsibility for training, including financing of courses. A modified version of Module 1 of CABI's course 'How to Become a Plant Doctor'[6] was implemented by MAAIF three times. The module was modified to include additional exercises on simple lab techniques and pests and diseases of the main crops of the specific region, while the duration was increased from three to four days.

Module 2 of CABI's course (how to give advice) has not yet been given in Uganda. The first group of plant doctor and trainers was scheduled to receive Module 2 training during the first half of 2012. Module 3 (how to design extension messages) was held once in 2006. Only three of the original 12 trainees are still involved with plant clinics.

In 2011 CABI introduced a new standalone course on the application and use of laboratory techniques in the field. This 'Master Class' introduced plant doctor trainers to simple diagnostic tools, and the use of photography and distance diagnostics in identifying the cause of plant health problems. Three Ugandans participated. One of the MAAIF affiliated plant doctor trainers indicated that some of the new learning had already been incorporated into MAAIF's own plant doctor course.

Most coordinators deemed the plant clinic staff to be well prepared for working at the clinics since the clinic duties were aligned with those of their existing jobs. One exception was a RicNet coordinator who rated his charges as only 'partially prepared'. Overall, 36% of the clinic staff and coordinators said they required continuing training on a range of general topics (symptom recognition, agronomy, soil health, giving advice, pesticide management, register management) as well as more specific ones (pathology, virology, bacteriology, entomology, pests and diseases of specific crops). Not all plant clinic coordinators were sufficiently prepared for their role in supervising and helping plant doctors. Few of them had received any plant doctor training.

[6] **Module** 1: 'field diagnostics and how to operate a plant clinic'; **Module 2:** 'how to give advice'; **Module 3:** 'how to design an extension message'

Table 14. Plant doctor training conducted in Uganda from April 2010 to December 2011.

Training course	Participants	Date	By
Module 1	16 trainees from Mukono, Buikwe, Iganga, Soroti, Rwenzori 5 trainers from MAAIF, Makerere, Buikwe, MUZARDI, Kyambogo[2]	April 2010	CABI
Module 1 (x2)	31 trainees from RicNet/SatNet and Self Help Africa	July 2010	CABI
Basic plant doctor course [1]	2 trainees from Bukwo LG	May 2011	MAAIF
Basic plant doctor course [1]	14 trainees from Self Help Africa	Aug 2011	MAAIF
Master class	18 plant doctor trainers from 10 African countries (3 Ugandans)	Dec 2011	CABI
Basic plant doctor course [1]	40 agricultural inspectors, MAAIF	Dec 2011	MAAIF

[1] A modified version of CABI's Module 1

[2] Kyambogo University

Apart from the need for further training on specific subjects, the demand for massive training of extension staff was evident. A Hoima LG official said, "*We want to train all the AASPs and SNCs, the lower cadres, to get a critical mass of clinic staff. We will use our own plant doctor trainees to train them*". Other coordinators confirmed the need to create a critical mass of plant doctors to ensure more regular clinic operations and allow expansion to more sub-counties. There was general uncertainty about further plant doctor training. The research team received many questions about "when Modules 2 and 3 training was likely to be and whether there would be any refresher training." No one was aware of any future training plans.

As part of a strategic effort to expand and consolidate the plant clinics in Uganda, 11 representatives from MAAIF (Department of Crop Protection), Makerere University's College of Agricultural and Environmental Sciences (CAES) and CABI met in November 2011 to discuss the establishment of a plant doctor course and a nationwide training program. It was agreed that, following a thorough review of the current curriculum, the course be offered by Makerere University's Continuing Agricultural Education Center (CAEC) in collaboration with MAAIF and CABI. However, the funding for a nationwide training program was yet to be secured. Since 2009, CAES has shown keen interest in supporting the plant clinics with plant doctor training and diagnostic backstopping as part of the activities of the IPDN (see Section 3.1.2). A 'Plant Health Systems Committee' was established at CAES to coordinate and operationalise the activities.

WORK LOAD AND STAFF RETENTION

The most common set up for a plant clinic comprised 1-2 plant doctors with 1-2 nurses/nursing aids, though there were variations between districts. Only SHA Kumi was able to mobilise entire teams of 4 plant doctors and 3-4 nurses for all clinic events, rotating between four venues in Kumi, Bukedea and Ngora districts. More than half of the interviewed clinic staff said that scarcity of personnel limited their ability to run regular clinics. Heavy work load from competing duties affected staff availability. The regular schedule of most clinics was thus disrupted because of lack of clinic staff (see Section 4.2).

LG-led clinics were affected by the limited participation by NAADS staff (Table 11). NAADS involvement was considered crucial because more than 90% of the funds and staff for agricultural activities in the districts come from NAADS. Each S/C is allocated two AASP, one for crops and one for livestock, and six CBF to provide farmer-to-farmer extension. The non-NAADS LG staff are few in number and stretched thin in their efforts to fulfil existing duties. In

Buikwe district, for example, there were only 8 LG staff members to cover all sub-sectors (agriculture, fish, livestock, entomology and trade). "*This means that we have very little representation on the ground*", a DAO from central Uganda said. Another DAO concurred: "*We are not enough. We are overwhelmed by work, both at the district and sub-county level*". The onset of the new NAADS also caused considerable drainage of LG staff in several places. "*We lost a lot of staff to NAADS, that's why the clinics were disrupted for several weeks at the beginning of 2011,*" a DMPO explained.

The majority of clinic staff were new to their roles. Of the 38 interviewees, only four from Mukono, Buikwe and Soroti had plant clinic experience of between one and two years. There had been considerable loss of trained clinic staff over the years. Almost half of the 86 persons who had received some kind of plant doctor training from CABI or MAAIF since 2006 were no longer involved with the clinics (Table 15). Those who had dropped out had either left because of job rotation, work load, retirement, or because the clinics for some reason had become inactive (see Section 4.2). Low staff retention was one of the reasons why the pilot clinics ceased to operate in 2009.

Table 15. Retention of clinic staff trained by CABI or MAAIF since 2006.

Organisation	No. trainees	No. active by Sept 2011	% retention
Mukono LG	8	5	63
Buikwe LG	7	4	57
SHA Kayunga	16	13	81
SHA Kumi	7	7	100
Bukwo LG	2	2	100
Serere LG	3	3	100
Soroti LG	3	3	100
Socadido	1	0	0
RicNet [1]	24	6	25
Iganga LG [2]	6	0	0
Backstopping [3]	9	4	44
Total	**86**	**47**	**55**

[1] It is uncertain how many are still active

[2] The plant clinic in Iganga ceased to operate in 2009

[3] Mainly MAAIF staff

RicNet suffered from 'internal staff weeding' as they called it. Two persons previously charged with clinic coordination, who had attended courses and stakeholder workshops, had left for other jobs leaving the plant clinic initiative without a solid base.

MOTIVATION AND INCENTIVES

Many clinic staff found the clinic work motivating. The professional challenge and direct interaction with farmers served as key motivators (Table 16, Box 10). As explained by a plant doctor from Kumi: "*As a plant doctor you should be able to answer ANY question. It is challenging and rewarding. There is so much learning in this, attending a clinic.*" Similar feelings were shared by a DNC: "*The clinics have given our staff more experience and confidence; the pictures, the repeated enquiries. It is very good practice.*"

Table 16. Reasons for joining the plant clinic initiative expressed by clinic staff and coordinators (47 respondents[1]).

Reason for joining the clinic	No. responses	
	Clinic staff	Coordinators
To help farmers/ it makes me feel useful	31	5
To get more training	24	1
The task was assigned to me	18	
It is interesting	14	3
The clinic brings us closer to the farmers	10	4
I volunteered	7	
It is in line with our mandate/ profession	1	9

[1] Multiple responses

The plant doctor courses were also mentioned as an incentive that helped staff do a better job and feel more confident. A plant doctor from Kumi was thrilled: "*I loved the CABI training so much*!" The plant clinic coordinators, for their part, tended to highlight the mandate of their organisation as a motive for taking up clinics.

Box 10. Comments from clinic staff about the benefits of attending the plant clinics.

- It is enriching and keeps the staff updated (*Mukono, Kayunga*)
- It makes the clinic staff useful to the farmers and the community (*Kumi, Kayunga, Rwenzori*)
- The clinic exposes the staff to practical experiences (*Kumi)*
- It increases the capacity of the staff in diagnosis of pest and diseases (*All*)
- It creates room for the staff to interact with clients (*Mukono*, *Soroti*)
- It is a participatory approach which motivates the staff as she works with the clients (*Rwenzori*)
- The clinic is a new way to reach out to the farmers (*Mukono*, *Buikwe*)
- The staff is pleased to work and share farmers' challenges (*Kayunga*)

Although the plant clinic work itself was generally perceived as a positive and enriching experience, the remuneration was regarded less favourably. As was the case in the pilot phase, the allowances were often too small, and either arrived late or never at all (see Section 3.5). This was particularly problematic where clinic staff had to pay for transportation and materials out of their own pockets. Work load, low number of clinic staff and lack of feedback (see Section 3.1.1) were also mentioned as demotivating factors. The clinic organisations recognised that there were few incentives for their staff. As a DNC from central Uganda observed, "*The incentives are few and the general work load is high. Farmers complain that the clinic doesn't open as announced. All that affects staff morale*". Along the same lines a RicNet coordinator said: "*It is difficult for us to pay the facilitation. Most nursing aids and nurses attend the clinics as volunteers. For them the facilitation is an important incentive.*"

Many plant doctors said they were motivated by the direct interaction with the clients and the challenge of dealing with so many plant health problems (*Nkokonjeru plant clinic*).

3.3. Plant health information

Plant clinic staff need timely access to up-to-date quality information on pests and diseases so that they can give the best advice to farmers. They need lists of expected problems, photographs, guidance on diagnosis and best advice on management. In Uganda and elsewhere these remain difficult needs to satisfy.

The majority of the plant clinic staff and coordinators mentioned MAAIF, ZARDI/NARO, internet sources, NAADS/LG and CABI as their main sources of information on pests and diseases in that order of importance (Table 17). The internet sources included Infonet-Biovision[7], an information portal on crops and pests in East Africa, and the East African Phytosanitary Information Committee[8] (EAPIC). Information was also accessed from international institutions such as the CGIAR centers[9] (Consultative Group on International Agricultural Research).

Many current extension initiatives promote the use of internet and mobile phone technology to improve extension workers' and farmers' access to timely and relevant agricultural information. During this study, Uganda hosted the following initiatives: TECA Uganda Exchange Group[10], Agri-Hub Uganda[11], Grameen Foundation AppLab[12] and Agriculture Research Extension Network[13]. Yet none of the clinic staff and coordinators mentioned them.

Table 17. Pest and disease information sources used by plant clinic staff and coordinators (45 respondents[1]).

Source of pest information	Mukono LG	Buikwe LG	SHA Kayunga	SHA Kumi	Serere LG	Soroti LG	Socadido	Ric Net	Total
MAAIF	3	1	3	5	1	2	1	3	**19**
ZARDI/NARO	4	1	0	5	4	1	1	1	**17**
Internet sources	1	1	0	3	5	0	1	3	**14**
NAADS/LG	1	2	1	2	2	3	1	1	**13**
CABI	1	0	2	3	2	1	2	2	**13**
NGO	1	0	4	0	0	0	0	1	**6**
International institutions	3	0	0	0	0	0	0	3	**6**
Community worker	0	2	1	1	0	0	0	1	**5**
University	3	0	0	0	0	0	0	0	**3**
Pests and disease manual	0	1	0	0	0	0	0	0	**1**

[2] Multiple responses

[7] www.infonet-biovision.org/

[8] www.eapic.org/

[9] www.cgiar.org/

[10] http://teca.fao.org/group/uganda-exchange-group

[11] http://apf-uganda.ning.com/

[12] www.grameenfoundation.applab.org/

[13] www.arenet.or.ug

Twenty-one of the 38 interviewed clinic staff members (55%) had access to internet, most of them from internet cafés or through personal modems (Table 18). Nearly everyone (19 of 21) said they used the internet at least once a week. Few had access to internet from work, SHA being one of the exceptions. There was no internet access at MAAIF's diagnostic centre at Namalere.

Table 18. Access to internet and frequency of use by plant clinic staff (38 respondents).

Plant clinic organisation	Access		Frequency of use			
	No	Yes	Every day	A few times a week	Once a week	Rarely
Mukono LG	2	5	2	0	2	1
Buikwe LG	1	3	0	1	2	0
SHA Kayunga	3	4	0	3	1	0
SHA Kumi	4	2	0	0	2	0
Serere LG	0	3	0	2	1	0
Soroti LG	1	1	0	0	0	1
Socadido	0	1	1	0	0	0
RicNet	6	2	0	2	0	0
Total	**17**	**21**	**3**	**8**	**8**	**2**

Despite the relatively high proportion of internet users among the clinic staff, few actively sought information on plant health problems. Clinic staff reported limited awareness of existing sources of information as one of the reasons. We also found a weak information-seeking culture among staff as well as technological constraints (internet availability, slow connections). Equally important, most staff had to pay for internet services out of their own pockets.

An effective plant health information system needs regular updating with quality data. In Uganda, MAAIF and the LGs are responsible for controlling crop and animal pests and diseases. Their mandate includes disease surveillance and updating pest lists, yet MAAIF and the LGs struggle to fulfil their mandates. Both MAAIF and the LGs are seriously constrained by lack of resources, staff and technology (e.g. cameras, GPS, computers, internet) as well as adequate policies and institutional structures (see Section 3.6).

Disease surveillance is, generally speaking, done in two ways: MAAIF controls the border points and the LGs the internal movements within the districts. MAAIF is not involved in the planning of disease surveys in the districts although they do carry out occasional inspections in nurseries etc. A DAO from the central region mentioned that the district conducts about two disease surveys in a year, sometimes more if there is a special request and supplementary funding: "*We gather demand from farmers, set up a surveillance team, mobilise SNCs and AASPs [which is an extra task for them], make random sampling, assess disease incidence* [% affected], *determine control measures and implement them*". She recognised that their effort had had limited effect on disease control. The results are not reported routinely to MAAIF, which makes it difficult for the Ministry to keep track of events. As a senior official from MAAIF explained, "*Survey reports are sent to the Chief Administrative Officers (CAO). If they find anything important they will also report to us, also if they need additional surveys or information. But they report to the CAO and the CAO may reports to us.*"

MAAIF has a team of about 40 AIs that checks movement of plant material at borders, inspects nurseries and performs other surveillance activities. According to one senior AI the border check system is not working well: "*We don't have any inspectors at the northern border. It is very difficult to conduct border checks effectively with the few staff we have*", she said.

MAAIF's current reporting system is inadequate; samples are recorded in a note book at Namalere and after analysis, a one page Word summary report is written. There is no functional electronic database on pests and diseases for Uganda. We noticed considerable frustration among MAAIF staff with existing practices. As a senior official said, "*Everybody writes reports but the data are not captured. We are trying to improve. It has not been motivating work. There is no remuneration, no recognition for typing up data. Maybe it will be better now that there is more government pressure to show results. Communication and exchange of information are weak. We really have to grow out of the notion that by keeping information to ourselves we are better than others. We don't know anything, and it is going to kills us*".

The lack of appropriate information was also evident at district level. After watching a presentation of plant clinic data and their potential applications, a District Planner from the Teso region noted: "*We rarely get access to that kind of data and it is very useful. Data are scarce in general. We should send them to Uganda Bureau of Statistics* [UBOS] *so others can use them*".

Our findings confirm many of the conclusions drawn at the regional stakeholder workshop on infectious diseases mentioned previously (AII, 2010b). The workshop identified a number of major limitations of the existing plant health information systems: inadequate information management, weak infrastructure, slow communication systems, lack of commitment, budgetary constraints and difficulties in mobilising response teams.

MAAIF expressed their commitment to addressing these challenges (Box 11). A senior official highlighted some of the new initiatives under the Pest and Disease Control component of DSIP to strengthen the information system. Among these were 1) hiring of more field inspectors to improve surveillance and data capture from the plant clinics, 2) expansion and strengthening of plant clinics, and 3) establishment of a computerised system for receiving SMS field reports and enquiries about pests and diseases.

Box 11. A good plant health information system.

"We need to build a good information system that ensures effective linkages between the plant clinics, the districts and MAAIF. It is essential to define roles, responsibilities and procedures and to create the incentives and motivation to keep the system going".

Senior Official, MAAIF

Better use of clinic data will only be obtained when data collection and management of clinic records are improved (see Section 3.1.1). A RicNet coordinator called for more clarity about the fate of clinic data: "*We need a common platform to share and use the information. What problems turn up? What to do with it? We need a system to refer to, to take action*".

EAPIC has made considerable progress over the last 2 years in streamlining pest and disease information from the East African countries and making them widely available through the EAPIC portal. However, no pest information system is better than the quality of the information that feeds it. The strengthening of both national and regional plant health information systems is required to ensure that the data sources are of the desired quality.

3.4. Input supply and technologies

Initially the plant health clinics were only set up to provide clients with information and advice on plant health problems. With time it became increasingly clear that clinic users also demand for access to agricultural inputs (e.g. seed, pesticides, fertilizer) from the clinics. The 2011 stakeholder meeting identified input (or 'drug') supply as a key issue to deal with in further plant health system development (MAAIF, 2011a).

In Mukono and Buikwe, 24.4% of the interviewed clinic users said that they came to the clinic to obtain agro-inputs (pesticides and seed). As an LC5 Chairman explained, "*The clients expect to have access to inputs at the clinic, even that they would get them for free. They need the medicine; the advice alone is not enough. They remain with the feeling that they are not served. People should feel it is worthwhile going to the clinic as a compensation for lost field time*". One of the clinic coordinators concurred, "*People want to be able to buy inputs e.g. clean cassava planting material. We still have to find a way to deal with that.*"

Some of the clinic organisations had attempted to respond to clients' expectations by including input displays and/or sales in the clinic setup (Table 4, page 8). SHA called them 'input shows'. In most cases the displays/sales were limited to a few products. Only NGOs sold inputs since the prevailing government procurement laws do not allow LGs to sell inputs. As a plant clinic coordinator from Buikwe pointed out there was need to raise farmer awareness about available technologies and display more options at the clinics to help inform and guide clinic users. Among RicNet operatives the integration of input sale into the plant clinic activities was seen as a promising business model to keep clinics going. This model was being tested in Kisinga (Kasese District), where a plant clinic is run by an input dealer trained and certified by UNADA.

Plant clinic at Katine market, Soroti district (Socadido). The selection of products on offer included seeds, pesticides and safety equipment for pesticide application.

In the latest agricultural census, UBOS gathered information on the extent of input use among agricultural households (HH) (UBOS, 2010). Table 19 highlights the findings from the three regions where the plant clinic operated. Local seed was the most common input (av. 91.0%). Improved seed was on average used by 31.2%, while the proportion of farmers using pesticides varied from 6.8% (fungicides) to 19.8% (insecticides).

The reasons mentioned for the low use of quality inputs included: limited access to supply, availability and awareness of products, high costs and fake products. MAAIF estimates that at least 13.8 billion USH (~6 million USD), accounting for 15-20% of the agrochemical business, is lost annually to fake agro-chemicals in Uganda (TECA website[14]).

Table 19. Input use among agricultural households (% HH) by type of input.

Agricultural Input	% of Ag HHs by input by region			
	Central	Eastern	Western	**Total**
Survey population (Ag HH)	*715,486*	*1,069,885*	*1,033,992*	***2,819,363***
Local seeds	89.3	88.8	94.4	**91.0**
Improved hybrid seeds	30.6	44.4	17.9	**31.2**
Organic Fertiliser	32.6	21.3	33.4	**28.6**
Inorganic Fertiliser	11.2	10.0	6.6	**9.1**
Insecticides	16.5	26.8	15.0	**19.8**
Herbicides	20.0	9.3	6.9	**11.1**
Fungicides	6.0	7.7	6.4	**6.8**
Other pesticides	5.9	10.4	5.1	**7.3**

Data from Agricultural Census (UBOS, 2010)

The abundance of fake agro-inputs on the market frustrated many clinic staff. In the words of one SHA coordinator: "*Seed certification and quality control are a big problem. There is a lot of fake seed and agrochemicals around and the law enforcement is weak. We need to make short cuts to make our own multiplication and quality control system which we can control and monitor. I encourage staff who are about to retire to invest in registered, quality inputs and make a business. They can link with clinics, integrate the clinics with plant pharmacies.*"

Weak law enforcement contributes to the continuing availability of fake products, but procurement of inputs through the Village Procurement Committees (VPC) used by NAADS groups was also mentioned as a weak link. A DNC from central region explained: "*We say the services are farmer owned so it is good they make their own procurements, but they need technical support to check the quality. If you do procurement at higher level, there is a risk of reduced transparency. UNADA gives us a list of certified suppliers that help guide the VPC. But there are also local suppliers at village level who purchase inputs from certified or other sources and in that connection anything may go wrong.*"

The situation is compounded by failures within LGs and NAADS to register and supervise the hundreds of VPCs. Some of the plant doctors said they feared that the continuing use of fake products would increase spread of pests and diseases, particularly through purchase of bad seed and planting materials. Some felt that the re-design of NAADS had jeopardised the quality control system for inputs thus exposing farmers to additional production risks.

According to a ministry official, MAAIF has put certain measures in place for strengthening law enforcement under the Plant Protection Act (1962). Letters had been sent to all districts about enforcement of by-laws on planting material explaining that transiting uncertified consignments should be destroyed. Another Ministry initiative was the establishment of an SMS reporting system whereby any authority or individual could report sources of fake/uncertified inputs.

[14] http://teca.fao.org/news/138-billion-uganda-shillings-lost-annually-fake-agro-chemicals-uganda-threat-food-security

The effectiveness of such measures is yet to be assessed. However, as suggested by the ministry official, law enforcement is being undermined by the low the penalties for violating the Act: "*The penalties have not been revised since 1962. Somebody who carries a truck without the necessary permits will get a fine of 2.000 USH (less than one USD)! This is a serious disincentive for enforcing the law*".

All the districts faced problems with technology delivery. In Buikwe, there had been a shortage of bean seed and cassava cuttings the previous financial year. In Hoima, LG staff mentioned how available technologies did not always meet the consumers' preferences (Box 12), while in the Teso region the plant doctors expressed their deep frustration with the available cassava varieties that were succumbing to cassava brown streak disease (see Section 4.1).

Part of the response by the new phase of NAADS to the problems of availability of and access to appropriate agricultural technologies has come in form of a NAADS-NARO component of ATAAS. The NAADS-NARO is designed to strengthen research-extension linkages and thereby ensure a better match between the farmers' needs and technology delivery (ATAAS, 2010). As a NAADS official observed, the zonal coordination is an important improvement on the structure for needs identification, technology dissemination and feedback, and also for ensuring better coordination than in the first phase of NAADS.

The NAADS-NARO component is yet to be fully operationalised. Some clinic coordinators, nevertheless, were positive about the prospects of using the plant clinics more strategically through the NAADS-NARO interface. "*The plant clinics can be used as a two-way channel: 1) as an entity to gather demand for research and 2) as an outlet for new technologies. There is a big potential to tap into NAADS-NARO. It will provide new opportunities to link the ZARDIs strongly to the clinics through training, monitoring visits and technical backstopping*", a coordinator from Soroti said.

Box 12. Choosing the right cassava.

"*TME 14 is a very good CMD tolerant cassava variety – we recommend it and give it to farmers so they can compare and observe for themselves. However, the TME varieties are not popular here. They are not starchy and not good for flour. They are stony and short-seasoned. Farmers don't like that because they want to be able to keep the cassava in the field for as long as possible as food storage. With the TME varieties you cannot do that because the roots turn hard and rot after maturing. We keep on bringing in new varieties and take their complaints*!"

District Agricultural Officer, western Uganda

So far, agro-input dealers have not been formally involved in the plant clinic initiative. During the study period, CABI established an independent collaboration with UNADA to explore the possibilities of strengthening registered agro-input dealers' diagnostic and record keeping capacity and establishing ways to reinforce the links between farmers, plant clinics and input dealers.

In human health, the combination of advice and drug supply is regarded essential in service delivery. The plant clinic organisations have realised that a similar model is needed for plant health services to meet the demands of the clients.

3.5. Finance

Since 2010, long-term funding of the plant clinics has been an issue of general concern among stakeholders. In the pilot phase the clinics depended entirely on CABI funds for running costs (Danielsen and Mutebi, 2010).

Table 20. Estimate of plant clinic operation costs (USH) according to clinic coordinators (8 respondents).

Cost item	Mukono LG	Buikwe LG	SHA Kayun.	Serere LG	Soroti LG	Socadido	RicNet
Allowances	36-40,000[1]	11-15,000[2]	11-15,000[2]	5-10,000[2]	46-50,000[1]	5-10,000[2]	16-20,000[3]
Transport	5-10,000	21-25,000	>50,000[1]	21-25,000	31-35,000[1]	5-10,000	5-10,000
Publicity	5-10,000	5-10,000	No budget	36-40,000	No info	16-20,000	>50,000
Storage	No budget	No budget	No budget	16-20,000	No budget	No budget	No budget
Materials[4]	11-15,000	No budget	No budget	36-40,000	36-40,000	>50,000	>50,000
Stationary[4]	No info	No budget	16-20,000	16-20,000	No info	5-10,000	26-30,000
Monitoring[4]	>50,000	46-50,000	26-30,000	5-10,000	No info	>50,000	>50,000

1 USD = 2,300 USH

The shaded items apply for each clinic event; the non-shaded items cover an undefined period

[1] not clear how many persons this covers

[2] per person

[3] all clinic staff reported never to have received any allowance

[4] not clear what period the amount cover

Table 20 gives an estimate of average costs for clinic operations. The shaded areas in Table 20 indicate estimated costs that applied to an average clinic event while the non-shaded rows cover an unspecified period. The amounts are not directly comparable since time periods and number of people involved differ. Clinic coordinators estimated the cost of running a clinic event as ranging from as low ~50,000 USH to over 100,000 USH. The actual cost of a clinic event depended on the number of staff attending and the nature of publicity and monitoring carried out. The coordinators' estimates of allowances and budgets for publicity and monitoring tended to be higher than those provided by clinic staff. In addition, the budget items differed among organisations. Only Serere LG, for example, had a budget for storage of equipment. Costs of materials, publicity and stationary were not included in all budgets.

Table 21. Degree of clinic staff satisfaction with payment (38 respondents).

Organisation	Satisfied	Partially satisfied	Not satisfied
Mukono LG	2	2	3
Buikwe LG	1	2	1
SHA Kayunga	0	7	0
SHA Kumi	3	3	0
Serere LG	0	3	0
Soroti LG	0	2	0
Socadido	0	1	0
RicNet	0	0	8
Total	**6**	**20**	**12**

Of the 38 clinic staff interviewed, 30 had received some form of allowance for serving at the clinics. Most of those who did not receive any payment (7) were from RicNet while one was from Buikwe. Twenty two respondents (58%) said they received the payment on time, while 16 (42%) mentioned 'most of the time' or 'never'. The majority of the plant clinic staff were not satisfied with the amounts they received (Table 21) and suggested this undermined staff

motivation. One of the plant doctors from Buikwe and a few others also observed that allowances to run a clinic were even lower than those paid for other extension activities. Matters were not helped by the inflation and high transport costs that were cited as reasons to why the allowances needed to be increased. There were also feelings of inequitable staff compensation. In the words of one respondent: "*The nursing aid spends most of the time at the clinic and is paid less*".

Between 2010 and 2011, the funding base for the clinics was expanded although CABI was still the main funding source. Most of the clinic organisations (except for Hoima and Bukwo LGs) received a start up grant in the order of 1,000-2,000 GBP[15] from CABI. As far as we are aware these grants will not be paid in 2012, though other support from CABI is expected. The grants did not cover staff salaries, which were meant to be covered by the clinic organisations themselves. Organisations used different strategies to continue the clinics but inevitably some stopped or sessions were intermittent (SOCADIDO and RicNet) (see Section 4.2). MAAIF's Production and Marketing Grant (PMG) helped to fund some clinics in Mukono, Buikwe, Hoima and Bukwo (Table 22). Some lighter funding was accessed from the NAADS in Soroti. Core funds from Irish Aid were used to run the SHA clinics, with 33.5 million USH allocated to the clinics in Kayunga. In most organisations, supplemental funding was not enough to maintain full clinic activity.

Hoima LG planned their clinics carefully from the outset, looking at funding and institutionalisation. According to a senior LG official, clinics were written into the budget and work plan for the 2011/2012 financial year: "*The clinics are also in our medium term (3year) and long term plans (5year). We have allocated 3.5 million USH for mobile clinics for each quarter.*" Buikwe also included the clinics in the LG work plan and budget for 2011.

Table 22. Sources of funding for running clinics in 2011 (does not include staff salaries).

Clinic organisation	CABI	PMG[1]	NAADS	Other	# sources
Mukono LG	X	X			**2**
Buikwe LG	X	X			**2**
SHA Kayunga	X			Irish Aid	**2**
SHA Kumi	X			Irish Aid	**2**
Bukwo LG		X			**1**
Serere LG	X				**1**
Soroti LG	X		X[2]		**2**
Socadido LG	X				**1**
Hoima LG		X			**1**
RicNet	X				**2**
Total	**8**	**4**	**1**	**2**	

[1] PMG – Production and Marketing Grant (MAAIF, previously under Plan for Modernization of Agriculture)

[2] Contribution to transport

MAAIF's direct financial support to the plant clinic initiative beginning 2010 was a significant change from the pilot phase and a clear indication of the Ministry's commitment. The inclusion of the clinics in the DSIP gave formal endorsement for government funding. The Ministerial Policy Statement of June 2011 highlighted plant clinics as a priority of the Pest and Disease

[15] British pounds

Control component with a target of 20 clinics for 2011/12 (MAAIF, 2011b). Around 40-50 million USH (~20,000 USD) was allocated to plant doctor training, provision of basic plant clinic tool kits, monitoring visits and technical support/backstopping.

All the clinic organisations emphasised the importance of stable funding. Most NGOs by default depend on project money and are vulnerable to changes in priorities set by funders and their available budgets. NGOs are often more flexible than government agencies, but their short term project horizon was perceived a huge challenge to their attempts to sustain the clinics. The LGs and the NAADS, on the other hand, were constrained by small budgets and bureaucratic procedures. The years 2010 and 2011 were particularly challenging for LGs due to the district reform, elections and start of a new phase of NAADS. Mukono and Soroti districts were divided in two, causing months of delay in starting clinic activities due to tardy transfer of half of the CABI grant to the new districts (Buikwe and Serere). In some of the districts, the money transfers from the CAOs' offices were reported to have been very slow making regular clinic operation difficult. As mentioned previously, MAAIF's tardy procurement system negatively impacted the clinics' ability to deliver the services effectively.

It has not yet been possible to tap into NAADS funds to cover running costs of the clinics. The current budget structure of NAADS does not favour that. "*Facilitation for the AASPs was not included in the new NAADS budget. It is supposed to be covered by the S/C Operational Costs, but this budget line is already stretched very thin. Unfortunately there are a lot of contradictions in the guidelines and budget. This year's NAADS budget is really terrible*," one of the DNCs said. A senior official from the NAADS Secretariat agreed, and confirmed that there were few available funds and a lack of flexibility in how NAADS operates. The overall funding of NAADS has suffered from the conflicting viewpoints and protracted negotiations between the Government and donor community, leading to the withdrawal of some donors from the programme, e.g. European Union and Danida (interview with donor representatives).

The 'non-NAADS' LG staff are stretched even thinner with small budgets and limited personnel to match the tasks (see Sections 3.2 and 3.6). More than 90% of the district agricultural budgets go to NAADS activities leaving the LGs with meagre resources to deliver other core functions. It is moreover important to note that funding for extension activities has always been uncertain and subject to unannounced change in Uganda, as in many other countries.

Although the mid and long-term funding status of the clinic is precarious, the situation has improved considerably compared to the pilot phase. In 2010 and 2011, we noted a clear shift from a perception of the clinics as a 'CABI activity' towards local ownership and leadership, signified by a wider awareness of the need for better financial planning from the outset. Financial and institutional sustainability were considered more carefully compared to the early years of plant clinics. SHA's suggestion at the 2011 stakeholder workshop to establish a consortium of clinic organisations, MAAIF and other key stakeholders was a significant move towards developing a joint funding strategy instead of each organisation independently applying a 'piece meal approach' to clinic financing (MAAIF, 2011a). This suggestion was included in the workshop resolution (Annex 1).

3.6. Policy, governance and leadership

The plant clinics have a mixed mandate of delivering on extension as well as pest and disease control. In this section we examine how the prevailing policy framework and governance structures influence the plant clinic initiative. The policies of relevance to the clinics include those on pest and disease control, agricultural extension and decentralised service delivery. We also discuss the role of leadership on the growth of the initiative.

POLICIES, INSTITUTIONAL MANDATES AND RESOURCES

As mentioned in previous sections, the plant clinics were officially recognised in 2010 with their inclusion in the DSIP sub-programme on pest and disease control. The Ministerial Policy Statement of 30 June 2011 stated that MAAIF shall 'popularize the use of plant clinics' and 'build capacity for diagnosis that shall involve increasing use of plant clinics in all districts' (MAAIF, 2011b).

The DSIP constitutes the overall policy framework for development of the agricultural sector in Uganda and represents Uganda's commitment to the Comprehensive Africa Agriculture Development Programme (CAADP) (MAAIF, 2010a). The DSIP is implemented by the Ministry itself and a number of semi-autonomous agencies, notably NAADS and NARO. The legal and regulatory framework for pest and disease control is defined in the Plant Protection Act (1962), later reviewed in the Plant Protection and Health Bill (2003), stating MAAIF as the national authority in the area.

Government policies on agricultural extension (syn. advisory services) are defined by the NAADS programme. NAADS was introduced in 2001 and represented a far-reaching extension reform. Decentralisation of service provision and substantial transfer of decision making to farmers' groups were two major ingredients of NAADS. The second phase of NAADS started officially by the end of 2010 but did not take off until mid 2011. NAADS2 target two segments of farmers, food security farmers and market oriented farmers. In both cases the inputs and services provided are defined by specific commodities (or enterprises) selected by farmer groups.

The Local Government Act of 1997 implied extensive transfer of authority and service provision capacity to the LGs. The new lines of command entailed a reporting structure where the CAO rather than the district departments became responsible for reporting back to the ministries. After decentralisation, the central government did not have any direct mechanism to ensure that LGs provided agricultural extension, so when NAADS was designed, the LGs agreed to provide the necessary staff to coordinate, oversee and backstop extension.

Although the plant clinics have become part of official MAAIF policy and the districts show increasing interest and commitment, we found some structural obstacles that made it difficult for the districts to institutionalise the clinics and for MAAIF to play the leading role they are set up to do according to the DSIP. There is a mismatch between institutional mandates/authority and allocated resources that limits the scope of the actions both at district and central level.

Table 23 illustrates the mandate and resources of MAAIF, LG and NAADS within pest and disease control and agricultural extension. Although NAADS is managed by LG, we here distinguish between extension provided though NAADS and 'non-NAADS extension'. MAAIF and LGs have the legal mandate to regulate pests and diseases yet they have limited resources and

capacity to fulfil this mandate. On the other hand NAADS have the mandate and resources to deliver extension services, but there is a perceived misfit between NAADS' commodity orientation and the broader mandate of plant clinics ('any problem in any crop'). The clinics risk 'falling between the two chairs' of extension and pest and disease control.

Table 23. Mandate vs. resources of government agencies for pest and disease control and agricultural extension.

Area	MAAIF	LG	NAADS
Pest and disease control			
Mandate	XXX	XX	X
Resources	X	X	X
Agricultural extension			
Mandate	X	X	XXX
Resources	X	X	XXX

xxx – strong; xx – medium; x – limited

How these mismatches were dealt with varied from district to district depending on the interest and attitude of the individual LG leaders. Hoima, Soroti and Buikwe LGs saw no contradiction between the NAADS mandate and the plant clinics, while NAADS in Mukono perceived the clinics as a separate LG responsibility. The DNC of Buikwe explained that the clinics were in the quarterly work plan and budget but not mentioned directly in the terms of reference of the AASP. He said, "*The AASPs have a list of things they are supposed to do, including 'any other duties as may be assigned from time to time'. So the clinics are covered, though not explicitly.*"

One of the weaknesses identified in the first phase of NAADS was that the programme worked largely through its own parallel structure detached from the rest of the LG. That made it difficult to create the necessary synergies with the production departments (ATAAS, 2010). Although NAADS2 was adjusted to ensure better alignment and integration there are still issues that place the plant clinics in a void. Some of the clinics in Buikwe were run by NAADS staff (SNC, AASP). Yet, in the words of the DNC, "*The plant clinics do not report directly to me but to the DPMO because in the work plan the clinics are not directly under NAADS advisory service.*" One may ask, who is responsible for the clinics, the DPMO or the DNC? Although the clinics were included in the district work plan and budget, in reality they maintained their informal status thus making them vulnerable to the effects of work load of the 'real' NAADS activities.

In the opinion of a senior MAAIF official the perceived contradiction between the mandates of NAADS vs. LG is not real: "*To think that NAADS doesn't work on pests and diseases is wrong. The plant clinics should be an instrument for NAADS to identify key problems, and then design an activity to be done. Few people have conceptualised it that way. NAADS provides advisory services on pest and diseases, soil, agronomy, value addition and so on. When you do extension you do it on all topics.*" The sub county chief of Mukura (Ngora district) agreed with this notion and suggested that NAADS should take over plant clinics since NAADS deals with production. "*You cannot deal with production without addressing pests and diseases*", he said.

There was a strong consensus among plant clinic staff and coordinators that the integration of clinics into NAADS is a key condition for institutionalisation and sustainability. "*Unless the clinics are institutionalised, they will stay in a small scale project mode and continue to rely on external funding,*" one of the coordinators said. Despite the acceptance of including the plant clinics into the NAADS activities in some of the districts, we found no example of financial contribution from the NAADS budgets to the clinics.

STRUCTURAL BARRIERS – MAAIF VS. DISTRICTS

The detachment of sector ministries from the districts during decentralisation and the transfer of technical capacity from LG to NAADS affected negatively the ability of LGs to carry out their core functions. A senior official from MAAIF explained: "*The LG extension staff are mandated to fulfil several functions: regulation, pest and disease control, extension, planning and statistics. But with NAADS the extension workers were taken off to only do extension. This left a big gap regarding the fulfilment of the other functions.*" As mentioned previously, over 90% of the district agricultural budgets are earmarked to NAADS (see Section 3.5).

MAAIF staff mentioned several times that the district governance structure limits the ministry's authority and ability to engage directly with the production departments. All reporting has to go through the CAO. If the district departments were obliged to report to their respective line ministries, it would, in the words of an official from Ministry of Finance, Planning and Economic Development, "*undermine decentralisation*."

It was a common viewpoint that the decentralisation took place too quickly. A MAAIF official explained that the decentralisation was carried out in an uncoordinated manner leaving the ministry with a meagre budget, weak capacity and inappropriate structures, especially for pest and disease control. MAAIF's authority and capacity were further weakened with the introduction of NAADS. MAAIF's problems with motivation, performance and leadership are deep-rooted and a consequence of years of continuous restructuring and instability (Rwamigisa and Birner, 2011).

A recent Public Expenditure Review confirmed that MAAIF has "*difficulties in carrying out its key functions*" and that "*there are always unspent balances at MAAIF*." The study further found that "*the most common challenges in project implementation was top-bottom approach to management, irregular release of funds, weak coordination, monitoring and evaluation system, weak information management and limited involvement of the designated district project coordinators*" (EPRC, 2009). A senior lecturer from Makerere confirmed that working with MAAIF could be challenging: "*MAAIF often starts things but don't follow through. They give the impression that they want to work alone.*"

Box 13. Failure to cope with pests and diseases.

"We are failing. Farmers end up confused. They don't get targeted information. Many different people work on different aspects of pest and disease control and people get inconsistent advice. It is difficult to make massive campaigns because our resources are very limited. There are more pests and diseases than ever before but what we are doing is merely fire fighting. A pest like mango fruit fly is difficult to control because it requires collective action. But we don't have a system that enables us to coordinate effectively with the district and others."

Senior Official, MAAIF

A senior MAAIF official expressed deep frustration about the lack of authority and resources to enforce regulations and handle major pests (Box 13). He explained, "*The districts carry out disease surveys each in their own way without any standardisation and coordinated follow up. Activities are scattered and fragmented, and many pests and diseases are getting out of control. If something is not done soon on cassava brown streak we will not have cassava in 5 years' time*". He further stated that the by-laws are not 'biting' because the districts are reluctant to take instructions from central level and because MAAIF itself does not have the capacity to follow up.

The weak relationship with the Ministry was also felt in the districts. A DNC from Teso region said, "*There is a wide gap between the Ministry and the districts. There is very little follow up on all activities. The institutional arrangements are inadequate; the structures are weak and underfunded*". One of the DAOs declared, "*We are too decentralised because we don't share reports*". Another DNC said that they would feel stronger and more confident with better backstopping and enforcement from MAAIF.

A senior MAAIF official lamented the weak connections with the districts: "*The linkage to the districts is not as strong as we would want because they are under a different administration. We have the technical input but not the administrative linkage. We don't have that muscle to order them around!*" He added, "*LGs want stronger linkage with MAAIF too. It strengthens them.*"

Given the weak relationships between the ministry and the districts, questions arise as to how MAAIF will be able to gather clinic register data and do follow up in a systematic way? What kind of arrangements needs to be put in place to ensure that the lines of command and information flows are in agreement with the existing governance structures? Who 'owns' the clinic data? One of the key motives of MAAIF to support the plant clinics is to enrich their pest information system by tapping into the clinics as a source of 'pest and disease intelligence' at community level. For this to become reality the issues of reporting and information management must be solved between MAAIF and LGs.

THE ROLE OF LEADERSHIP

The current policy and institutional environment represents both opportunities and challenges for the plant clinic initiative. Yet, the degree to which the opportunities are exploited depends on the leadership and commitment shown by the actors involved.

The revival of the plant clinic initiative in 2010 and 2011 was driven by enhanced commitment at central and district level and fuelled by new funds from CABI, MAAIF and some clinic organisations as well as training of a new cadre of plant doctors. The demand for better farmer services and pest information systems became more explicit. An LC5 Chairman said, "*The farmers have lived with the diseases for so long that they have become immune. They are used to big losses. Something needs to be done.*" A MAAIF official was categorical about the value of the clinics: "*There is **no** other way we can gather regular information about pests and diseases from farmers' fields.*" Another official stated: "*The clinics are a wonderful idea! They help improve extension and surveillance and for the farmer it is help at the door step. Everybody gets something out of it.*"

Box 14. Commitment of MAAIF to plant clinics.

"We are taking plant clinics very seriously, that is why they are in the DSIP. We need to clarify the key roles of MAAIF in the scaling out effort and establish clear standards and procedures. We have weak structures and the funds are limited but it is important to keep in mind, that no matter how the structure of MAAIF is, the functions remain the same. The plant clinics fit in."

Commissioner, Department of Crop Protection, MAAIF

The increasing pressure from the districts motivated the Ministry to take action. MAAIF staff mentioned that DAOs from different districts, including Bukwo, Kibale, Busheny, Kasese and Nebby, came to ask for information and guidance on plant clinics. "*We tell people that the clinics are a way to get out of the offices to meet the clients where they are*", an official said. He continued, "*But we as a ministry have a problem. They all want clinics and we get stuck. How can we meet this demand? The*

Ministry's response to this pressure is slow. Having proper guidelines in place will be critical as the pressure increases so that people at the districts know how to go about it."

Since the re-initiation of the plant clinics in 2010, MAAIF has shown stronger commitment to the initiative (Box 14). The Department of Crop Protection has created a core team to support the clinics, organise plant doctor training and stakeholder meetings and procure materials for selected districts. A senior official has been assigned to undertake the plant clinic coordination. He spends around 30% of his time on this task. The use of AIs to strengthen the links between the clinics and the Ministry is an innovative idea attempting to address some of the weaknesses in the system. The collaboration with Makerere and CABI to institutionalise and scale up plant doctor training was also established in the period. Yet progress continues to be slow reflecting the institutional and financial weaknesses mentioned earlier.

MAAIF respondents were aware of its limitations and highlighted the need to create stronger linkages with other key actors to make the system work effectively. A senior MAAIF official explained: "*For us strengthening the collaboration with NAADS is critical. If we achieve that it will work. The biggest challenge will be to overcome historical barriers between our institutions.*"

MAAIF's involvement in the clinic initiative has enhanced their visibility and motivation. The plant doctor courses were well received. One of the trainees, an AAO from Ngora district, appreciated MAAIF's training. "*This is the first time in the last twelve years I realise that I belong to the Ministry of Agriculture*!" he said. Such positive feedback can be a real incentive for the Ministry plant clinic team. It creates more confidence, enthusiasm and visibility.

Box 15. Local level leadership as a driving force.

"The plant clinic idea came up in 2009 during a NAADS review workshop where pest and diseases turned out to be one of the biggest challenges of farmers. The NAADS projects focus on production, but there is no entity that takes care of pests and diseases in a systematic way. Facing the constant threats of epidemics such as banana bacterial wilt, cassava viruses and army worm, we felt that we needed to do something different.

When the Plan for Modernisation of Agriculture [PMA] guidelines for 2009/2010 came out, we saw that "Establishment of diagnostic plant clinics" was one of the priority areas. We started exploring and discussing how a mobile plant clinic scheme could be organised and got in contact with the Department of Crop Protection of MAAIF who gave us some general guidelines. We made a plan for mobile clinics for the financial year 2010/2011 and the first clinic was held on 11 August 2010. The clinics were approved by the District Council and included in the District Development Plan."

Technical leader, Hoima LG

The LGs and NGOs embraced the clinic challenges in different ways. As mentioned earlier Hoima, Mukono, Buikwe, Bukwo LGs included the clinics in district budget and work plans while the future of the clinics of Soroti and Serere LGs is more uncertain. The DNC of Soroti suggested the plant clinics should work more closely with farmer groups to enhance accountability. He also suggested involving the CBFs as nursing aids since they are a more stable and motivated human resource base than the AASP. These ideas are yet to be pursued.

Hoima is so far the only LG that started plant clinics on their own initiative without any external support for training, materials and guidance (Box 15).

Collaboration between NGOs and public sector agencies is common in Uganda. The plant clinics benefitted from this as LG staff were seconded to SHA to support the clinics and other project activities. MAAIF used DSIP funds to train a group of SHA people.

SHA actively sought the involvement of other actors in the districts. They held four stakeholder meetings with the participation of political, technical and administrative leaders and civil society representatives. One of the SHA coordinators observed: "*We can't do it alone. We need to get others on board and create joint commitment. Collaboration is necessary for sustaining the clinics.*" The stakeholder meetings created good response. In Kayunga the CAO asserted that the LG would help with equipment and training. This was confirmed by the Speaker who said that funds for clinic equipment would go into the budget circle. "*There is no reason why the Council would object*", he said.

SHA held four stakeholder meetings for local leaders and civil society to discuss how to sustain the plant clinics in the future. In Kayunga the meeting included a demonstration of a plant clinic (*right*).

RicNet and SOCADIDO were not able to establish broader partnerships or secure alternative funding to keep the clinics going. As a result the clinic activities declined when the CABI grant ran out in 2011. RicNet's idea of converting the clinics into a self-sustaining business by combining them with input sales has yet to be systematically assessed.

The 2011 national stakeholder workshop (MAAIF, 2011a) led to the signing of a 10-point resolution highlighting the steps needed to expand and improve the plant clinics, strengthen the links between plant health system actors and ensure long term sustainability (Annex 1). Some fundamental questions were subsequently raised by a senior lecturer from Makerere: "*How do you follow up on the workshop resolution when there is no constituency around the clinics, no formal structure? Where will the leadership come from*?"

Despite clear signs of enhanced commitment by MAAIF, LGs, NGOs and Makerere, there remain some deep-rooted contradictions and weaknesses in the system that make the establishment of a national plant health system with a well-functioning governance structure a big challenge.

4. Plant clinic performance

4.1 Clinic coverage

Clinic coverage was assessed in terms of both the geographical outreach of the clinics (clinic catchment area) and the diversity of queries received. The data presented in this section were obtained from plant clinic registers.

The plant clinics received 2,598 queries from 2,069 clients between July 2010 and September 2011 (Table 24). Only 37 clients (1.8%) returned to use the clinics. Overall, 33% of the clinic clients were female, though there were big differences between different clinics, perhaps amplified by the considerable variation in sample size. A total of 205 clinic sessions were held (not including the fixed clinic in Mairirwe, Hoima district). Clinic sessions per organisation varied from 1 to 42, reflecting differences in start dates, number of clinics, and regularity of clinic operation (see Section 4.2).

SHA (Kumi and Kayunga) and Hoima LG accounted for 60.4% of all queries. Their clinic sessions were well attended with an average number of queries ranging between 25 and 40. The lowest attendance per clinic session was for clinics run by Mukono, Buikwe, Serere LGs, Socadido and RicNet, while Soroti and Bukwo LGs lay in the middle range. The good attendance at the SHA and Hoima clinics was largely attributed by clinic staff to the targeted publicity campaigns held prior to clinic sessions (see Section 3.1.1).

Table 24. Plant clinic sessions from July 2010 to September 2011 – Queries and clients received.

	Queries received			Clinic sessions		Clients		
Clinic organisation	No. queries	%	No. crops	No.	Av. queries	No.	% women	No. return clients
Mukono LG	138	5.3	17	32	4	113	37	6
Buikwe LG	214	8.2	23	40	5	185	35	2
SHA Kayunga	481	18.5	24	19	25	400	44	3
SHA Kumi	601	23.1	29	22	27	430	17	9
Serere LG	65	2.5	16	8	8	56	16	0
Soroti LG	73	2.8	13	5	15	53	18	3
Socadido	186	7.2	20	25	7	173	31	1
Bukwo LG	20	0.8	10	1	20	20	15	0
Hoima LG	489	18.8	36	10	40[1]	275	41	14
RicNet	331	12.7	17	43	8	312	40	2
Total	**2,598**	**100**	**53[2]**	**205**	**13[3]**	**2,069**	**33**	**37**

[1] The 92 queries from the fixed clinic in Mairirwe are not included.

[2] The total is lower than the sum of the column since crops are between districts.

[3] Average queries for all clinic sessions

CROP QUERIES

Fifty three different crops were received at all the clinics (Table 24). The crops received included a wide range of roots and tubers, cereals, vegetables and pulses, and a few queries on tree and oil crops, spices and ornamentals. The number of crops covered per district varied from 10 in Bukwo to 36 in Hoima. The three most frequently cited crops, namely cassava, orange and banana accounted for 40% of all the queries (Table 25).

Table 25. Frequency of crop queries presented at the plant clinics – Summary of all districts.

Rank	Crop	No.	%
1	Cassava	451	17.4
2	Orange [1]	319	12.3
3	Banana	267	10.3
4	Groundnut	188	7.2
5	Tomato	142	5.5
6	Coffee	140	5.4
7	Bean	112	4.3
8	Maize	74	2.8
9	Sweet potato	72	2.8
10	Rice	67	2.6
11	Green gram	65	2.5
12	Mango	59	2.3
13	Eggplant	49	1.9
14	Cowpea	42	1.6
15	Pineapple	39	1.5
16	Cotton	36	1.4
17	Cabbage	35	1.3
18	Jackfruit	20	0.8
19	Avocado	18	0.7
20	Sorghum	16	0.6
21-22	Cocoa, Watermelon	14	0.5
23	Potato	10	0.4
24-26	Bitter Berry, Passion fruit, Solanum	8	0.3
27-29	Lemon, Pawpaw, Sesame (Simsim)	7	0.3
30	Soya bean	6	0,2
31-32	Green pepper, Pumpkin	5	0,2
33	Sugarcane	4	0.2
34-36	Barley, Guava, Yam	3	0.1
37-41	Eucalyptus, Millet, Nakati (Greens), Onion, Vanilla	2	0.1
42-53	Carrot, Cocoyams, Digitanscalam, Hibiscus, Ova, Peach, Peas, Pepper, Pigeon pea, Plantain, Tangerine, Wheat	1	0.04
	Miscellaneous [2]	11	0.4
	No crop information	242	9.3
	Total	**2,598**	**100**

[1] Orange and citrus merged

[2] Includes 'all crops', 'fruit crops', 'vegetables', 'living house', soil

In the western region, banana was the dominant crop, while in the central and eastern regions cassava and orange dominated (Table 26). Cassava was consistently brought to clinics and always featured among the top five crops for all regions. Banana, coffee, groundnut and bean were in the top five crops for two of the three regions where clinics were held. The frequency of crops received by region generally matched their geographical distribution according to official records (UBOS, 2010). Fewer maize queries were received than expected, perhaps because of the crop's lower commercial value compared to tomato for example. Tomato also tends to suffer from more serious plant health problems than maize.

Table 26. The most frequently presented crops at clinics, by region.

Rank	Western [1]	Central [2]	Eastern [3]
1	Banana	Cassava	Orange
2	Cassava	Banana	Cassava
3	Coffee	Coffee	Groundnut
4	Groundnut	Bean	Tomato
5	Bean	Tomato	Green gram

[1] Hoima, Kasese, Bundibugyo

[2] Buikwe, Mukono, Kayunga

[3] Soroti, Serere, Katakwi, Kumi, Bukedea, Ngora, Bukwo

Many plant problems were brought to the clinics. The most frequently reported are listed in Table 27. Cassava brown streak disease (CBSD) banana bacterial wilt (BBW), groundnut rosette, orange leaf miner and a fungal disease in orange (most likely scab or citrus black spot) were the most commonly recorded diseases. These five problems comprised more than a quarter (26.7%) of all queries.

Table 27. Plant health problems identified at the plant clinics – Summary of all districts.

Plant health problem	No.	%
Cassava brown streak disease	272	9.5
Banana bacterial wilt	203	7.1
Groundnut rosette	109	3.8
Orange leaf miner [1]	96	3.4
Fungus on orange [1, 2]	84	2.9
Cassava mosaic disease	64	2.2
Tomato blight [3]	54	1.9
Coffee wilt disease	47	1.6
Scab on orange [1]	39	1.4
Green gram, aphids	33	1.2
Banana weevil	32	1.1
Scales on orange [1]	30	1.0
Coffee stem borer	29	1.0
Pineapple mealybug	29	1.0
Aphids on orange [1]	28	1.0
Maize stalk borer	27	0.9
Orange, fruit fly [1]	27	0.9
Bean, aphids	26	0.9
Coffee twig borer	25	0.9
Cassava mealybug	23	0.8
Rice blast	21	0.7
Insects in green gram	20	0.7
Tomato bacterial wilt	20	0.7
Bean fly	19	0.7
Water logging in beans	19	0.7
Cowpea, aphids	18	0.6
Mango fruit fly	18	0.6
Fungus in tomato	16	0.6
Orange dog fly [1]	16	0.6
Cassava white fly	14	0.5
Maize streak virus	13	0.5
Insects on groundnut	12	0.4
Cotton, aphids	11	0.4
Rotting groundnut seeds	11	0.4
458 minor problems (1-10 queries)	866	30
Undiagnosed	*479*	*17*
Total [4]	**2,850**	**100**

[1] Merger of 'orange' and 'citrus'

[2] 'Fungus' on orange is most likely citrus black spot or scab, which are both common in the Teso region.

[3] Not specified whether it is late blight or early blight.

[4] The total number of problems is higher than the number of queries, since some of them had more than one problem: 18 crop queries had 3 problems; 217 crop queries had 2 problems.

Table 28 shows the five most frequently presented problems in each district, all of them major problems known to cause heavy losses to Ugandan farmers. Only 3 *Striga* cases were recorded, much lower than the results of a previous clinic register analysis, where *Striga* was the second most commonly presented problem (Danielsen and Mutebi, 2010). CBSD was recorded in most districts with clinics. Several plant doctors were concerned about how to manage it successfully (Box 16).

Box 16. Devastating cassava brown streak disease.

"Cassava variety MH 97/2961 used to be tolerant but now there are signs that the tolerance has succumbed to CBSD. We have received several samples with clear root rot symptoms (picture). The situation is worrying. Often we don't know what to do and what to recommend. We need access to updated information about new varieties, their performance and availability".

Plant doctors, Teso region

Table 28. The five most frequently presented plant health problems in the clinic districts.

Mukono	**No.**	**Buikwe**	**No.**	**Bukwo** [1]	**No.**
BBW	23	CBSD	23	Maize, termites	2
CBSD	11	BBW	10	BBW	1
CWD	10	Coffee stem borer	10	Barley blight	1
Bean, aphids	7	Tomato bacterial wilt	8	Bean, aphids	1
Maize stalk borer	5	CWD	6	Sweet potato weevil	1
Undiagnosed (6%)	*8*	*Undiagnosed (10%)*	*8*	*Undiagnosed (0%)*	*0*
Soroti	**No.**	**Serere**	**No.**	**Katakwi**	**No.**
Fungus on orange [2]	29	Fungus on orange [2]	24	Fungus on orange [2]	16
Orange leaf miner	20	Scab on orange	17	CMD	5
CBSD	9	Orange leaf miner	17	Fungus on eggplant	5
Tomato blight	9	Scales on orange	12	Orange dog fly	2
Cassava mealybug	9	CBSD	10	Watermelon aphids	2
Undiagnosed (1%)	*2*	*Undiagnosed (1%)*	*2*	*Undiagnosed (2%)*	*1*
Kumi	**No.**	**Ngora**	**No.**	**Bukedea**	**No.**
Groundnut rosette	28	Orange leaf miner	34	Groundnut rosette	13
Orange leaf miner	13	CBSD	34	Green gram, aphids	11
CBSD	11	Groundnut rosette	18	CBSD	9
Green gram, aphids	8	Green gram, aphids	11	Cowpea aphids	7
Cotton, aphids	7	Cassava mealybug	9	Orange leaf miner	7
Undiagnosed (4%)	*7*	*Undiagnosed (6%)*	*16*	*Undiagnosed (4%)*	*8*
Kayunga	**No.**	**Kasese**	**No.**	**Bundibugyo**	**No.**
CBSD	149	BBW	64	BBW	2
BBW	43	Coffee pest	6	Tomato wilt	2
Groundnut rosette	23	CMD	2	Cabbage caterpillar	1
Coffee twig borer	22	Coffee leaf rust	2	Hibiscus, aphids	1
Maize stalk borer	16	Cotton, aphids	2	Tomato blight	1
Undiagnosed (8%)	*39*	*Undiagnosed (8%)*	*8*	*Undiagnosed (98%)*	*226*

Hoima	**No.**
CMD	34
BBW	33
Pineapple mealybug	23
Groundnut rosette	18
CWD	17
Undiagnosed (26%)	*129*

CBSD – Cassava brown streak disease;
BBW – Banana bacterial wilt;
CWD – Coffee wilt disease;
CMD – Cassava mosaic disease;

[1] In Bukwo a total of 18 plant health problems were recorded;

[2] 'Fungus' in orange is most likely scab or citrus black spot, both common problems in the Teso region.

GEOGRAPHICAL COVERAGE

The clients came from 20 districts, 107 sub-counties, 392 parishes and 851 villages (Table 29). A total of 79 queries (3%) came from outside the clinic districts. Most of these were from areas neighbouring the clinic districts. The majority of 'out of district' clients (46 queries) were 'Mukono clients' who visited clinics in adjacent Buikwe. Eighteen of the 'outsiders' came from districts without a clinic (Amuria, Buvuma, Kaberamaido, Mbale, Mubende, Nakaseke and Pallisa). In Mukono, Kayunga, Bukwo, Hoima, Kasese and Bundibugyo all clinic users came from within the clinic district.

Table 29. Geographical reach of the plant clinics from July 2010 to September 2011.

Clinic district	No. districts [1]	No. sub-counties	No. parishes	No. villages
Mukono LG	1 *(0)*	7	21	47
Buikwe LG	6 *(56)*	25	64	123
SHA Kayunga	1 *(0)*	8	39	110
SHA Kumi	6 *(8)*	22	153	205
Serere LG	2 *(1)*	7	20	40
Soroti LG	2 *(6)*	12	22	43
Socadido	6 *(8)*	19	58	111
Bukwo LG	1 *(0)*	1	N.I.	16
Hoima LG	1 *(0)*	7	9 [3]	129
RicNet	2 *(0)*	18	29	55
Total [2]	**20 *(79)***	**107**	**392**	**851**

[1] The numbers in brackets show the number of queries received from outside the clinic districts

[2] The totals are lower than the sums of the column since there are overlaps between districts.

[3] The information on client origins for Hoima was incomplete so the nine parishes is most likely an under-estimate.

N.I. – No information available

The clinic catchment areas for the central and Teso regions are illustrated in Figures 3 and 4. Each dot represents a parish from where one or more clients came. The maps are incomplete because GPS coordinates are missing for 52 parishes and three of the seven clinic locations in Kayunga are not indicated (Kayonza, Kitimbwa, Kangulumira). Around half of the clients came from a handful of parishes as indicated with red dots on the maps. Maps were not generated for the other regions due to limited availability of GPS coordinates.

The maps demonstrate that the clinics reached farmers from a significant geographical distance within each district. The map for Teso shows higher parish coverage in Kumi, Bukedea and Ngora compared to the other districts. This correlates well with the higher client turnout in the clinics managed by SHA Kumi. In central region, the number of parishes was lower than in Teso, while client density per parish was higher in Kayunga (data not shown).

Maps are a useful tool for future studies to illustrate service coverage and identify appropriate clinic locations and possible gaps in coverage. The individual clinic catchment area depends on a number of area-specific features, which we have not addressed in the present study. Such features include presence and quality of roads, market characteristics, availability of transport, population density and natural barriers (swamps etc.).

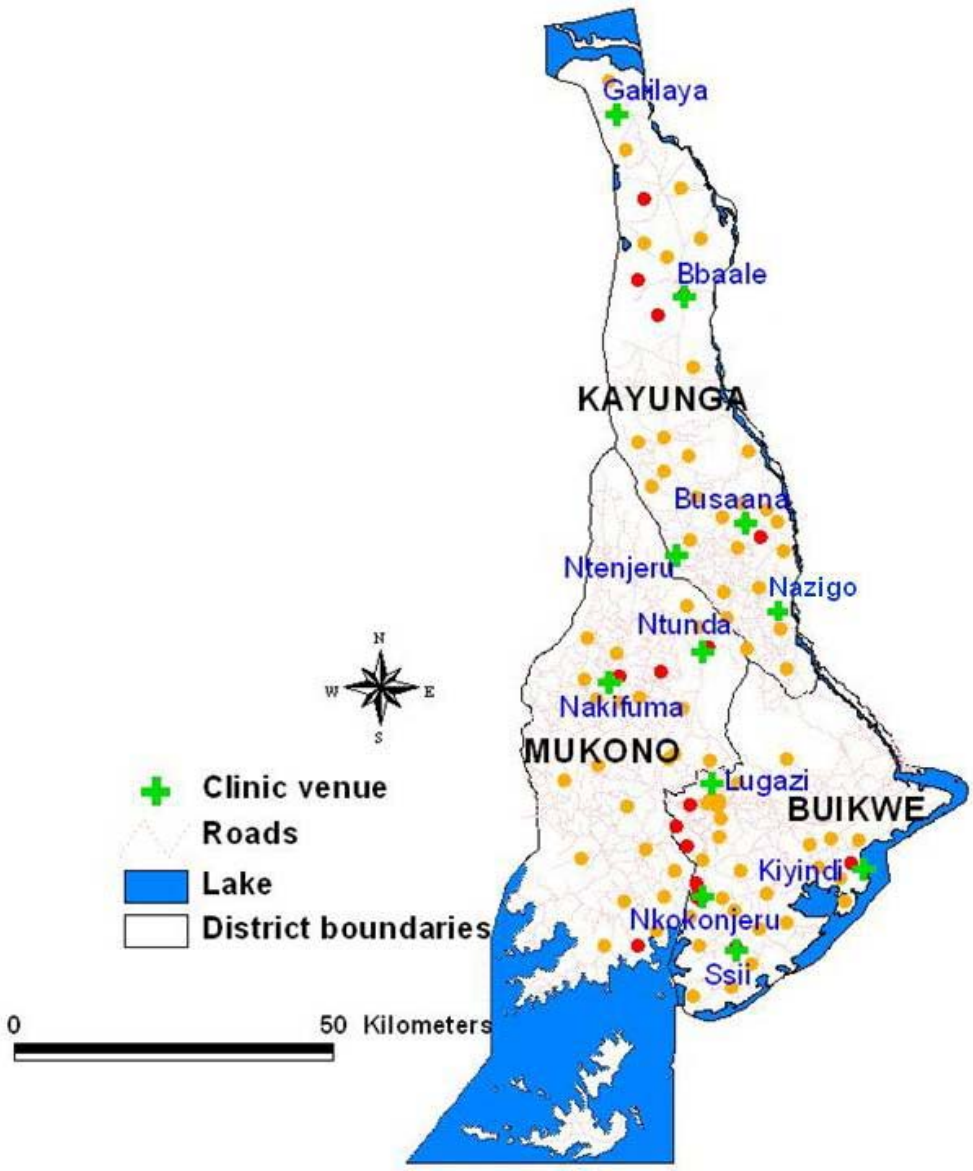


Figure 3. Plant clinic catchment areas in the central region. The dots indicate parishes from where the clients came. Half of the clients came from parishes marked with red dots (*99 parishes, 22 coordinates missing*).

Table 30 shows the populations in the parishes from where the clinic users came, and the proportion of households (HH) reached by the clinics. The parish populations are projections of the 2002 census data (UBOS, 2002) so certain degree of error is expected. The calculations of HH coverage were based on 77% of the clinic users (1,602) due to the following omissions: Bukwo district was excluded due to the limited clinic activity in the study period. Katakwi and Bundibugyo district were not included either because of missing parish data and parish names, respectively.

The overall HH coverage was 0.56%, ranging from 0.27–0.44% in Mukono, Buikwe, Bukedea, Soroti, Serere and Kasese, to 1.05–1.98% in Kayunga and Hoima. Kumi and Ngora with 0.55–0.86% lay somewhere in between. These relative figures confirm the tendencies from Table 24. The organisations with more active clinics (SHA and Hoima LG) obtained higher coverage. Although still low in numbers, the geographical reach of the plant clinics was substantial.

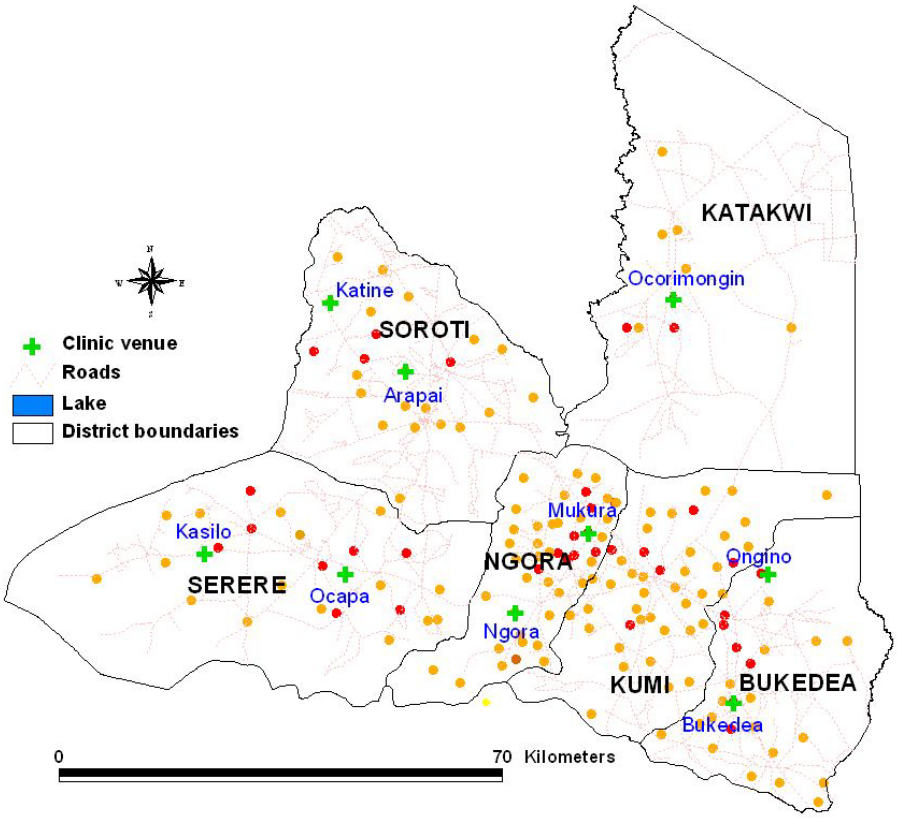


Figure 4. Plant clinic catchment areas in the Teso region. The dots indicate parishes from where the clients came. Half of the clients came from parishes marked with red dots (*190 parishes, 30 coordinates missing)*.

A recent agricultural census showed that relatively few farmers (5.4% and 7.7%) received information about pests and diseases from extension workers and NAADS, respectively (UBOS, 2010). Despite the short period the plant clinics have been running in Uganda and the modest funds put into them, our findings clearly point out the potential of clinics to enhance the coverage of existing extension services.

Table 30. Proportion of parish HH reached in plant clinic districts from July 2010 to Sept 2011.

Clinic district[1]	Parish population[2, 3]	HH[3]	Clinic users	% HH coverage
Mukono	159,700	39,925	145	0.36
Buikwe	175,400	39,864	118	0.30
Kayunga	177,200	37,702	395	1.05
Kumi	144,000	293,88	162	0.55
Bukedea	78,800	16,766	58	0.35
Ngora	102,200	20,039	167	0.83
Serere	211,800	39,222	105	0.27
Soroti	163,200	31,385	97	0.31
Hoima	64,320	13,983	277	1.98
Kasese	93,900	17,717	78	0.44
Total - parishes	**1,370,520**	**285,990**	**1,602**	**0.56**

[1] Bukwo district is not included since only one clinic was held; Bundibugyo district is not included because the client origin was only noted in 13 of the 321 cases; Katakwi is not included because parish population data could not be obtained.

[2] The data cover the populations of 269 parishes from where the clinics users came. Population data could not be obtained from 73 other parishes across the districts.

[3] Population numbers are projections based on the 2002 census data (UBOS, 2002).

4.2 Regularity and timeliness

Table 31 shows the overall plant clinic activity in the study period based on information from plant clinic registers. Save for the fixed clinic in Mairirwe, Hoima district, all the clinics were scheduled to run on a fortnightly basis (Table 3). For a variety of reasons, compliance with the planned schedules fluctuated over time. Most of the LG-led clinics delayed in getting started although the start-up grants from CABI had arrived around October 2010. LG activities were heavily constrained by the district reform and the electoral campaigns during the last quarter of 2010 and first quarter of 2011.

Table 31. Number of clinic sessions held by month from July 2010 to September 2011.

Organisation / Plant clinic	2010						2011									No. clinic session	Current status [7]
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S		
1 Nakifuma										2	3	2	2	2		11	Regular
1 Ntenjeru										3	2	2		1		8	Irregular
1 Ntunda										2	2	2	2	1	4	13	Regular
2 Kiyindi					1	1	3	1	1			3	3			13	Regular
2 Lugazi					1	2	1			1	2	3	3	3		16	Regular
2 Nkokonjeru [1]					2	4						2	1	2		11	Regular
3 Kayunga [2]							1		1	2	2	2	2	2	7	19	Regular
4 Kumi [3]							1		1	2	1			4		9	Irregular
4 Bukedea										1	2			1		4	Irregular
4 Ngora			1				1		2	2	1		1	1		9	Irregular
5 Bukwo														1		1	Just started
6 Kasilo												1	3	1	3	8	Irregular
7 Arapai												2	1	1	1	5	Irregular
8 Katine		2	1	2	1		1	2								9	Stalled
8 Ocapa	2			1	1	1	2	3								10	Stalled
8 Ocorimongin				1	1		3	1								6	Stalled
9 Hoima [4]		2	3	1						1					3	10	Restarting
9 Mairirwe [5]				5	9	8	4	5	8	8	11	13	9			80	Regular
10 Bwera			1	4	1											6	Stalled
10 Kisinga				3	2									1	2	8	Irregular
10 Kyondo				2	2	1	1									6	Stalled
10 Bundibugyo		1	1	1	2		1	1	2							9	Stalled
10 Bubandi [6]								2	2	2	2	2	2		2	14	Uncertain
Total	**2**	**5**	**7**	**20**	**23**	**17**	**19**	**15**	**17**	**26**	**28**	**34**	**29**	**21**	**22**	**285**	

Grey cells indicate periods without clinic operation. White cells are months with no data available**.**

Clinic organisation numbering:1 Mukono LG, 2 Buikwe LG, 3 SHA Kayunga, 4 SHA Kumi, 5 Bukwo LG, 6 Serere LG, 7 Soroti LG, 8 Socadidod, 9 Hoima LG, 10 RicNet

[1] Occasionally rotating with Ssii

[2] Mobile clinic rotating between Bbaale, Busaana, Galilaya, Kangulumira, Kayonza, Kitimbwa and Nazigo

[3] Rotating between Ongino and Mukura. From the register it was not possible to distinguish between the two clinic venues

[4] Mobile clinic rotating between Bulindi, Buhanika, Butimba, Ikoba, Kabwoya, Kigorobya, Kinogozi and Kyangwali

[5] Fixed clinic based at farmer coop, open every day

[6] The register from Bubandi did not indicate the exact date of attendance. Two days per month were tentatively assigned

[7] As of September 2011

Agricultural extension activities were also generally affected by the initiation of the new phase of NAADS. The establishment of new administrative and operational procedures, and the recruitment and relocation of staff took up a significant amount of time and resources. During this period, there were virtually no LG plant clinic operations except for some activity in Buikwe district and at Mairirwe clinic in Hoima district. By mid 2011, Buikwe and Mukono LGs had resumed regular clinic operation while Serere and Soroti LGs were still having difficulties in complying with the established schedule. Hoima and Bukwo LGs were only getting started by the end of the study period.

The NGOs were less affected by the political and institutional events. SHA, RicNet and SOCADIDO ran clinics during the hectic months although with varying regularity. After the first quarter of 2011, the clinic activities of RicNet and SOCADIDO dwindled as the CABI grant ran out. SHA Kayunga maintained steady activity from April 2011 while the operations of SHA Kumi were interrupted in June and July due to problems with their truck (see Section 3.1.1).

Clinic staff and coordinators also attributed the limited compliance with planned schedules to staff scarcity, work overload, emergence of unplanned activities and inadequate funds for clinic operations. As explained by one of the clinic coordinators, the Teso region clinics also experienced weather related problems: "*Apart from the political fever we have had over the past 5 months, we have also suffered a long dry spell in Teso. Plant clinic activities have slowed down because of that.*"

Beyond clinic regularity, we also looked at time management at the clinics sites. In Mukono and Buikwe, 25% of the interviewed clinic clients mentioned 'short waiting time' as a desirable clinic feature. Our clinic visits revealed different time management practices. At one of the visits to the Nkokonjeru clinic we witnessed a smooth clinic operation with timely start, short waiting time and careful client attendance (Box 17).

Box 17. Good time management.

"*The clinic started and ended on time. Clients started coming immediately the tent was set up. They waited for about 7-10 minutes before being attended to.*

The clients were given photo sheets to look at while they were waiting. Farmers and plant doctors were patient and took time to listen to each other and ask questions.

At one time the plant doctor called someone to ascertain the dosage of a pesticide, meaning that the clinic was not working in isolation."

Excerpt from field report, Nkokonjeru plant clinic

In several other cases, however, we found time management problematic. Some clinics opened 1.5 to 5.5 hours late. On these occasions, late staff show-up prompted farmers to abandon the clinic sites (Ntunda, Ssii, Nakifuma, Kyindi). One of the coordinators from Buikwe LG referred to instances where they had received complaints about staff not turning up for clinic sessions. In response to this, the Chairman of the Ssii S/C Farmers Forum urged the clinic staff to keep time as farmers have a lot of activities to attend to.

The late arrival of plant doctors occasionally left the nurses and nursing aids in an awkward position. On one occasion in Nkokonjeru, the nursing aid set up the tent and the furniture but then had to excuse himself for about two hours. He could not do any anything before the arrival of the plant doctor who kept the clinic registers. Similarly, in Nakifuma and Kyindi the plant nurse was forced to wait for the plant doctor before she could start registering the clients because the registers were kept at the plant doctor's place.

Among the reasons mentioned for late arrival of plant doctors were that: '*plant doctors were engaged in other duties assigned to them*' (Lugazi and Ntunda), '*staff spent time looking for means of transport*' (Ssii) and '*clinic staff turned up late because of too much rain in Lugazi and Mukono.*'

Staff attitude towards the clinic job also affected time keeping and client attendance. In one instance, clients waited for about 30 minutes before they were attended to while the plant doctor went off to purchase pineapples. In another case, a clinic staff member was found lying down because he was tired and bored. In a third case, we observed that after the DMPO and plant clinic coordinator had left the clinic, the plant doctors lazed about leaving the plant nurse to do the diagnosis despite her little experience with the clinic activities.

The above observations were based on a few visits to clinics in Mukono and Buikwe so we cannot claim that they represent the general state of the clinics in these districts. Nonetheless, the issues of time keeping and staff attitude can potentially affect clients' confidence in the service and may go some way in explaining the low turnout observed (Table 24).

The plant clinics of SHA Kumi were busy and dynamic although time keeping sometimes slipped.

Although time keeping was also an issue in other districts, better manning of the clinics and a positive staff attitude seemed to make up for the late start at the Mukura plant clinic (SHA Kumi) (clinic visit, 8th September 2011). The clinic was supposed to begin at 9:00 am but could only open at 10:23. Despite this late start, 15 clients had been registered by the nursing aid by 11:55 am. Additionally, having several plant doctors at the same desk had the advantage of saving time since many clients could be attended to simultaneously. Under this arrangement, a number of farmers were pulled by the opportunity to listen in on the conversion between the farmer and the plant doctor sitting next to them. The plant doctors also enjoyed the attention they were getting and the positive group dynamics created by the interaction with several clients at the same time.

Time management was influenced by the client/staff ratio and how busy the clients were. While visiting Kitimbwa clinic in Kayunga district on 1st September 2011, we noticed a relaxed atmosphere where no one seemed to be in hurry. The plant doctors took their time to explain and discuss. After being attended to the clients sat back and waited for the overall wrap up. They all seemed to enjoy the session.

Mobile plant clinic at Butema market, Hoima district. The clients were organised in two lines to be attended to by the plant clinic staff. Due to the high turnout the clinic staff gave advice in group rather than individually.

The clinics managed the waiting time in different ways. At the Ssii clinic (Buikwe) farmers were urged to keep around and listen to the advice given to others since most of the farmers grow the same crops. In some cases clients were given photo sheets to keep them busy. At the Nakifuma clinic (Mukono) we observed an elderly man waiting quite a bit while reading a pamphlet form NARO on BBW and listening to the other clients. Similarly, in Katine (Soroti) we found that waiting clients benefitted from listening to the conversations of others.

Hoima LG was pragmatic in dealing with a situation where few staff had to attend to many people. The clients lined up in two rows in front of each of two tables where they had their queries registered. Because of the big influx of people the clinic staff had decided to queue the feedback to clients until all had their problems recorded and diagnosed. Thereafter the problems were grouped and advice was given to the entire group of clients.

Giving advice to a group had its pros and cons. It gave people a chance to learn about more problems and to discuss with others. On the other hand, the waiting time became long. Many different problems were brought in, so it became difficult to address them all within a reasonable time. Some clients complained that they were getting hungry and tired. Time management is always an issue and there will inevitably be some trade-offs between attending to individuals as opposed to attending a group.

Due to the high turnout at the plant clinic at Butema market, the waiting time became long for some of the clients.

4.3 Quality of plant healthcare

The reliability of a diagnosis and the efficacy and feasibility of the advice determine the quality of plant healthcare. In this section, we assess quality from the information available in the clinic registers using the method described by Danielsen *et al.* (2012). A more comprehensive assessment of quality would also require feedback from clinic users, observations on staff-client interactions and visits to farmers' fields.

QUALITY OF DIAGNOSES

The quality assessment of diagnoses focused on the 10 most commonly presented crops, comprising 70% of all queries (1,832) (Table 32). Where more than one problem was recorded for a query, only the most important one was considered. There were 169 queries (9.2%) with 'no diagnosis' (i.e. with nothing written in the register) for all clinic organisations (Table 32). The highest proportion of 'no diagnosis' was found in Hoima LG (24%). All queries were diagnosed for Bukwo LG and Serere LG, though note the lower number of queries received at these sites. According to the clinic register, about half of the undiagnosed cases received a recommendation, suggesting a verbal diagnosis given to the farmer. As mentioned earlier (see Section 3.1.1), some plant doctors said it was difficult to fill out the query form when clinics were busy. The majority of the 'no diagnosis' entries (75%) came from SHA Kumi and Kayunga and Hoima LG which had some of the busiest clinics with an average of 25 to 41 clients per clinic session (Table 24). Hoima had received little guidance on how to fill out the clinic registers, which could also explain the absence of information about the possible causes of a problem in their registers.

Table 32. Queries recorded for the top-10 crops, proportion of undiagnosed cases and queries with samples.

Clinic organisation	No. queries	% without a diagnosis	% queries with samples		
			Yes	No	N.R.
Mukono LG	108	4.6	56	24	20
Buikwe LG	169	10.1	29	57	14
Self Help Africa KA	431	6.7	61	0	39
Self Help Africa KU	420	6.2	0	0	100
Bukwo LG	16	0.0	0	0	100
Serere LG	47	0.0	0	0	100
Soroti LG	68	1.5	0	0	100
Socadido	140	1.4	0	0	100
Hoima LG	338	24.0	0	0	100
RicNet	95	8.4	0	0	100
Total	**1,832**	**9.2**	**20**	**7**	**73**

N.R. Not recorded

A diagnosis without a sample is more difficult and therefore less reliable. The presence or absence of a sample was rarely recorded in the early stages of plant clinics in Uganda. A new query form introduced to Mukono and Buikwe LGs by CABI in 2010 includes a space to note if a sample was available. This information was recorded for more than 80% of the queries, with 29% of the farmers bringing samples to Buikwe LG and 56% to Mukono LG. A

modified form used by SHA Kayunga also noted if the clients brought a sample, something almost two thirds of them (61%) duly did. It is not clear whether the 39% blank entries meant 'no sample brought'. All other clinic organisations failed to record presence of samples, thus limiting the scope of the quality assessment.

Table 33 summaries the diagnoses according to type of causal organism. Insects comprised the largest group (27%), followed by viruses, fungi and bacteria with 26, 16 and 12%, respectively. Most virus problems were on cassava or groundnut. Only a few cases of nematodes and weeds were recorded and none for phytoplasma, suggesting that these groups were under-represented at clinics.

Table 33. Diagnoses according to general categories for the top-10 crops received at the plant clinics.

Category of diagnosis	No.	%
Insect	497	27
Virus	479	26
Fungus	300	16
Bacteria	227	12
Nutrient problem	35	1.9
Abiotic	32	1.7
Nematode	14	0.8
General agronomy	13	0.7
Weed	3	0.2
Birds	1	0.1
Symptom description	62	3.4
No diagnosis	169	9.2
Total	**1,832**	**100**

We used a new method developed by CABI to validate the individual diagnoses (Eric Boa, *personal communication*). The method is still being tested and the results are preliminary. Our aim here was to create a general overview of the clinic data rather than exploring the details of the recorded queries.

The validation procedure considers: 1) *Specificity*: Does the 'diagnosis' represent a specific plant health problem? 2) *Plausibility*: Is the suggested cause a reliable or credible problem on the host? 3) *Likelihood*: Does the problem occur in the area served by the clinic? 4) *Consistency and completeness*: Do the recorded symptoms support the diagnosis? 5) *Ambiguity*: Do the recorded symptoms uniquely identify the diagnosis – or are there other problems with similar characteristics?

The validation of a diagnosis can have any of three main outcomes, all based on the available evidence recorded at the clinic: *Complete* – The diagnosis is an accurate interpretation of the problem presented; *Partial* – The diagnosis is broadly supported by the available evidence, but there's still some doubt; *Rejected* – Insufficient evidence to support the diagnosis. The validation process is illustrated in Table 34.

Table 34. Validation process of written plant clinic records[1].

Specific	Plausible	Likely	Consistent / Complete	Unambiguous	Result
No or Yes	**NO**				REJECT
No or Yes	Yes	**NO**			REJECT
No or Yes	Yes	Yes	**NO**		REJECT
No	Yes	Yes	Yes	Yes	PARTIAL
No	Yes	Yes	Yes	No	PARTIAL
Yes	Yes	Yes	Yes	Yes	COMPLETE

[1] Method under development (*Eric Boa*, CABI). The red **NO** is a stop.

A query with 'no diagnosis' is always rejected. The validity of a non-specific diagnosis varies from case to case. For example, 'fungus' in orange could be diagnosed as either scab or citrus black spot if the description of symptoms on the fruit matches known symptoms[16]. The control options for the two are similar (pruning, removal of infected fruits and eventually spraying with fungicide). In contrast, 'blight' in tomato and potato is insufficient information to target the advice and therefore an invalid diagnosis. The two blights, early blight (*Alternaria solani*) and late blight (*Phytophthora infestans*), require different control measures.

'Fungus' in citrus – two diseases, same treatment. 'Scab' (*right*) and 'citrus black spot' (*left*) are caused by two different fungi, but the control measures are the same.

Early or late? – 'blights' in potato and tomato. 'Late blight' (*left*) and ' early blight' (*right*) are both fungal diseases but they require different treatments.

In our quality assessment we first removed the 169 queries with 'no diagnoses' to limit the bias resulting from poor record keeping. We then assessed the validity of the diagnoses by crop (Table 35) and by clinic organisation (Table 36). Overall, 74.5% of the queries had a complete (26%) or partial diagnosis (48.5%), while 25.5% were rejected. There was substantial variation between crops and pests. More than half of the banana and groundnut queries presented to clinics resulted in a complete diagnosis. Orange, bean, sweet potato and rice had the highest rejection rate (32.2–38.4%) whereas cassava, groundnut, coffee and maize had the lowest (15.6–17.7%).

Ambiguous and inconsistent or incomplete descriptions were the major reasons for rejection or partial validation of problems such as coffee wilt disease, coffee twig borer, cassava mosaic disease and orange leaf miner. The rejection rate of orange leaf miner was surprisingly high (39% reject and 55% partial, *data not shown*), though this could be due to the ambiguous way in which symptoms were described. Among the partial validations we found '*brown spots with yellow patches on the fruits*', '*wilting of the plant*' and '*oranges eaten by insects*'. A high complete validation rate (>50%, *data not shown*) was noted for BBW (with distinctive premature ripening of fruit), banana weevil (black tunnels in base of pseudostem) and CBSD (brown decay in tubers).

[16] Based on own observations in the Teso region

Table 35. Validation of plant health diagnoses for the top-10 crops – *By crop.*

Crop	Queries [1]	% complete	% partial	% reject	Total
Cassava	401	34.7	47.6	17.7	100
Orange	305	3.6	58.0	38.4	100
Banana	245	55.1	17.6	27.3	100
Groundnut	173	54.9	29.5	15.6	100
Tomato	135	5.9	66.7	27.4	100
Coffee	126	9.5	74.6	15.9	100
Bean	93	11.8	50.5	37.6	100
Maize	65	27.7	55.4	16.9	100
Sweet potato	61	3.3	63.9	32.8	100
Rice	59	1.7	66.1	32.2	100
Total	**1,663**	**26.0**	**48.5**	**25.5**	**100**

[1] 169 queries without a diagnosis were removed from the data set

The proportion of valid diagnoses varied substantially between clinic organisations (Table 36). Buikwe LG, Mukono LG and SHA Kayunga had complete validation rates above the average (35.1–49.3%) and some of the lowest rejection rates. Part of the differences is due to the prevalence of specific crops and pests in different regions. The low completion rates by Soroti LG, Serere LG and Socadido (6.4–8.7%) are largely explained by the problems in validating orange leaf miner diagnoses. RicNet had a high rejection rate (71.3%) because many queries lacked a symptom description.

The validation results presented here are only partial indicators of the quality of diagnoses made by plant doctors. We cannot conclude to what extent the results obtained reflect limitations in knowledge or experience of the plant doctors or poor record keeping and ability to accurately describe symptoms. Further studies are needed to distinguish such effects. Better recording of information and management of clinic registers would have an immediate effect in improving quality assessment and control.

Table 36. Validation of plant health diagnoses for the top-10 crops – *By clinic organisation.*

Clinic organisation	Queries	% complete	% partial	% reject	Total
Buikwe LG	152	49.3	35.5	15.1	100
Mukono LG	103	38.8	40.8	20.4	100
Self Help Africa KA	402	35.1	48.8	16.2	100
Self Help Africa KU	395	21.0	54.2	24.3	100
Bukwo LG	16	18.8	56.3	25.0	100
Serere LG	47	6.4	48.9	44.7	100
Soroti LG	67	7.5	14.9	77.6	100
Socadido	138	8.7	76.1	15.2	100
Hoima LG	257	19.8	57.2	23.0	100
RicNet	87	20.7	8.0	71.3	100
Total [8]	**1,663**	**26.0**	**48.5**	**25.5**	**100**

QUALITY OF ADVICE

For the general description of the advice given, the entries with 'no diagnosis' and/or no recommendations (606 entries, 23%) were removed from the dataset, reducing it to 1,992 queries. We grouped the recommendations according to type (Table 37). The most frequent recommendations were various cultural practices (40.1%), chemical pesticides (32.2%), resistant varieties (12.3%) and clean planting materials (10.2%). Only a minor proportion covered fertilisers and organic pesticides. The proportion of curative measures was slightly higher than preventive measures, 54% against 46%.

Table 37. Types of recommendations given at the plant clinics – All crops.

Type of recommendation	No. times given	%	Prev/Cur
1 Pesticides			
Chemical	1,034	32.2	Cur
Biological	40	1.2	Cur
2 Fertilizer, synthetic and organic	70	2.2	Prev
3 Resistant/ tolerant varieties	396	12.3	Prev
4 Clean seed/ planting material	329	10.2	Prev
5 Cultural practices			
Removal/ destruction of infected plants/ parts	647	20.1	Cur
Crop rotation	185	5.8	Prev
Other cultural practices [1]	490	15.2	Prev
6 Other			
Bring sample, follow up visit	13	0.4	
Other	10	0.3	
Total [2]	**3,214**	**100**	

Prev – preventive measure; **Cur** – Curative measure

[1] Include planting time and space, weeding, mulching, water management, sterilisation of tools and others

[2] The total is higher than the number of queries (1,992) since more than one recommendation was given in 963 cases. Entries with no diagnosis and/or no recommendation were not included.

In 1,029 cases (52%), a single recommendation was given while between two and four were given for the rest of the queries. On average two recommendations were given per problem. Single recommendations were mainly on pesticides (636 queries), removal of infected plants (136 queries) and resistant varieties (104 queries) (*data not shown*). The proportion of single recommendations varied significantly between organisations with SHA Kumi having the highest proportion (71%) and SOCADIDO, Mukono LG and Buikwe LG the lowest (8, 11 and 13%, respectively) (Table 38). For most pests and diseases, a combination of practices is necessary for effective prevention and control (Adipala *et al.*, 2000). From a feasibility point of view it is also an advantage to have more than one option to choose from. Farmers may not be able to apply the best solution because of cost or limited availability of inputs yet they can still adopt certain practices to limit losses.

Table 38 illustrates the relative distribution of the main types of recommendations given by the different clinic organisations. The distribution depends on the predominant crops, pests and diseases in the particular area. For example, in the Teso region where orange pests and diseases dominated, the relative share of chemical pesticides was higher than in districts where banana bacterial wilt and cassava viruses were the dominant diseases (Mukono, Buikwe, Kayunga, Hoima, Rwenzori). Chemicals were not commonly recommended for these latter diseases.

Table 38. Distribution of types of recommendations given by clinic organisations (%).

Clinic organisation *(% single recommendations)*	**Chemical pesticides**	**Resistant varieties**	**Clean planting material**	**Removal of infected plants**	**Crop rotation**	**Other**	**Total**
Mukono LG *(11%)*	22	13	14	20	7	25	100
Buikwe LG *(13%)*	23	17	10	18	3	30	100
SHA KA *(19%)*	13	18	12	21	10	25	100
SHA KU *(71%)*	59	7	4	13	5	12	100
Bukwo LG *(54%)*	69	0	4	15	4	8	100
Serere LG *(25%)*	49	5	6	20	5	16	100
Soroti LG *(45%)*	47	2	16	19	7	9	100
Socadido *(8%)*	32	5	13	23	0	26	100
Hoima LG *(40%)*	29	19	9	16	5	21	100
RicNet *(55%)*	19	0	6	51	5	18	100

We made a closer assessment of the advice given for five major problems: cassava brown streak disease (CBSD), banana bacterial wilt (BBW), groundnut rosette, orange leaf miner and coffee wilt disease (CWD). They represent four different types of causal organism (virus, bacteria, fungus and insect) and comprised more than 25% (764) of all queries (Table 27).

Measuring the quality of advice based entirely on the written clinic records is of course not comprehensive. We don't know what is behind the cases of missing advice (473 queries) and those with limited details on how to apply the recommendations (variety names, spraying details, planting time and distance etc.). Maybe additional verbal or written information was conveyed to the clients during the consultations or maybe the omissions reflect gaps in the knowledge of the plant doctors. Here we ignore these gaps and focus on the generic advice given.

The recommendations were compared with those currently suggested in Uganda (Table 39). The practices are scientifically validated options recommended by different programmes and institutions, including MAAIF. These 'best practices' are not absolute standards. New, but not yet widely available practices, as well as locally adapted practices may be equally useful or better. The recommendations given by plant doctors for the five major pests were categorised into: 'best practice', 'partially effective' and 'ineffective'. A partially effective recommendation will reduce spread and severity of the disease but only to a limited extent.

Table 39. 'Best management practices' of five key plant health problems recommended for Uganda.

CBSD	**BBW**	**Groundnut rosette**	**Orange leaf miner**	**CWD**
1. Plant disease free planting material	1. Avoid planting sick suckers	1. Plant resistant varieties	1. Remove and destroy infected plant parts	1. Destroy infected plants
2. Destroy infected plants	2. Break off male bud	2. Early planting	2. Prune the tree	2. Plant disease free seedlings
3. Plant resistant varieties	3. Cut and bury infected plants	3. Establish good plant population	3. Apply insecticide or mineral oil to nurseries and young trees	3. Avoid moving diseased plant parts
	4. Clean tools	(4. Spray against aphids) [1]		(4. Plant resistant varieties) [2]
		(5. Uproot affected plants) [1]		

CBSD – Cassava brown streak disease; **BBW** – Banana bacterial wilt; **CWD** – Coffee wilt disease;

[1] Not necessary if 1-3 are followed.

[2] Still a limited option for Uganda

For the control of CBSD 95.5% recommended partially effective options, while the share of 'best practice' and ineffective advice was the same (2.6%) (Table 40). In four of the ineffective cases, pesticides were recommended. In 31 cases, only 'uproot and burn/destroy' was recommended. This practice will have limited effect unless combined with clean planting material and/or resistant variety. Forty-one recommended resistant/tolerant varieties as a sole recommendation. This advice is only feasible if the varieties are available, accessible and accepted by the users.

Mass campaigns have been carried out across the country to promote the 'ABCC practices' for BBW control: A–Avoid planting infected suckers; B–Break off male bud; C–Cut and bury infected plants; C–Clean tools (Table 39). The ABCC practices were recommended in 1.7% of the clinic cases and 94.9% were a partial combination of these practices. Ineffective advice, including 'resistant varieties', accounted for 3.4%. Resistant varieties are still not an option for BBW control in Uganda. Almost all existing varieties are affected by the disease (Tripathi and Tripathi, 2009).

Table 40. Efficacy of the advice given at the plant clinics for five major pests and diseases.

Pest/ disease	No. queries	'Best practice'		Partially effective		Ineffective	
		#	%	#	%	#	%
CBSD	266	6	2.3	254[1]	95.5	6	2.3
BBW	177	3	1.7	168[2]	94.9	6	3.4
Groundnut rosette	100	5	5.0	92	92.0	3[3]	3.0
Orange leaf miner	80	0	0.0	16	20.0	64[4]	80.0
CWD	41	4	9.8	37[5]	90.2	0	0.0
Total	**664**	**18**	**2.7**	**567**	**85.5**	**79**	**11.8**

CBSD – Cassava brown streak disease; **BBW** – Banana bacterial wilt; **CWD** – Coffee wilt disease;

[1] 65 cases included ineffective advice, mostly 'crop rotation',

[2] 24 cases included ineffective or vague recommendations such as 'plant resistant variety', 'rotate crops', 'apply manure', 'control weeds', 'apply good cultural practices', '

[3] 'Spray with fungicide' or 'spray against white flies'

[4] 12 cases included 'plant resistant variety'

[5] Five cases included 'early planting' and 'plant resistant variety'

Also for groundnut rosette, partially effective recommendations comprised over 90% while only three examples of wrong recommendations were noted. Chemical control of aphids was recommended 61 times either alone (most of them) or in combination with other options. Resistant varieties were recommended 31 times, alone or combined.

The recommendations on orange leaf miner differed from the other four diseases in that the vast majority were found ineffective (80%). All recommendations, except four, were for insecticide application. In 60 of these cases this was the only advice. The use of insecticides is not regarded an effective measure against leaf miner in adult trees because the leaves are hardened and because of the risk of killing natural enemies and creating insecticide resistance (Jeninah Karungi-Tumutegyereize, *personal communication*). Spraying a grown-up tree is not practical either and it poses a health risk on the applicant. Usually leaf miner damage is minimal on established plants. Only in nurseries and young trees can the use of pesticides be justified. Pruning and removal of infested leaves and debris are considered the best way to keep the populations low in adult plantations.

The records on CWD show that plant doctors know the key messages on field sanitation and clean planting materials. All cases, but one, included advice to 'cut and destroy infected plants' making the percentage of 'best practice' higher compared to the other diseases (9.8%). However, there seems to be some confusion regarding the terms 'clonal coffee' vs. 'resistant varieties'. In some cases these were erroneously used as synonyms. 'Clonal coffee' refers to the way the material is produced rather than the variety. Resistant varieties were recommended 12 times. If no other specification is given, such information is misleading since resistant varieties are still a limited option in Uganda.

Overall, the pattern of efficacy of advice was similar for CBSD, BBW, groundnut rosette and CWD. Although the recorded recommendations were often incomplete, the key messages for standard management of these diseases seem to be well known by the plant doctors but more consistency is needed. Only the orange leaf miner recommendations were of lesser quality.

Table 41 shows the efficacy of advice presented by clinic organisation. The lower efficacy observed among the Teso clinics is mainly attributed to the ineffective advice given on orange leaf miner. The pattern of efficacy of advice is similar for the other organisations with very low proportions of ineffective advice (0-3.1%), but also low percentages of 'best practice' (0-7.0%). We should emphasise that a quality assessment based only on five plant health problems cannot be used to draw broad conclusions regarding the quality of advice given by the different clinic organisations. It is also worth keeping in mind that the category 'partially effective' covers many nuances that merit further analyses.

Table 41. Efficacy of advice given by plant clinic organisations for the five major pests and diseases (%).

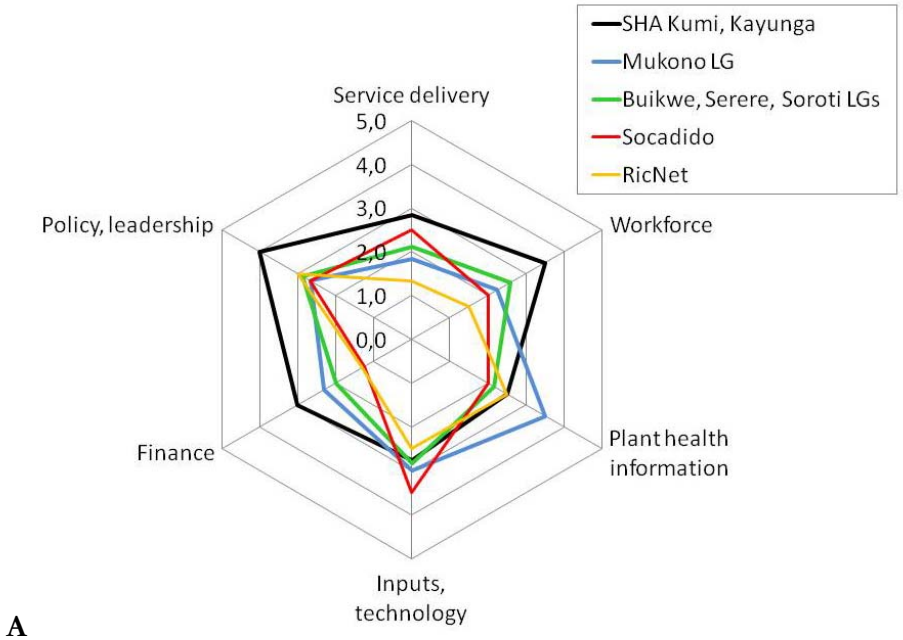
		Efficacy of advice by organisation (%)			
Clinic organisation	**No. queries**	'Best practice'	Partially effective	Ineffective	Total
Mukono LG	43	7.0	93.0	0.0	100
Buikwe LG	70	0.0	100	0.0	100
SHA KA	225	6.2	90.7	3.1	100
SHA KU	150	0.0	64.7	35.3	100
Serere LG	11	9.1	54.5	36.4	100
Soroti LG	18	0.0	55.6	44.4	100
Socadido	42	0.0	88.1	11.9	100
Bukwo LG	2	0.0	100	0.0	100
Hoima LG	55	0.0	98.2	1.8	100
RicNet	48	0.0	100	0.0	100
Total	**664**	**2.7**	**85.5**	**11.8**	**100**

The feasibility of recommendations does not always match the technical quality (efficacy). What farmers are willing and able to do in their fields depends on many factors that are beyond the control of the plant doctors. Availability of labour is a constraint for the application of work intense practices (removal/destruction of diseased plants, pruning, weeding). Availability and access to improved varieties and clean planting material are a general challenge for most farmers. Consumer preferences also play an important role when farmers choose their varieties (Box 12). For the advice to be useful for the plant clinic users, it is crucial to establish feedback mechanisms to ensure that the plant doctors are aware of the fate of the advice and what the clients think of it, both in terms of efficacy and feasibility.

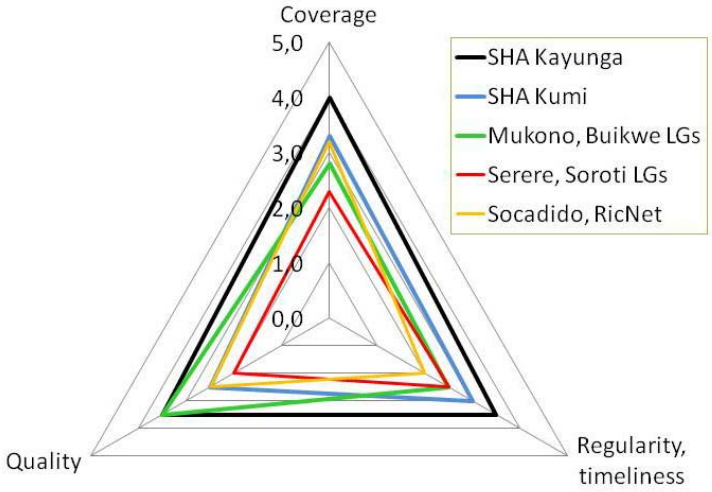
5. Discussion

The previous chapters show that many factors influenced the performance of plant health clinics, from practical, everyday concerns of clinic staff to the policy framework that shapes public sector activities and relationships with the NGO and private sectors. The use of a plant health system framework to analyse events enabled us to organise the issues and identify key features that affect plant clinics and their surroundings.

The 'spider web' diagrams presented in Figure 5 are graphical summaries of our findings. We used a 1–5 scale[17] to rate the plant health system components (Figure 5A) and clinic performance indicators (Figure 5B) for each plant clinic organisation. Clinic organisations with similar rating patterns where grouped (±0.3 deviation of averages).



A



B

Figure 5. Assessment of plant clinic organisations by *plant health system component* **(A)** and plant clinic *performance indicator* **(B)**.

[17] 1–poor; 2–inadequate; 3–fair; 4–good; 5–excellent

We did not have enough information from Bukwo and Hoima LGs to include them in this analysis. The rating of each of the variables used in this study (Tables 1 and 2) are shown in Annex 2. Some of them were not rated due to insufficient information.

The variations between the organisations observed in Figure 5A reflect a combination of differences in context (funds, staff, policies) and differences in behaviour (leadership, management, attitude). SHA was rated higher than the other organisations on four of the six system components, reflecting a pro-active attitude towards clinic investment and networking. Mukono LG and SOCADIDO were above average on plant health information and inputs, respectively. For most organisations, the plant health system components were rated below 3 ('fair') suggesting general systemic weaknesses.

The question is, do 'better' (higher rated) plant health system attributes lead to better clinic performance? Our results suggest so. The rank of the clinic organisations varied slightly between 5A and 5B, yet, in general there was a good correlation between the two. SHA was rated highest for all three performance indicators, though SHA Kumi's rating was reduced because of lower proportion of female clients and poorer quality of advice compared to SHA Kayunga (see Sections 4.1 and 4.3). The lower ratings of SOCADIDO and RicNet were partially due to irregular operation. The LGs were placed in between with Buikwe and Mukono matching the quality of healthcare rating of SHA Kayunga. The performance of LG-managed plant clinics was negatively affected by external events: the district split up, the elections and the prolonged initiation of NAADS2.

Both NGOs and LGs have a useful role to play in running plant clinics and the potential synergies are significant. The joint model for running clinics used by SHA Kumi, through secondment of LG staff, combined the best of both worlds: the flexibility and resources of the NGO and the technical capacity and anchoring in the public system of the LGs.

Overall, clinic coverage and regularity correlated well with four of the system components: service delivery (particularly publicity), workforce (clinic staffing), finance and leadership. In contrast, we could not relate quality of diagnoses and advice to any particular system component, e.g. access to plant health information, technical backstopping or agro-inputs.

The rating of the clinic organisations should be treated with some caution since it was based on a relatively limited data set. The assessment of quality of advice was based only on review of five pests as recorded in the clinic registers. A more comprehensive quality assessment would involve field observations and gathering user opinions. The selection of variables for this study was based on previous studies and own experiences. These are, however, not exhaustive and some important aspects may have been omitted. The choice of variables depends on the purpose of the study and future findings may lead to further adjustments of the method.

This research is part of ongoing efforts to develop methods and approaches to study plant clinics and plant health systems and to identify adverse and enabling influences on performance. This is the first study that uses a framework derived from human health to analyse plant clinics. The initial results are encouraging since the framework gives a structure to the analysis of human behaviour and outcomes and to the identification of interventional needs. Further testing is needed to explore the full scope of the method, with possible refinements for use in the context of farmers and their crops. The preliminary results presented here have helped to understand

what works and why. The application of a human health system framework could also be used to track performance over a longer period of time.

The plant health clinics in Uganda experienced a significant revival in 2010 and 2011. There was growing interest and commitment at districts and central level reflecting the acceptance of clinics as a unique method to help improve plant health extension and disease vigilance. Incorporation of plant clinics in government policies, expansion of the funding base for clinics and wider stakeholder engagement created momentum for a new generation of the plant clinic initiative with more focus on expansion, consolidation and integration with key actors in plant health. Ownership was strengthened and clinic management improved with stronger local leadership. The clinics were no longer seen as a 'CABI project'.

It was nonetheless evident that the clinic initiative expanded in a loose and unregulated way. Backstopping remained weak and uncoordinated. It was not clear who was directing the activities. MAAIF and CABI had spearheaded the initiative by giving plant doctor training and initial guidance but none of them provided the overall leadership to guarantee that basic standards and procedures were in place and followed up on. Each clinic organisation seemed to be tackling the challenges each in their own way. Many of the observed clinic weaknesses were products of missing coordination, follow up and communication.

The current policy framework in Uganda supports plant clinics and this is a major step forward, reflecting the fact that evidence of success helps to create greater commitment in running plant clinics. However, the existing governance structures, institutional mandates and resources make it difficult to institutionalise the mixed-mandated clinics. The mandate for extension lies with NAADS, while the mandate for pest and disease control lies with MAAIF and LGs and much of the actual field work is implemented by NGOs. Finding a solid institutional base for the 'orphaned' clinics will be a major challenge.

Despite the prevailing weaknesses, the clinics produced notable results. More than 2,000 farmers from almost 400 parishes were reached. Dozens of crops were attended confirming that plant clinics are inclusive in meeting farmer demand on any problem in any crop. Considering the still modest clinic investments, these results are remarkable. Feedback from some of the clients confirmed that plant clinics fill a gap in extension. An old farmer who came to the clinic at Mukura market with his cassava plant said "*this is the first time in my life I've seen people follow us to give us a service*".

The sustainability of plant clinics is still uncertain and hard earned progress is vulnerable to unpredictable events. Funds are limited and skilled human resources to man the clinics have yet to reach a critical mass. Yet, the recent expressions of commitment from the major players suggest that the evolution of stronger links between components of a plant health system is a real possibility. The outcomes of this research may guide the further developments.

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ANNEXES

Annex 1. Resolution on plant clinics in Uganda

The enclosed 10-point resolution was signed by representatives from MAAIF, LGs, NAADS, Makerere University, NARO, NGOs, CABI and University of Copenhagen at a stakeholder workshop held by MAAIF in Mukono on 11 – 13 May 2011: "Exchange, learn and plan for next generation plant health clinics in Uganda" (MAAIF, 2011a).

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Sustainability of the plant clinics and the supporting network needs to be addressed from the outset. The institutionalization of the clinics through the integration into existing structures, programmes and budgets is an essential part of this. Ensuring funds to create and maintain skilled workforce and to ensure continuous technical backstop support is another. Finally, mechanisms must be put in place to ensure farmer ownership and accountability.

The workshop recommends to:

1. Establish a network of plant clinics in Uganda to ensure the effective delivery of extension services to farmers and maintain vigilance of plant pests and diseases.
2. Enhance farmer ownership of plant health clinics by raising awareness and engaging with a broader range of clinic partners.
3. Establish a framework for plant clinic operation that clearly defines roles, responsibilities and procedures for harmonizing operations across the plant clinic network.
4. Develop a robust monitoring system to ensure the quality of services is maintained through farmer feedback and regular performance assessments.
5. Establish linkages between plant clinics and registered input suppliers to improve the quality of inputs and promote safe use of chemicals.
6. Develop a national plan for plant doctor training to meet the increased demands of an expanded network of clinics.
7. Find ways to institutionalize the plant clinics and integrate them into NAADS under the new ATAAS programme.
8. Develop a diagnostic support network for the clinics by establishing firm linkages to research and diagnostic capacity within Ugandan institutions (MAAIF, universities. NARO/ZARDIs)
9. Establish standardized methods of data management to ensure information is shared and used to support decision making and pest and disease management at the district and national level.
10. Establish a consortium to lever funds to support further plant clinics expansion and consolidation.

The workshop participants are committed to bring forward these recommendations.

Annex 2. Rating of plant clinic organisations

Scale: 1–poor; 2–inadequate; 3–fair; 4–good; 5–excellent

Rating of plant clinic organisations[1] by *systems component*

Plant health system component	Clinic group	1		2	3			4	5
	Variable	SHA Ka	SHA Ku	Mu LG	Bu LG	Se LG	So LG	So ca	Ric Net
1. Service delivery	Clinic materials	3	2	3	2	3	3	3	2
	Logistics	3	3	2	2	2	3	3	1
	Publicity	4	4	2	2	2	2	2	2
	Record keeping	4	4	2	2	2	2	3	1
	Monitoring, quality control	2	2	1	2	2	2	2	1
	Technical backstopping	2	1	1	1	2	2	2	1
	Average	**3.0**	**2.7**	**1.8**	**1.8**	**2.2**	**2.3**	**2.5**	**1.3**
2. Workforce	Clinic manning	3	3	1	1	1	1	1	1
	Skills, level of training	3	3	3	3	3	3	3	2
	Retention	4	4	3	3	4	4	1	1
	Incentives and motivation	4	4	2	2	3	3	3	2
	Average	**3.5**	**3.5**	**2.3**	**2.3**	**2.8**	**2.8**	**2.0**	**1.5**
3. Plant health information	Sources	3	3	4	3	2	2	2	3
	Access and use	2	2	3	2	2	2	2	2
	Average	**2.5**	**2.5**	**3.5**	**2.5**	**2.0**	**2.0**	**2.0**	**2.5**
4. Input supply, technologies	Access	3	3	3	3	3	3	3	3
	Availability	3	2	3	3	2	3	4	2
	Average	**3.0**	**2.5**	**3.0**	**3.0**	**2.5**	**3.0**	**3.5**	**2.5**
5. Finance	Available funds	3	3	2	2	2	2	1	1
	Diversification of funding sources	3	3	3	3	2	3	2	2
	Level of self-funding	3	3	2	2	1	1	1	1
	Average	**3.0**	**3.0**	**2.3**	**2.3**	**1.7**	**2.0**	**1.3**	**1.3**
6. Policy, leadership	Policy / governance framework	4	4	4	4	4	4	4	4
	Local level support/leadership	4	4	2	2	2	2	2	3
	Central level support/leadership	4	4	2	3	2	3	2	2
	Average	**4.0**	**4.0**	**2.7**	**3.0**	**2.7**	**3.0**	**2.7**	**3.0**
	Overall average	**3.2**	**3.0**	**2.6**	**2.5**	**2.3**	**2.5**	**2.3**	**2.0**

Rating of plant clinic organisations[1] by *performance indicator*

Plant health system component	Clinic group	1	2	3	3	4	4	5	5
	Variable	SHA Ka	SHA Ku	Mu LG	Bu LG	Se LG	So LG	So ca	Ric Net
1. Coverage	Clients attended	4	4	2	2	2	2	3	2
	Geographic reach	4	4	3	4	3	3	4	3
	Gender balance	4	2	3	3	2	2	3	4
	Average	**4.0**	**3.3**	**2.7**	**3.0**	**2.3**	**2.3**	**3.3**	**3.0**
2. Regularity, timeliness	Compliance with clinic schedule	4	3	3	3	2	2	1	1
	Time keeping, waiting time	3	3	2	2	3	3	3	3
	Average	**3.5**	**3.0**	**2.5**	**2.5**	**2.5**	**2.5**	**2.0**	**2.0**
3. Quality of plant healthcare	Validity of diagnosis	4	3	4	4	2	2	3	2
	Efficacy and feasibility of advice	3	2	3	3	2	2	2	3
	Average	**3.5**	**2.5**	**3.5**	**3.5**	**2**	**2**	**2,5**	**2.5**
	Overall average	**3.7**	**2.9**	**2.9**	**3.0**	**2.3**	**2.3**	**2.6**	**2.5**

[1] **SHA Ka**–SHA Kayunga; **SHA-Ku**–SHA Kumi; **Mu LG**–Mukono LG; **Bu LG**–Buikwe LG; **Se LG**–Serere LG; **So LG**–Soroti LG; **Soca**–SOCADIDO