

## EVALUATION OF FARMERS' SATISFACTION TO PLANT HEALTH ADVICE OFFERED THROUGH PLANT CLINICS IN RWANDA

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### ABSTRACT

Plant pest and diseases are one of the major constraints of agriculture production in Rwanda. Plant clinic is rapidly gaining popularity in the region including Rwanda, and it was reported to be among potential solutions to overcome this challenge. However, there is little information documenting the appreciation of farmers toward advice given through plant clinics in Rwanda. Therefore, this study was conducted in order to assess farmers' satisfaction vis-à-vis the services rendered to farmers by plant doctors, and to document major source of plant health information. A survey with plant clinic users, non-users of plant clinics, service providers, key informants and focus groups were conducted. Participants were selected in locations of eight clinics launched from 2011 to 2013 and a structured questionnaire and group discussions were used to collect all data. The survey results showed that plant clinics were ranked by plant clinic users as the major source of plant health information at 97.5% while 79.5% of respondents mentioned that plant doctors had competence and they highly appreciated the advice received from plant doctors. Establishment of plant clinics and awareness creation for farmers' participation can contribute to increased agricultural productivity through effective management of pest and diseases in Rwanda.

**Key words:** diagnosis, diseases, disease, management, pest, plant doctor.

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### INTRODUCTION

Agriculture remains the backbone of Rwanda's economy and most households in Rwanda are engaged in some sort of crop or livestock production activity. Agriculture makes up around a third of gross domestic product. Currently, agriculture contributes about 30% to the country's GDP and a big number of the population engaged in agriculture related activities. In that sense, agriculture is very important for food security, nutrition and poverty reduction (MINECOFIN, 2013; NISR, 2015). Due to the mountainous nature of Rwanda's geography, only about 60% of the total land area is currently under cultivation (1,735,025 Ha).

Given the limited availability of arable land for agriculture and the constantly growing food requirements of the population, ensuring food security poses a major challenge (MINAGRI, 2011). Increasing agricultural productivity and food security in Rwanda therefore requires an increasing production per unit area and per unit time. Setting this as the goal, the Ministry of Agriculture and Animal Resources

(MINAGRI) initiated the Crop Intensification Program (CIP) in 2007 and since then seeds of some priority crops such as maize were imported and distributed freely to farmers and subsidies were applied for inorganic fertilizer.

As a result, the consolidated use of land area under these different priority crops has increased from 28,788 Ha in 2007 to 254,000 Ha in 2010 and 502916 Ha in 2011; the total production of maize, wheat and cassava have tripled, the total production of beans doubled while the production of rice and Irish potato increased by 30% (REMA, 2014).

Intensive agricultural techniques using high yielding crop varieties and optimum and efficient use of other improved inputs has helped to achieve high production. However, the intensive cultivation has many inherent risks leading to crop losses. These include the large-scale seed imports, monocropping and movement of infected plant parts which seem to play a big role in aggravating crop pests and diseases in Rwanda (Kabirigi and Gaidashova 2014).

The plant health clinics, as an innovative delivery method for agricultural extension services to help farmers to deal

with plant pests and diseases and other related problems, were established in Rwanda by the Rwanda Agriculture and Animal Resources Development Board (RAB) in partnership with Center for Biosciences and Agriculture International (CABI) in 2011. They benefited and still are benefiting from regional experience such as Uganda (Brubaker et al., 2013) and international experience such as Bolivia and Bangladesh (Bentley et al., 2009; Harun-Ar-Rashid et al., 2010, Bentley et al., 2011). The mode of operation is the same and consists of diagnosing and giving advice on how to deal with plant health problems. Advice provided often includes selection of varieties and other valuable inputs that can help in the improvement of plant health and vitality. In the short run, this type of advice provides plant resistance to problems and helps mitigate losses. In the long run, this may lead to increased profitability through increasing yields (Brubaker et al., 2013).

In this process, farmers frequently visit plant health clinics to get information concerning plant health problems in terms of diagnosis and recommendations for management. Farmers, after seeking remedial measures, apply them to test and see the results. Most of the time, they have gotten an overwhelming response and appreciated the recommendations from plant doctors. Since its introduction in Rwanda, there is little information documenting the appreciation of farmers toward advice given for plant pest and disease management.

Therefore, the objective of this study was to assess farmers' satisfaction vis-à-vis the services rendered to them through plant clinics and to document major source of plant health information.

## 2. MATERIALS AND METHODS

### 2.1. Description of the study location and methodology

This study was conducted in eight plant clinics established between 2011 and 2013. They were selected in different Provinces including Kigali city, Northern province, Southern Province, and Western Province (Table 1). The number of plant clinics selected in each location depended on the total number of plant clinics available in the Province and the establishment date. The target groups for this study were users who visited plant clinics before (37), users who were leaving the plant clinics at the time of interview (39), non-users of plant clinics (40) for formal interview. The descriptive methodology was used to collect data; a series of

formal interviews was conducted, and a questionnaire was composed of both open ended and closed ended questions. The service providers such as agro-dealers, local authorities, farmers' associations totaling were considered for informal interview and group discussions. The checklist was used to carry out some informal interviews and focus group discussions.

**Table 1: Location of plant clinics surveyed**

Province	District	Sector	Plant clinic site
South	Nyamagabe	Tare	Gasarenda
	Huye	Rusatira	Kinkanga
	Ruhango	Byimana	Ntenyo
Kigali city	Nyarugenge	Mageragere	Nyarurenzi
North	Gakenke	Gakenke	Gakenke
		Rusasa	Murambo
West	Nyabihu	Shyira	Vunga
	Rutsiro	Gihango	Congo Nile

### 2.2. Data collection

The selection of respondents among different categories of respondents followed a two-stage clustered and randomized procedure. Secondary data were collected from existing literature on Plant health clinics while primary data were collected from interview with different stakeholders involved in plant health problems especially the users and non-users of plant clinics. The structure questionnaire covering questions on awareness, perception, importance of plant health clinics and the client satisfaction vis-à-vis the services offered by the plant health clinics was used to get all information from different stakeholders. Data collection was done through face to face interviews. Other questions relating to plant health clinics' achievements and the list of statements that had to be rated by the respondents were also used. The rating was from 1 representing strongly disagree to 5 representing strongly agree.

### 2.3. Data analysis

The qualitative data analysis collected mainly through key informant interviews and focus group discussions consisted in identifying the main crop health advisory services in the region covered by the study and from the identified services the advantages and constraints of plant health clinics are highlighted. The quantitative data were examined in depth

providing detailed descriptions of clients' awareness, perception, importance of Plant health clinics and their satisfaction vis-à-vis the services offered by the plant health clinics. Data were categorized and coded and these data were synthesized into general conclusions. Statistical packages for social sciences (SPSS) were used to process the coded data.

### 3. RESULTS AND DISCUSSION

#### 3.1. Main characteristics of respondents

The main characteristics of respondents include their age, sex, the distance to the plant clinic (PC) and the farm size owned (Table 2).

**Table 2. Respondents' characteristics**

Variables	Measurement	PC users	PC exit	PC non-users
Age (Years)	Mean	41	44	45
	Min.	23	29	22
	Max.	65	90	70
	SD	10.67	11.27	13.73
Sex	Male	30	24	23
	Female	9	13	17
Distance to PC (Km)	Mean	2.2	5.03	2.08
	Min.	0.1	0.2	0.2
	Max.	6	20	7
	SD	1.6	5.17	1.73
Farm size (Ha)	Mean	1.21	0.50	0.58
	Min.	0.2	0.0025	0.2
	Max.	5	3	1.5
	SD	0.85	0.69	0.28
Animal kept	Cow	43	39	22
	Goats/sheep	43	36	23
	Poultry	75	39	3

The plant health clinics users seemed to be young compared to other respondents, they seem to own more lands and to keep more animals. Respondents interviewed while leaving the clinic (PC exit) seem to travel a long distance to reach the clinic compared to other types of respondents and among respondents a big number of men were observed among the non-users of plant health clinics. In analyzing the relationship between the above variables and the types of respondents, the Pearson correlation was calculated, and no

significant correlation was observed. The results of this study showed that more users of plant clinics were young people. This can be associated with the reason that Rwanda has more youth considering the whole population. Based on statistics from the general census, it was shown that people who are below 25 years old represent 67 % of the population in Rwanda. Likewise, it was shown that the Rwandan population who are above 65 years old represent 3% (Ministry of Youth, Culture and Sport 2005). The results of this study corroborate with the findings of Ghiasi et al. (2017). These authors showed that more men used clinics than women. In contrast to this study, they revealed that people who visited plant clinics in Guilan Province of Iran were old where the average age was 52.05 years.

#### 3.2. Source and importance of plant health information

The information related to crop health came from different sources, but the importance of the information provided was appreciated by the users of information depending on a wide range of criteria set by these users of information. Survey findings revealed that plant health clinics were the first major source of information with an overwhelming percentage of 97.5% followed by lead farmers with 2.5%. The reasons that motivated the respondents' choices include the plant doctors' knowledge (79%), the effective, clear and important advice provided (18%) and the quality of diagnosis and advice provided (3%). This is obvious since plant doctors receive basic training in field diagnostics and plant health management as well as other courses to enhance their technical competence and the quality of service (Boa, 2010, Negussie et al., 2013).

Srivastava (2013) reported plant clinic as an innovative paradigm which is very important for food security assurance through provision of timely diagnosis and giving necessary advice to the growers and gardeners. The ranking of the plant clinic as the first source of plant health information is also in agreements with several findings (Srivastava, 1999; 2009). In addition to its major importance in diagnostics and plant health advisory to farmers, the author reported other plant clinic roles including training and teaching to students and extensionists on field diagnosis of pests and diseases, integrated pest management promotion and pest and disease surveillance.

Being the main source of plant health information, plant health clinics play an important role but as noticed by Flood (2010), this importance is sometimes overlooked. Little information available on crop pre-harvest losses indicated that crop health information and crop protection intervention play an important role in crop productivity increase. For instance, Oerke and Dehne (2004) reported

that 50% of maize production would be lost if no crop protection measures applied.

The crop health information received from plant doctors is shared to other different farmers mainly the farmer groups where the plant health clinics users belonged. Several authors reported plant clinics as important source of information for pest and disease management (Boa, 2009, Bentley et al., 2011, Uzayisenga et al., 2014). Findings indicated that 92.3% of the total plant healthclinics users have shared the information received with farmers' group while most respondents (75.7%) interviewed while leaving the plant health clinic for the first time intended to share with neighbors the information received (Table 3).

**Table 3. People with whom respondents shared or intended to share the information**

To whom do you share or intend to share information?	PC users		PC exit	
	Freque ncy	Perc ent	Freque ncy	Percent
With other household members	2	5.13	5	13.51
With a farmers' group	36	92.31	3	8.11
With a lead farmer	1	2.56	0	0.00
With none	0	0.00	1	2.70
With neighbors	0	0.00	28	75.68
<b>Total</b>	<b>39</b>	<b>100</b>	<b>37</b>	<b>100</b>

### 3.3. Major crops brought to plant clinic for plant health advice

Survey findings indicated that seven different crops were recorded at different plant health clinics visited where maize, cassava and beans being the most popular and this is obvious since they are among the priority crops of the country (NISR, 2015a,b&c). Most plant health clinics users (94.6%) and those visiting the clinic for the first time (74.1%) brought a life sample and a wide range of symptoms were observed and recorded. In addition, the findings indicated that 62.5% of the respondents interviewed while leaving the clinic had experienced the problem, they brought to the clinic even before. The problem was not limited to the respondents; other farmers were also affected. Thirty-eight of the clinic users indicated that the crop health problem faced was also present in their neighborhood while among those leaving the clinic, the proportion was much higher (81.1%). The record of different symptoms for each crop indicated that plant is suffering from different diseases/pests and this may significantly reduce the crop productivity of a certain crop affected by different diseases and pests (Oerke and Dehne 2004). The presence of the

observed problem in the neighborhoods of respondents call for a wider intervention and the plant health clinics approach may offer a good and innovative solution since they are run by trained agronomists or local extension workers who are familiar with agriculture and local conditions. Plant health clinics provide demand driven advice to farmers, rather than promoting pre-packaged and technology-centered solutions (Negussie et al., 2011, 2013).

### 3.4. Implementation of advice and achievements

Generally, farmers bring to the plant health clinic live samples and the plant doctor diagnoses the problem and provides advice to solve the diagnosed problem. Depending on the crop stage and the gravity of the problem, the plant doctor provides different options for managing the problem including the use of pesticides. Some cases go beyond the plant doctor's knowledge and he/she must refer the client to other service providers.

Survey findings indicated that more than 90% of the total farmers who visited the plant health clinic were provided with different options with the use of pesticides being the main managing option with 84% of the cases and all have bought and applied the advised pesticides. The 16% remaining were provided with other managing options and applied them. On the side of impact resulting from the implementation of guidance received, findings indicated that crop yield has significantly increased for all crops brought to clinics for advice and the percentage of increase ranged from 128% for maize to 47% for eggplants as indicated in the table 4.

**Table 4. Average crop yield (t/ha) before and after implementing plant health clinic advice**

Crops	Yield before (MT/HA)	Yield after (MT/HA)	% change
Maize	1.05	2.39	128
Beans	0.72	1.1	53
Banana	9	15.75	75
Eggplants	9.37	13.75	47
Pineapple	3.2	6.4	100

The yield changes as reported by plant health clinic users showed how important is the approach. The plant health clinics approach offered and is continuing to offer important and innovative solutions to farmers' problems. However, by analyzing the above changes in the line with other studies conducted in different countries, some differences were observed. In fact, the plant health clinics impact studies conducted in Bolivia and Bangladesh revealed relatively high positive changes in yield. For

instance, potato yield changes in Bolivia went up to 100% while for Bangladesh the maximum average change observed was 44%. These were attributed to the fact that the studies in both countries looked at changes over longer time periods (Harun-Ar-Rashid et al., 2010, Bentley et al., 2011). In Uganda however, low yield changes or no changes were observed, and this was attributed to a relatively short period of time considered by the study and the approach used where both experimental and control groups were used (Brubaker et al., 2013). The yield changes in Rwanda, in the line with other studies, may be attributed to the intervention of plant health clinics but also to the prioritization of some crops by the government policy that yielded in production increase as highlighted in the REMA and NISR reports (REMA, 2014; NISR, 2015)

Survey findings have also indicated that farmers have shown much trust in plant doctors. In fact, farmers interviewed while leaving the plant health clinics are expected either to fully implement the advice received (78.4%) or to partially implement them (21.6%). According to some of these respondents (24.3%) the banana yield is expected to increase by 400%, coffee by 200%, maize by 100%, beans by 82%, Irish potato by 79% and tomatoes by 56%. Even if the number of respondents was relatively small, these findings indicated that farmers have believed and still believe in recommendations provided by plant doctors for improving significantly their crop yield. The yield increase demonstrated by farmers after application of plant health advice agree with the findings of several authors (Bentley et al., 2009, Boa, 2010, Savary et al., 2012). These authors revealed pests and diseases as major constraint in agricultural production contributing to decreasing of yield qualitatively and quantitatively. In Iran, farmers mentioned service usefulness and service relevance as important factors that push them to visit plant clinics including (Ghiasi et al., 2017).

### 3.4. Farmers' satisfaction towards plant doctors' technical competencies and application of advice provided

Farmers, with regards to plant doctors' technical competences, were asked to respond to three statements and results showed that the three statements have almost the same mean but the plant doctor' ability to diagnose farmers' problem was ranked first with a mean of 4.56 and the provision of adequate solutions to farmers' problem was ranked third with a mean of 4.48 (Table 5).

**Table 5. The plant doctor' technical competencies**

Statement	Mean	SD
The plant doctor was able to diagnose my problem	4.56	0.64
The plant doctor provided an adequate solution to my problems	4.49	0.56
The plant doctor explained me how I can prevent the problem in the future	4.54	0.61

(1=strongly disagree; 5=strongly agree)

With regards to the application or implementation of advice provided, farmers were asked to respond to two statements and like the technical competences of plant doctors, the two statements were highly rated with a mean of 4.46 for respondents who fully implemented the advice provided by plant doctors and a mean of 4.43 for respondents who agreed that the solution provided solved their problems (Table 6).

**Table 6. Implementation of advices provided**

(1=strongly disagree; 5=strongly agree)

Statement	Mean	SD
I fully applied the advice I received from the advisor	4.46	0.50
The solution provided solved my problem	4.43	0.55

### 3. 5. Farmers' recommendations and suggestions

The farmers' suggestions may be one of the ways of appreciating the importance of plant health clinics in providing adequate solutions especially when farmers suggest the scale up of the approach. In this regard, respondents have provided a wide range of suggestions but most of them suggested increasing the number of plant health clinics, to get a more permanent clinic with a house rather than a mobile clinic, to increase the number of sessions and number of plant doctors (Table 7). The recommendation on increasing the number of plant clinics at national level was reported (Uzayisenga et al., 2014). Being important at agricultural universities where graduates undergo pest and disease trainings, plant clinic course was shown as good approach to teach diagnostic information on plant disease; and all governments were proposed to increase the number of plant clinics to help farmers (Srivastava, 2013).

**Table 7. Respondents' suggestions**

Suggestions	Respondents (%)
Having a fixed structure to protect clients from rain and sun	36.56

Having an agro-dealer shop at the plant clinic (PC) so that users can access agrochemicals easily	23.66
Increase the number of sessions so that more farmers can attend	3.23
Increase the number of PC to shorten the distance walked by farmers	25.81
Increase the number of Plant Doctors to increase PC and sessions	7.53
Reasonable price for the products (pesticides)	2.15
Training of farmers on crop diseases/pests for early diagnosis	1.08
<b>Total</b>	<b>100</b>

#### 4. CONCLUSION

The survey findings revealed that plant health clinics were the main source of crop health information and the importance of this information in improving crop production and productivity was highlighted. Plant clinics approach offer innovative solutions in the sense that most plant doctors are extension agents living in the vicinity of farmers and provide efficient and effective solutions to crop health problems. After the crop health problem diagnosis and provision of advice, farmers fully agreed to follow the guidance. Survey findings indicated that the full implementation of advice resulted in the high increase of yield and much trust in plant doctors; they finally expressed their wish to scale up the approach. It is important to increase awareness among farmers through sensitization campaigns to visit plant clinics. It is important for agricultural universities and colleges to include plant clinic approach in the student trainings to help them to get practical information on pest and diseases faced by farmers and their management.

#### ACKNOWLEDGEMENTS

This study was supported by Plantwise Programme led by Center for Biosciences and Agriculture International (CABI). Plantwise Rwanda is implemented by Rwanda Agriculture and Animal Resources Development Board (RAB). The authors acknowledge the technical support of the CABI Country Coordinator for Rwanda and contributions of farmers and plant doctors.

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