Research Brief

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LEARNING

Profiling of Plant Clinic Users

It is estimated that 26% to 40% of the world's potential crop production is lost each year because of weeds, pests and diseases (OECD-FAO, 2012). Unfortunately, the limited use of crop protection practices, coupled with the changing climate (risk of new pest introductions) and increasing trade in a globalized world (risk of pests moving across borders and regions) are likely to exacerbate this situation. The CABI-led Plantwise programme is contributing to global efforts to mitigate losses from crop health problems and improve rural livelihoods by helping farmers in over 30 countries to lose less of their crops. A key component of the Plantwise programme is the establishment of plant clinics, which are meeting places (mostly operating regularly near local markets) where farmers who are struggling with plant pests and diseases can send samples of their 'sick' crops for diagnosis and plant health advice. Based on the need to understand which types of farmers plant clinics are currently reaching, this study was conducted with the objective of profiling plant clinic users. Profiling the plant clinic users can be helpful in any attempt to prioritise and target farmers with certain characteristics that align with the objectives of Plantwise.

Highlights

- The purpose of this study is to understand the types of farmers Plantwise is currently reaching so as to inform decisions on whether to focus or change methods to reach a particular profile of farmers.
- The study is based on available Plantwise-related socio-economic survey datasets.
- Characteristics of a typical household that visit plant clinics include middle-aged male head of household with low education attainment, small land holdings with secure tenure, low asset accumulation, limited off-farm employment opportunities, and low participation in farmer group activities.
- Compared with other farmers in similar environments (i.e., non-clinic users), plant clinic users are relatively "asset-rich" and are slightly better educated.
- Further data on indicators such as access to infrastructure, production orientation (commercial versus subsistence), income and food security, and traits are needed to be able to adequately profile the plant clinic users.

What we did

First, we examined all the available Plantwise-related socio-economic surveys for their potential inclusion in farmer profiling study. We then focused on surveys that capture quantitative variables, and this resulted in exclusion of a number of datasets that contain very few measurable variables. Additionally, we excluded surveys that specifically targeted clinic users with particular characteristics, and thus had problems with selection bias. We finally settled on the following datasets: 2017 plant clinic impact assessment datasets for Rwanda and Malawi; data from the 2017 CABI country coordinator (CCC)-led study on the effect of Plantwise on pesticide usage in Kenya; 2015 Plantwise special study data collected by the People Empowering & Development Alternatives (PEDA) International in Malawi, Sri Lanka, Vietnam and Zambia; and 2017 randomized control trial (RCT)-based data collected by the American Institute for Research (AIR) to assess the impact of plant clinics in Kenya. With the exception of the AIR survey that used RCT design, all the surveys selected the plant clinic users using clinic data from the Plantwise Online Management System (POMS). Non-users of plant clinics were selected from non-clinic areas but were similar as possible to users of plant clinics in terms of characteristics such as similarity of agro-ecological conditions, socio-economic conditions, cultivated crop, and pests and diseases.

The socio-economic variables available in the various surveys that were considered useful for the profiling are presented in Table 1. The variables include household demographic characteristics (e.g., gender, age, household size, dependency ratio and level of education); household resource endowment (such as off-farm job or income, access to electricity, quality of housing, asset index, land holdings and livestock holdings); and institutional-related variables (access to credit, membership in associations and land security). Data on household demographics are captured in all the surveys, while information on resource endowment and access to institutional services are only available in some of the datasets.

The profiling exercise was conducted by comparing users and non-users of plant clinics using two methods. First, descriptive statistics were used to compare mean differences between plant clinic users and non-users. Then, a probit regression analysis was estimated to assess factors influencing participation in plant clinics. Descriptive statistics were applied to all the datasets, but the regression analysis was restricted to three of the datasets [i.e., Rwanda, Malawi (2017 data), and Kenya (AIR data)] that have adequate sample sizes and capture enough explanatory variables.

Who are the plant clinic users?

Table 2 presents the summary statistics of the sampled users and non-users of plant clinics in Rwanda, Malawi and Kenya. The results indicate that a large share (ranging from 78% in Rwanda to 94% in Malawi) of households that visit clinics are headed by males. An average household consists of 5-6 members, with a middle-aged head. We find that the clinic users have low level of education, particularly in Rwanda where about 75% of them have attained only primary education. About 40% of the clinic users in Malawi have attained at least secondary education, and the AIR data shows that only 14% of the sampled clinic users in Kenya have achieved tertiary education. We also find that only about a quarter of the sampled clinic users are involved in income-generating activities besides farming. Results also show that most (88%) of the clinic users in Rwanda have access to credit, while 54% and 31% of the clinic users respectively in Malawi and Kenya are not credit-constrained. Results on the wealth-related variables indicate that plant clinic users in Rwanda are largely resource poor farmers. For instance, only 44% of the clinic users in in this country have access to electricity, and very few of them

live in houses constructed with modern housing materials. They also own very few livestock. The average land size ranges from 1.26 hectares in Rwanda to 2.25 hectares in Kenya, suggesting that the clinic users are largely smallholders. Based on the Kenya AIR data, we find that only 17% of the clinic users are members of farmer-based organizations. However, a large share of the clinic users participates in group activities, which can be a farmer, religious, political or common interest group.

Table 3 shows the descriptive statistics of clinic users and non-users based on the PEDA datasets from Malawi, Sri Lanka, Vietnam and Zambia. Here again we find that plant clinic users' households are on average headed by males who are middle-aged with very low educational attainment (mostly only primary education). In Zambia, however, nearly all (97%) of the clinic users have had at least secondary education. Results also show that with the exception of Zambia where households own on average about 5 hectares of land, clinic users have small land holdings, ranging from about 1 to 2 hectares. We also find that the sampled farmers have secure land tenure as they have greater control over the lands they cultivate.

Table 1: Description of variables used in the profiling

Variable	Description	Unit
Gender	Gender of household head	1=Male
Age	Age of household head	Years
Farming experience	Number of years of farming experience	Years
Household size	Number of household members	Number
Dependency ratio	Ratio of members aged below 15 and above 64 to those aged 15–64	Ratio
No education	Household head has no formal education	1=Yes
Primary education	Household head attained primary education	1=Yes
Secondary education	Household head attained at least secondary education	1=Yes
Tertiary education	Household head attained tertiary education	1=Yes
Off-farm job	Household members engage in off-farm income generating activities	1=Yes
Non-farm income	Total annual household non-farm income	KSh
Credit access	Household has access to credit	1=Yes
Electricity access	Household uses electricity for lighting	1=Yes
Quality of roof material	Main building material of the roof used for the house	1=Modern
Quality of wall material	Main building material used for the walls of the house	1=Modern
Asset index[1]	Household asset accumulation	Index
Land holdings	Total amount of land owned by household	Hectares
Land rented	Total land rented in for farming	Hectares
Land cultivated	Total land area cultivated in recent cropping season	Hectares
Land security	Household has full control over cultivated land	1=Yes
Livestock holdings	Total livestock holding of household in Tropical Livestock Units (TLU)	TLU[2]
Farmer association	A household member belongs to a farmer association	1=Yes
Group membership	A household member belongs to a group or an association	1=Yes
Altitude	Altitude of the locality of the household	M.a.s.l

[1] Following Filmer and Pritchett (2001), we constructed the asset index using principal component analysis. The asset index is based on household ownership of 25 durable agricultural assets.

[2] Tropical livestock units aggregate livestock into one index using the following weights: cattle=0.7, pigs=0.2 sheep=1, goats = 0.1 and chickens =0.01 (Chilonda and Otte 2006).

Table 2: Summary statistics of plant clinic users and non-users

	Rwanda		Malawi		Kenya (CCC-led data)		Kenya (AIR data)	
	Users (n=260)	Non-users (n=384)	Users (n=277)	Non-users (n=459)	Users (n=172)	Non-users (n=171)	Users (n=296)	Non-users (n=2254)
Gender	0.78	0.77	0.94	0.93	0.87	0.82	0.89***	0.78
Age	48.12	48.71	43.7***	40.8	56.80	55.16	48.99	49.89
Household size	5.13	5.00	5.92***	5.39				
Dependency ratio	0.98	1.07	1.08	1.11				
No education	0.08	0.08	0.03	0.05	0.11	0.10	0.03**	0.06
Primary education	0.75**	0.82	0.56***	0.68	0.25***	0.44	0.47**	0.54
Secondary education	0.16***	0.09	0.40***	0.26	0.64***	0.46	0.39	0.37
Tertiary education							0.14***	0.09
Farming experience							22.75	24.63
Off-farm job	0.29	0.35	0.25	0.18				
Non-farm income							5887.50	6618.83
Credit access	0.88*	0.83	0.54***	0.4	0.31	0.35		
Electricity access	0.44**	0.33						
Quality of roof material	0.24***	0.36	0.67**	0.55				
Quality of wall material	0.08	0.07	0.87	0.83				
Land holdings	1.26***	0.38	1.87***	1.45	2.25	1.91	1.68*	1.39
Land rented	0.22***	0.06	0.11***	0.03	0.41	0.30		
Land cultivated					1.84*	1.22		
Livestock holdings	0.90***	0.68	1.69	1.25			7.18	6.35
Asset index							0.25**	-0.03
Farmer association							0.17***	0.08
Group membership							0.82***	0.71
Altitude	1830.86*	1859.01	1033.90***	1205.26	1630.16	1624.66		

Note: ***, ** and * indicate that mean values for plant clinic users are significantly different from non-users at the 1%, 5% and 10% levels, respectively.

Table 3: Summary statistics of plant clinic users and non-users (PEDA data)

	Malawi		Sri Lanka		Vietnam		Zambia	
	Users (n=105)	Non-users (n=106)	Users (n=114)	Non-users (n=108)	Users (n=102)	Non-users (n=50)	Users (n=62)	Non-users (n=109)
Gender	0.56	0.47	0.76	0.71	0.81***	0.62	0.50	0.55
Age	42.75	40.94	48.43	47.94	53.33*	50.02	49.64*	45.96
Household size	5.79*	5.21	4.65	4.26	4.61	4.44	8.16	7.61
No education	0.07	0.12	0.01	0.04				
Primary education	0.71***	0.88	0.98	0.94	0.61*	0.76	0.03*	0.12
Secondary education	0.22***	0.00			0.24*	0.39	0.97**	0.87
Land holdings	1.10	0.98	1.21	1.06	2.45	2.03	4.94	5.85
Land security	0.98	0.95	0.96	1.00	0.99	0.96	1.00	0.97

Note: ***, ** and * indicate that mean values for plant clinic users are significantly different from non-users at the 1%, 5% and 10% levels, respectively.

What characteristics distinguish clinic users from non-clinic users?

Table 2 also reports the results of the test of mean differences between clinic and non-clinic users. Results reveal statistically significant difference in level of education between the two groups across the three countries. Compared to non-clinic users, significantly more head of households of clinic users have attained at least secondary education. Furthermore, clinic users appear to be significantly wealthier than non-clinic users. For instance, clinic users have more access to electricity (in Rwanda), have better housing quality (in Rwanda and Malawi), and have higher livestock holdings (in Rwanda) than non-clinic users. Moreover, clinic users have accumulated significantly more agricultural assets than non-clinic users (Kenya). They also own and rent in significantly more land than non-clinic users. In Malawi, plant clinic users have more household members and the head of households are significantly older than non-clinic users. The Kenya AIR data also shows that a higher proportion of clinic users are members of farmer associations and other groups than non-clinic users.

Comparing the characteristics of the clinic users with non-clinic users in the PEDA datasets (Table 3), we find that there is a statistically significant difference in the education level of household head between clinic users and non-users, and this is consistent across the PEDA study countries. In particular, we find that non-clinic users are significantly more likely to have attained only primary education, while clinic users are significantly more likely to have acquired at least secondary education.

Who is likely to attend plant clinics?

The results of the probit analysis of the factors influencing plant clinic usage are displayed in Table 4. Interestingly, we find that after controlling for household demographics, wealth and access related variables, female-headed households are significantly more likely to attend plant clinics than male-headed households in Rwanda, whereas the opposite holds for the case of Kenya. Off-farm job is significantly and negatively associated with plant clinic participation in Rwanda, implying that households involved in off-farm income-generating activities are less likely to visit plant clinics. The plausible explanation is that such households have limited time to invest in attending clinic sessions. In both

Rwanda and Malawi, we find that households that own more land or are able to rent in more land have a higher probability of visiting plant clinics. Results show that households whose heads have attained at least secondary education are about 20% more likely to seek plant clinic advice in Malawi. Similarly, attainment of tertiary education by household heads is significantly and positively related to clinic participation in Kenya. Moreover, access to credit significantly increases the likelihood of participating in clinics. We also find that households located at higher altitudes are less likely to visit plant clinics, and this is likely due to access challenges. Households with large sizes and low dependency ratio are more likely to visits clinics in Malawi. Finally, according to the Kenya AIR data, households with members in farmer associations and in any other groups have a higher probability of attending plant clinic sessions.

Table 4: Determinants of plant clinic participation in Rwanda and Malawi

	Rwanda		Malawi		Kenya	
	Marginal effect	Std. error	Marginal effect	Std. error	Marginal effect	Std. error
Gender	-0.069*	0.037	-0.053	0.039	0.065***	0.018
Age	-0.001	0.001	0.002	0.002	-0.000	0.001
Household size	0.000	0.011	0.027***	0.010		
Dependency ratio	-0.032	0.022	-0.047**	0.023		
Primary education	-0.021	0.072	0.077	0.072	0.036	0.026
Secondary education	0.115	0.092	0.196**	0.077	0.035	0.027
Tertiary education					0.075**	0.034
Off-farm job/income	-0.111***	0.041	0.017	0.042	-0.002	0.002
Credit access	0.030	0.055	0.081**	0.033		
Farmer association					0.070***	0.019
Group membership					0.048***	0.016
Electricity access	0.079**	0.039				
Quality of roof material	-0.162***	0.039	0.043	0.039		
Quality of wall material	-0.086	0.071	-0.060	0.052		
Land holdings	0.195***	0.031	0.045***	0.013	0.003	0.002
Land rented	0.217**	0.085	0.205**	0.082		
Livestock holdings	-0.005	0.025	0.000	0.002	0.000	0.000
Asset index					0.001	0.004
Altitude	0.000*	0.000	0.000***	0.000		
No. of observations	629		718		2515	

Note: ***, **, * denote 1%, 5%, and 10% significance level, respectively

How do these findings relate to different farmer segmentations?

There exist a number of studies that have segmented farm households into different types. We briefly look at some of these segmentations and attempt to relate our findings to them.

The OECD distinguishes between five types of rural population (rural worlds) based on their wealth endowments, access to infrastructure and institutional services, needs, and social networks. The five rural worlds consist of: 1) Large-scale commercial agricultural households and enterprises; 2) Traditional land holders and enterprises, not internationally competitive; 3) Subsistence agricultural households and

micro-enterprises; 4) Landless rural households and micro-enterprises; and 5) Chronically poor rural households, many no longer economically active. Using attitudinal variables, TNS/Research International have segmented farmers into six major types, which reflect their propensity to adopt innovations. The six attitudinal segments include contented dependents, competent optimists, independents, frustrated escapists, traditionalists and trapped (BMGF 2011).

On the basis of smallholder participation in grain markets, Jayne et al. (2010) identified four categories of smallholder households in eastern and southern Africa. The categories include sellers of staple grains, buyers of staple grains, households that both buy and sell grain in a given year, and those that neither buy nor sell. Similarly, Ferris et al. (2014) segmented maize farmers in eastern and southern Africa into five farmer types, namely, commercially active smallholders; periodically market-linked smallholders; vulnerable, but market-viable farmers; vulnerable farmers (market challenged); and the ultra-poor. They further showed that nearly half of the farming population in their study data fall into the “vulnerable farmers (market challenged)” category. Applying principal component and cluster analysis, Staal et al. (2001) also identified four major dairy farmer groups that vary according to their level of intensification, available household resources, and access to input and output markets. They termed the groups “informal resource poor”, “intensive part-time”, “extensive landed”, and “specialist dairy farmers”. Finally, based on demand for financial services for agricultural activities, and using variables related to types of crops grown, the way that smallholders engage with markets and how markets are organized, Christen and Anderson (2013) differentiated smallholder agricultural households into non-commercial smallholders, commercial smallholders in loose value chains, and commercial smallholders in tight value chains.

In sum, the existing farmer profiling studies are based on various indicators, depending on the purpose for which the profiling was intended. Indicators that are common to most farmer profiling studies are related to wealth endowment and market orientation. Unfortunately, the data used in our analysis did not capture information on market participation or commercial orientation of households; hence, we cannot directly relate our findings to previous farmer profiles. Nonetheless, based on the characteristics of the clinic users in the sample used in this study, we can conservatively say that most of the plant clinic users fall under Rural World 2 (traditional land holders and enterprises, not internationally competitive) and Rural World 3 (subsistence agricultural households and micro-enterprises). Additionally, in terms of land size and assets, we can cautiously relate the plant clinic users to the ‘vulnerable, but market viable farmers’ in the Ferris et al. (2014) farmer typology. This farmer type is defined to own between 2 to 5 acres of land and has some primary education, and these resonate with the characteristics of the plant clinic users in our sample.

Conclusions

We have analysed the characteristics of plant clinic users and non-users using different survey data that captured information on household demographic characteristics, resource endowments and access to institutional services. Some heterogeneous results were noted across datasets, but we found that the characteristics of a typical household that visit plant clinics include middle-aged male head of household with low education attainment, small land holdings with secure tenure, low asset accumulation, limited off-farm employment opportunities, and low participation in farmer group activities. It should be stressed that the datasets used in this study were not specifically collected for profiling plant clinic users. Hence, some necessary variables for characterising agricultural households, such as access to infrastructure, proximity and integration into market, production orientation (commercial versus subsistence), income, food security, networks and traits were missing in all or most of the datasets. In addition, Plantwise is

currently active in over 30 countries, but our analysis is based on data from only six countries. Moreover, some of the datasets (e.g., Rwanda and Malawi) only captured information on farmers who brought specific crops to the clinics. Therefore, our findings cannot be generalised to all Plantwise countries or even to all plant clinic users in our study countries. This notwithstanding, we can cautiously conclude that based on the few datasets used in our study, Plantwise (in terms of plant clinics) is currently reaching smallholder resource-poor farm households with limited education attainment; but when compared with other farmers in similar environments (non-clinic users), Plantwise is mostly reaching the richer of the poor and the slightly better educated.

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