Delivering messages from plant clinic

The influence of communication on farmer's perception and uptake of advice: Nepal

Jeffery W. Bentley, Abhishek Sharma, Vinod Pandit and Solveig Danielsen

June 2017

Acknowledgements

The plant clinics in Nepal are operated by the Plant Protection Directorate. Thanks to all of the plant doctors, farmers and other people mentioned in this text who graciously spent time talking to us and showing us their work. Abdillahi Alawy and Malvika Chaudhary read and made valuable comments on a previous version.

Plantwise is supported by

Ministry of Agriculture,
People's Republic of China

Authors

Jeffery W. Bentley
Agricultural Anthropologist
Casilla 2695
Cochabamba, Bolivia
Jefferywbentley@hotmail.com

Vinod Pandit
CABI Country Coordinator for Nepal
CABI India, 2nd Floor, CG Block, NASC Complex
DP Shastri Marg
New Delhi - 110012, India
v.pandit@cabi.org

Abhishek Sharma
Kathmandu Medical College
PO Box 21266, Sinamangal
Kathmandu, Nepal

Solveig Danielsen
Plantwise Research Coordinator
Landgoed Leusderend 32
3832 RC Leusden, Netherlands
s.danielsen@cabi.org

Photos

Jeffery W. Bentley

Cover photo

Plant doctor Shiva Baral from Hemja plant clinic shows a photo on his laptop to a client.

Contents

Summary 2
1. Introduction 3
2. Plantwise in Nepal 3
3. Study design 4
4. Results and discussion 5
4.1 Plant clinic visits 6
4.1.1 Gokarna plant clinic 6
4.1.2 Hemja plant clinic 8
4.1.3 Arye Bhanjyang plant clinic 11
4.1.4 Bhalwari plant clinic 17
4.1.5 Discussion of clinic visits 21
4.2 Visits to farmers 21
4.2.1 Gokarna 23
4.2.2 Hemja 28
4.2.3 Arye Bhanjyang 31
4.2.4 Bhalwari 32
4.2.5 Discussion of farm visits 34
5. Conclusions and recommendations 36
References 38
Annex. Study tools 39

Summary

A study was carried out in Nepal in November 2016 in order to investigate the following questions: How do plant doctors and their client farmers communicate? How does this communication shape the farmers' response to the advice? The study team visited four plant clinics (Gokarna, Hemja, Arye Bhanjyang, and Bhalwari), listened to consultations at the clinic, reviewed clinic records and visited 14 farmers who had taken queries to these plant clinics to hear about their experiences following the clinic visit.

The farmers usually bring good samples of sick plants. This non-verbal communication helps to show the phytosanitary problem to plant doctors. However, the plant doctors themselves seldom send samples of unfamiliar plant health problems to the laboratory.

Some of the plant doctors have fact sheets to distribute, including some in the Plantwise format and some that are not. Part of the non-Plantwise fact sheets are printed on inexpensive paper, and come on a pad, so the plant doctor can rip off one sheet at a time. This makes the written material easier to distribute to farmers, an idea that could be copied in Nepal and elsewhere. The plant doctors have illustrated guides to insect pests and diseases, which they do consult at the clinic. Pest management decision guides were not seen at the clinics, neither was the use of the Plantwise fact sheet app.

The plant doctors recommend cultural control and pesticides more or less equal measures. They also recommend pheromone traps, which can contribute to less use of pesticides. Some plant doctors regularly recommend removing the diseased leaves from plants, leaving the healthy tissue (an uncommon cultural control). Plant doctors often give farmers several recommendations, which farmers tend to regard as a menu, choosing some and not others. Some farmers, including those who have attended farmer field schools (FFS) are interested in alternatives to chemicals.

The plant doctors were generally conscientious about telling farmers the diagnosis and the dilution rate of pesticides, writing both on the prescription form. However, dilution rates are often expressed as grams per litre, which farmers often find difficult to understand. Sometimes plant doctors also tell the farmers the background information: why the technology works. At times parts of the prescription form are written in English (especially the diagnosis and the name of the pesticide). Farmers find English words hard to understand.

Of the 14 farmers visited, nine said that they had adopted all or some of the advice. They appear to choose creatively from the options the plant doctors give them, almost always finding something they can try on their own farms. However, there were times when the farmers could use more background information or a fact sheet or a clear statement of the dilution rate of a chemical product. Three farmers rejected all of the advice, and in two cases farmers adopted unhelpful advice.

This study revealed few clear cases where technical advice was rejected only because of failed communication. However there was one failure to properly identify an emerging pest (*Tuta absoluta*, the leaf miner), and a case where lentils were mis-diagnosed as having blight. In both cases the farmers adopted the advice without solving their problem. In another case, a farmer miscalculated the dilution rate for insecticide and killed her onions. But in general, the communication between farmers and plant doctors is clear, especially in speech. The plant doctors and the farmers can all speak Nepali, even if some are bilingual in minority languages as well. The plant doctors ask the farmers questions about the crop history, which helps to make a proper diagnosis. The plant doctors engage in a friendly and respectful communication with farmers.

The local communities are satisfied with the plant clinics, as are the individual farmers. Every clinic visited enjoys the support of either an agricultural cooperative or a FFS group that provides a place to meet, and local leaders who attend. Nepal is starting to experiment with using FFS farmer graduates as plant doctors.

1. Introduction

Adoption of agricultural technology is influenced by many factors, among these the type and quality of communication between the extension agents and the farmers and how the messages are understood and perceived. Plant clinics give some of the most individualised technical recommendations of any agricultural extension method. In a plant clinic each farmer receives a message tailored to his or her problem—and gets a written prescription just for her or him. The plant doctors have to know how to diagnose the pests and diseases of their area, recommend an appropriate management strategy, and how to communicate this to a local audience of female and male smallholders.

The quality of communication between plant doctors and farmers is crucial for the delivery of a good plant clinic service. Much of Plantwise's extension training curriculum focuses on communication and human relations to enable effective transmission of sometimes complex messages. Messages about pests and diseases and specific control measures can be complex to some farmers who have minimal education. The format, language and vocabulary used by the extension agents as well as his/her attitude will inevitably affect how messages are transmitted. Therefore, the quality of these exchanges will depend on characteristics of both the extension agent the farmer as well at the message itself, whether written, visual or verbal.

CABI-Plantwise[1] commissioned a study with the purpose to assess how the delivery method and communication between plant doctors and male and female farmers affect the adoption of advice given at the plant clinics. Specifically, the objectives were to:

- describe the nature and quality of communication between plant doctors and plant clinic users of both genders, including questions such as: Are plant doctors using the right words to convey the technical message? Are plant doctors interacting appropriately and respectfully with farmers (e.g. listening enough)? Are plant doctors making good use of written materials such as fact sheets and other visual aids?

- assess how language, quality of communication and type of delivery method (verbal only vs verbal plus written) influence farmers' understanding and perception of the messages given and the adoption of advice.

The study was carried out in three countries in 2016: Malawi, Nepal and Costa Rica. This report presents the findings from Nepal.

2. Plantwise in Nepal

The plant clinics were piloted in Nepal in December 2008 (Khatiwada 2009), and began operating in 2009 with World Vision and Secard (Society for Environmental Conservation and Agricultural Research and Development Nepal). The Ministry of Agricultural Development, Plant Protection Directorate (PPD) joined the effort in 2011, when Plantwise started, and entered into agreement with CABI for structured national level programme adoption in 2013. Of the 75 districts in Nepal, plant clinics have been established in 45 districts. Some have closed because of frequent transfers

[1] Plantwise is a global programme, led by CABI, to increase food security and improve rural livelihoods by reducing crop losses.

and retirement, but plant clinics are still active in at least 35 districts[2]. The PPD is planning on providing nation-wide coverage soon in support of district level office and farmer field schools.

The plant clinics operate with PPD staff and extension workers of the Ministry of Agricultural Development, who share offices in government extension agencies at district level called as "District Agriculture Development Offices (DADOs) and "Agriculture Service Centres (ASCs)", respectively. Logistical support is provided by local organisations, including multi-functional cooperatives and farmer field school (FFS) groups. The plant clinics are aimed to improve the diagnostic and advisory capacity of the extension staff and allow them to reach more farmers. The plant doctors receive technical backstopping from CABI Plantwise. The plant doctors have received Plantwise training (modules 1 and 2). FFS graduates are now being trained and are starting to work as plant doctors, alongside extension workers and PPD staff.

3. Study design

For this qualitative study, four study areas were chosen in consultation with CABI and the PPD. The sites that were chosen to represent a geographic cross-section of the country, including three sites in the hills and one in the Terai (lowland plains). The sites also represent different cropping patterns and literacy levels.

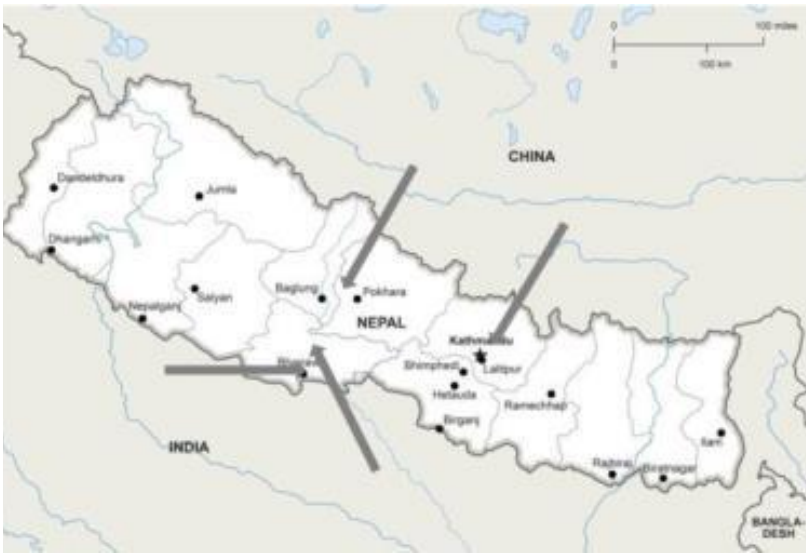


Fig. 1. Selected study sites (arrows) in Nepal

In each of the four study sites, the team visited a plant clinic in operation during regularly scheduled hours to observe the interaction between plant doctors and farmers. The clinic visits also included discussions with plant doctors, review of the plant clinic records and exit-interviews with clients immediately after being seen by the plant doctor. The plant clinics are held in association with cooperatives and/or FFS groups.

Farmers to visit were chosen from the local clinic records, in order to include both men and women, and to see a wide range of crops and problems (e.g. insect pests as well as crop disease). Table 1 summaries study areas and methods used.

The fieldwork was conducted from 7 to 16 November. The review meeting (debriefing) was held with the PPD on 17 November.

[2] Aarghakhachi, Baglung, Bara, Bhaktapur, Biratnagar, Chitwan, Dang, Dhading, Dolakha, Ilam, Jhapa, Jumla, Kailali, Kapilvastu, Kaski, Kathmandu, Kavre, Khajura, Lalitpur, Lamjung, Makwanpur, Nawalparasi, Nuwakot, Palpa, Parwat, Ramechhap, Rukum, Rupandehi, Salyan, Saptari, Sindhuli, Sindhupalanchok, Siraha, Solukhumbu, and Tanahun.

Table 1. Summary of study areas, methods and targets (F=female; M=male).

Method	Kathmandu District	Kaski District	Palpa District	Rupandehi District	Total
Plant clinic observation	Gokarna plant clinic	Hemja plant clinic	Arye Bhanjyang plant clinic	Bhalwari plant clinic	4
Visit to farmers	Gokarna: 3 F, 1 M	Hemja: 3 F, 1 M	Arye Bhanjyang: 3 F	Bhalwari: 2 F, 2 M	15: 11 F, 4 M

4. Results and discussion

The plant clinics in Nepal are starting to work with FFS graduates (farmers) who attend the clinic and help out, including holding consultations with farmers. (Some clinics have already started working with FFS grads, and others soon will). The PPD hopes that the FFS graduates will be able to take over many of the roles of plant doctors, and run plant clinics in some cases.

Each plant clinic keeps a record book with a list of the farmers who attend

All of the clinic activities are held in the Nepali language, which all of the observed plant doctors and farmers speak (although some of the farmers are bilingual in Nepali and one of the minority languages of Nepal).

Prescription books. Farmer queries are written on bilingual prescription forms printed in English and Nepali. Some of the plant doctors write the answers in Nepali only, for the farmers, who are the audience. Some plant doctors write parts of the prescription in English (especially the diagnosis and the names of chemicals). Most of the clinics visited keep their prescription books neatly organised, although at one out of the four clinics, the forms were loose, and slightly out of order.

Printed material. The plant doctors in Nepal use an illustrated manual on plant diseases, and one on insect pests; both published in the Nepali language by the PPD. The plant doctors also use a Nepali version of the Plantwise diagnostic guide. Two of the clinics have printed fact sheets for farmers (Plantwise and non-Plantwise). Locally produced Plantwise pest management decision guides were not seen at the clinics, neither was the use of the Plantwise fact sheet app.

Social media. The plant doctors are linked via Facebook, although the study team did not see the plant doctors using this social media in the field (e.g. to ask each other for help with diagnoses.

POMS data. The Plantwise Online Management System (POMS) hosts data on the queries presented by the farmers. Table 2 summarises the crop queries and their frequencies recorded from 10 plant clinics across the country over a period of a year (not all clinic data are recorded in POMS, i.e. only Hemja and Arye Bhanjyang plant clinics are represented in the table). The table shows that although there are many crops represented, farmers most often consult the plant clinic about fruits and vegetables. The farmers visited at the clinics and on their farms represented both the frequently-queried crops (such as tomato) and the less common ones, such as paddy, and even mustard. Lentil is surprisingly absent, given that it is eaten at most meals.

Table 2: Crops brought to 10 plant clinics in Nepal.

Crop	# queries
Tomato	65
Cucumber	41
Cauliflower	34
Mango	22
Cabbage	19
Pumpkin	15
Potato, citrus (lemon, mandarin, orange, pumelo)	14
Paddy (rice)	13
Chillies (and pepper)	12
Bitter gourd	10
30 other crops*	<10 each
Total	**362**

Source: Plantwise Online Management System (data from 19.10.2015 –19.10.2016). Hemja and Arye Bhanjyang plant clinics are represented in the table.

* Onion, broad bean, faba bean, pomegranate, squash, broad leaf mustard (and mustard), litchi, cowpea, sponge gourd, guava, garlic, maize, okra, bottle gourd, brinjal, pea, snap dragon, belly flower, broccoli, Buddha citta, chayote, coconut, colocasia (taro), ginger, gooseberry, marigold, mushroom, pepino melon, pineapple, radish

4.1 Plant clinic visits

4.1.1 Gokarna plant clinic

The plant doctor in Gokarna[3] is Hari Bahadur Bhandari, an entomologist who was transferred a few months earlier from the Ministry of Environment, to become the plant protection officer at the district (local) in Gokarna, in the Valley of Kathmandu.

The clinic meets in front of a small shop owned by the cooperative

The plant clinics are held once a month, usually on the seventh of the month, in association with a multi-functional cooperative (which is active not just in agriculture, but also in financial services, and medical care for its 1000 members). The clinic meets on the street in front of the cooperative's "department store" (a retail shop).

The clinic opens late in the morning, because most of the farmers are women. The late opening gives the farmers a chance to meet their other obligations, before coming to the clinic.

[3] Clinic code NPKT01

The day the team attended, the plant doctor was a bit overwhelmed with attention. Besides training a FFS graduate, Mr Bhandari was also hosting a Japanese volunteer, and three young university students who were looking over his shoulder, taking notes and snapping photos. The local member of parliament also stopped by and made a short speech.

Operating the clinic

In spite of these distractions, Mr Bhandari patiently began taking the samples. He seemed confident with the plant health problems. He communicated well, asking the farmers—almost all women—clarifying questions about their problems.

For example, Anu Pandit brought in citrus. Mr Bhandari asked her if every fruit is like that. Ms Pandit nodded yes. She called the problem "eye mascara disease." Mr Bhandari made the diagnosis based on the symptoms he observed but also based on the interview with the farmer (i.e. encouraging the farmer to communicate)[4]. Mr Bhandari asked her if there were a lot of insects, and then he explained that there was an insect which can't be seen with the naked eye. The insect produces a sweet substance, which grows a fungus which is black on the leaves (i.e. sooty mould). Mr Bhandari asked if the fruit was falling off the tree. Ms Pandit said it was. The plant doctor prescribed mixing 5 ml of oil in a litre of water. In fact, sooty mould is caused by a fungus which grows in the honey dew excreted by aphids, mealy bugs and other sucking insects. Depending on the type of oil and insect that was causing the problem, the recommendation could kill the pests, which would solve the sooty mould problem.

The group soon grew into a small crowd. Fortunately, Mr Bhandari had a colleague from the Ministry, Hari, who was writing farmers' names in a record book and helping with the patient flow. Hari explained the background information well. For example, for a problem with sooty mould in citrus, he explained how it is caused by an insect that exuded a sweet substance onto the plant, and the fungus grows in that sticky honeydew.

Mr Bhandari advised one or two farmers on how to take samples. One farmer brought in a dry tip of an orange branch as her sample, but explained that the fruit was drying. This was one of the few examples the study team observed of a poor sample brought by a farmer. Mr Bhandari patiently told her to bring in a better sample, a bigger part of a branch and some of the fruits.

Some farmers were sending in samples with their neighbours. Each sample was labelled with the farmers' name, the name of the crop and what the farmer thought the problem was.

Mr Bhandari and the FFS trainee, Mr Shrestha, worked swiftly and many of the farmers brought in two or three samples, so the clinic was busy. Sometimes both clinicians were dealing with two different problems from the same farmer at the same time. It got a little hectic, but everyone remained patient.

The clients were mostly middle aged women, at the height of their farming careers. They seemed to have a sense of ownership of the clinic: when one older woman tried to jump the queue, the other women told her to get in line. The farmers were speaking up and confidently telling the plant doctor about the problem with each plant. And they seemed happy to answer his clarifying questions.

[4] The team did not observe anyone using USB microscopes.

Anu Pandit has brought in a problem with citrus

Potato plant wrapped in newspaper. Some farmers send samples with neighbours

4.1.2 Hemja plant clinic

Hemja is a small town, a half hour's drive from Pokhara. The little valley bottoms, surrounded by forested hills, are productive farmland. The president of the local multi-functional cooperative attends the plant clinic[5], along with Plant Protection Department (PPD) staff and extension workers. They set up a small table and some plastic chairs, along with an umbrella and a banner, announcing the plant clinic.

The ministry has put up posters of beneficial insects and some showing grotesque birth defects, caused by pesticides, to discourage the abuse of agrochemicals. Farmers soon begin to approach the table, set up in front of the cooperative store. There are three plant doctors and not much space. Shiva Baral of the PPD is the lead plant doctor. All of the farmers brought samples. As with the plant clinic in Gokarna, this one does not have fact sheets.

Hemja plant clinic by the cooperative

Plant health consultations

The study team did not do exit interviews in Nepal. Instead, Abhishek Sharma was able to simultaneously translate the conversations at the clinic into English. Instead of exit interviews, the authors present a summary of the interactions at the clinics.

Tomato 1. Shelik, the cooperative leader, is also a farmer. He has brought a tomato sample of his own. The clinic is a bit chaotic. While Shiva Baral is helping this respected leader, a young man tosses a gourd leaf with aphids onto the table between the two older men, demanding a solution. Shiva tells him to see one of the other two plant doctors.

[5] Clinic code NPKK01

The diagnosis: leaf miner and leaf spores (Septoria). Shiva Baral says to apply systemic Bavistin (carbendazim) and copper oxycloride (fungicides), and spray them both again ten days later. This may control the disease as "routine applications of fungicides is essential in controlling" Septoria (Babadoost 2013). Then (for the leaf miner) apply Nico Neem (neem oil and karanj oil) 5 ml in one litre of water every 7 to 10 days, twice. These oils are not very toxic and may help to control this new pest. The Plantwise green-and-yellow list for leaf miner (from Kenya) does recommend several low toxic insecticides, as well as crop rotation and other cultural controls (Otipa et al. 2014).

Mr Baral then used an innovative communication strategy. He gave Shalik the prescription form, telling him to read it, and if Shalik has any questions to come back to the clinic. Shalik stood near the table, reading the form, until he nodded in approval and walked off.

Tomato 2. Soroj Raj Tonilsime has a tomato problem which Shiva identifies as a mix of three problems: Septoria leaf blight, early blight and powdery mildew. Shiva Baral cuts open the tomato and finds that it is full of fruit fly maggots. Fortunately, all three diseases are fungi, and can be treated with a fungicide, while the fruit flies can be managed with a pheromone trap and with Nico Neem, a natural insecticide. It is a lot of information, given fairly quickly, but as the farmer goes off he seems to be satisfied.

Cauliflower 1. Farmer Chitra Poudel brought a cauliflower sample. The plant doctor diagnoses two problems on it: micro-deficiency and black rot. Only a confident plant doctor identifies two problems at once. A novice could easily confound the two. The recommendation is 1) Use compost fertilizer. 2) Multi-plex (for the micro-nutrients) 2 ml in 1 litre of water every week. 3) Remove leaves with those symptoms. 4) Remove weeds around it. And 5) Use half g of Bavistin in 50 g of seeds. The first two recommendations should give the crop the nutrients it needs.

Recommendation #3 is a favourite of Nepali plant doctors, and it may remove some inocula from the garden, but it may also open a fresh wound. Recommendation #4 may not be of much direct benefit (and besides, Nepali farmers keep their vegetables largely free of weeds, anyway). Recommendation #5, for a seed dressing of fungicide, is intended to improve the next season's crop. Unfortunately, no background information is given to help the farmers understand why these recommendations will manage the problems, e.g. what factors aggravate the problem and how the recommended chemical and/or cultural practice(s) work to address these.

Cauliflower 2. Kalika Karki brought a cauliflower sample and Shiva Baral asked her some questions about the history of the problem, listening to the answers to get more information to help him make the diagnosis. Based on the various symptoms he diagnosed black rot, leaf miner and Septoria, and recommended alternating systemic and contact fungicides for Septoria, and using neem-based insecticides to control the leaf miner. He added the most common recommendations: removing leaves with the black markings and burying them in the ground. As mentioned above, the study team is not sure if culling leaves is the best strategy.

The plant doctor went on to say that the leaf was turning yellow due to micro-nutrient deficiencies, so Ms Karki should apply Multiplex in water to the plant. (Multiplex is the name of a company that produces micro-nutrients and other products). He also recommended compost fertilizer (which will give the plant macro and micro-nutrients). The farmer offered the information that she had used a contact pesticide, Dithane. Even though she said the plant recovered, Shiva Baral said that she needed to alternate the Dithane with a systemic fungicide. This interaction shows that this plant doctor does listen to farmers, to learn about their crop history.

Plant doctor Shiva asks Shalik (from the cooperative) if the cooperative shop keeps Bavistin, and he says yes, so Shiva writes a prescription for Bavistin. Mr. Shiva is careful to only recommend products that farmers can find on the market.

Spinach. Shiva Raj Poudel has white rust and a nutrient deficiency in his spinach. The plant doctor, careful to use his interview to get missing information, asks the farmer if he has planted spinach before; he hasn't, which tells Mr. Shiva that the inoculum has not built up in the soil. The plant doctor also asks the area planted, 100 square meters.

White rust (*Albugo occidentalis*) is an oomycete (McAvoy 2016) and the plant doctor recommends fungicides, including the dilution rate. (White rust does respond to some chemical control but the team could not verify if this was one of them).

Safer recommendations

Pesticides have improved over the past few years. They are not as toxic as they once were, and plant doctors can recommend commercially formulated botanical insecticides such as Nico Neem, as well as pheromone traps that use just four drops of Malathion to kill hundreds of fruit flies, without actually spraying the crop.

Farmers can buy the pheromone traps from agrovet shops. Besides the plant clinics, farmers can also learn about pheromone traps from government extension agents, farmer field schools and other sources.

Building credibility with pictures

Shiva Baral uses an innovative communication device. He has a PowerPoint on his laptop, with 173 slides of plant health problems found in this area. He has taken the photos from various sites on the Internet, including PPD Nepal, and the Plantwise Knowledge Bank. He has also taken some pictures himself.

Shiva Baral shows the pictures to increase credibility. When the farmers see the pictures, they realize that Shiva knows what he is talking about. It increases their confidence in his recommendation.

Plant doctor Shiva Baral uses a laptop with photos to convince farmers that the diagnosis is correct

Plant clinics and radio

As the plant clinic was being conducted, local journalist Moti Sager Adikiri sat comfortably, stopping the plant doctor for little interviews, and asking the farmers to say a few words into the recorder as they left the clinic. All this talk was less intrusive than it sounds. There was a relaxed atmosphere, and the interviews were purposely kept short.

Moti is the chargé of Radio Hemja, a four-year-old community radio station that has an approximate coverage of 300,000 listeners in six districts. They broadcast live here http://radiohemja.com/ (from 5 AM to 10 PM, Nepal time).

Every week, Moti edits the interviews from the various plant clinic stakeholders like plant doctors, extension workers, farmers and others and turn them into a 30 minute program about agriculture, which he broadcasts during prime time, from 7 to 7:30 PM on Mondays, re-broadcast the next evening. Listeners call in with questions, and although these are not recorded, they give Moti feedback. He knows that the audience likes his agricultural programme. He may get a dozen calls each time he airs it. Many of the radio programmes are on plant health.

Thus, the content for the radio is generated by the clinics. When listener feedback identifies a topic of interest, Moti organises a talk show where agronomists come in and speak with farmers and listeners who call in with questions. Thus,

Shiva Baral has been on the talk show several times to discuss plant health, on topics as demanded in the plant clinic. This shows how a clinic can link to a radio station to make the insights from the plant clinic more widely available, to a larger audience.

An upbeat, pleasant demeanour helps to get the interviews for the radio

Moti Sager Adikiri makes original content from the plant clinics, to broadcast on Radio Hemja

4.1.3 Arye Bhanjyang plant clinic

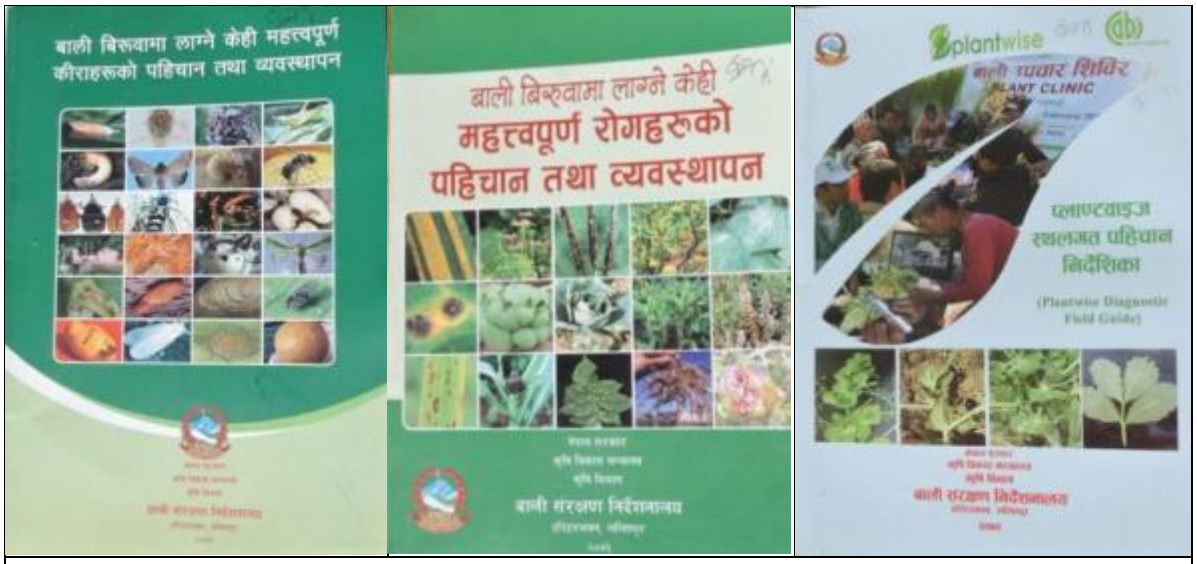
The plant clinic[6] is on the narrow highway, on the mountainside overlooking the vast Mari Valley. Agricultural land is so prized that people have carved terraces from the slopes, and the valley bottom is devoted to crops, as people build their homes on the higher land above it, saving the best land for farming.

The land is rugged and much of it is road-less. Some farmers walk for hours to get to the plant clinic. But they do come, even though this clinic only started three months earlier and has only met for three times since it started, including today. There is a nucleus of supporters, mostly women FFS graduates and the clinic is hosted by a local cooperative, as are the two clinics described above.

[6] Clinic code NPSJ01

The cooperative building is in a forest along the highway, away from the towns and villages. Farmers bring their fruits and vegetables such as tomatoes, chili, pumpkin, turnip, beans, coriander, bottle gourd, and spinach, which the cooperative sells in the nearby town of Modan Pokhra. For a year, there was a plant clinic in Modan Pokhra itself, but the plant doctor was transferred. After a gap of some months, this clinic started.

The plant doctors have some illustrated guides to pests and diseases, which they do consult during the clinic to help make diagnoses. They hand out written material (fact sheets) some of the time.



Various references materials are available at the plant clinics: Manual of insect pests (left); Crop diseases of Nepal (middle), and The Plantwise field guide (right)

The study team would have liked to interview the cooperative leaders and plant doctors to get more background, but soon the farmers started arriving, and they were all carrying samples. It was a pleasant surprise to see them at all. This clinic was actually scheduled for the following day, Sunday, 13 November, but a few days earlier the Communist Party of Nepal announced a general strike for Sunday. No cars would be allowed to travel and all business would be suspended. The date of the clinic was hastily changed to avoid the strike, and farmers were advised over the radio (and some on the telephone) that the clinic had been rescheduled for Saturday, 12 November.

Plant health consultations

Tomato. Novin Giri arrives first, just as the tables and chairs emerge from the cooperative storeroom. He shows a dried up tomato stem. The disease is well advanced, which makes it hard to diagnose, so plant doctor Santosh GC gathers more information by asking Mr Giri some questions, learning that the plant dries up from the tip, and from spots that develop. Several spots form and the branch dries up in a week. Mr Giri has tried Himil, (a fungicide: metalaxyl 8% + mancozeb 64% WP), but it didn't alleviate the problem.

Plant doctor Santosh realized that the problem was due to the tomato variety, Vincetti, which farmers like because it is high yielding, but it is not well adapted to Nepal. He diagnosed the disease as late blight and recommended several cultural controls—crop rotation (but not with brinjal or potatoes or other Solanaceaous crops). It is not clear that the farmers understand the concept of botanical families. The background information would need to be explained carefully, but there is no time for that when the plant clinic is busy.

Other recommendations include: treat the soil with a fungicide and bury the leaves. Increase the distance between the plants. Again, it would be good if they could explain the reason behind each of these recommendations. (The study team is not sure why Metalaxyl did not cure the late blight; perhaps the problem is really some other disease, or the farmer applied the fungicide incorrectly, or the disease was too far advanced when the fungicides were used. The plant doctor seems to agree that the fungicide is not effective, so he offers some alternatives.)

Novin Giri listens intently to advice about his first sample

Spinach. Juno Gaha is next, with diseased spinach. It has been a devastating problem for her. Out of 25 square meters of spinach, she only has five or six plants left. The plant is turning yellow, with some brittle, brown spots. The plant doctors want a more diagnostic symptom, so they hand her a book, the disease manual, and ask her to find a picture of the disease. That's not very helpful, so the plant doctors ask Ms Gaha what she has applied on the spinach.

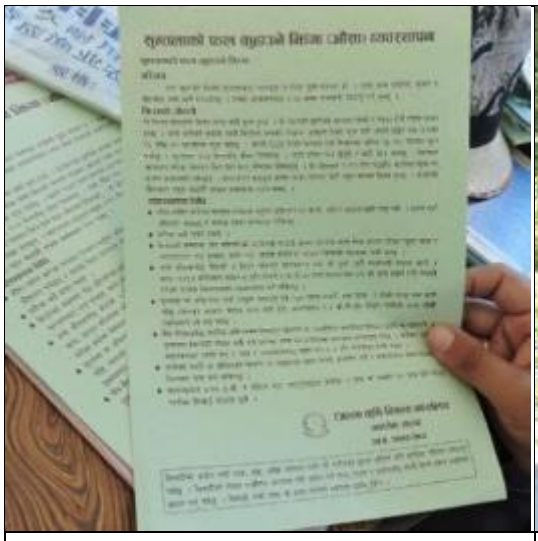
"Only organic fertilizer," she says. She has recently graduated from an FFS.

The symptoms include a dry, papery rot, which is almost certainly fungal. So the plant doctors ask the farmer if she would be willing to try a chemical. The plant doctors know that she is trying to be an organic farmer. She refuses the chemicals, because the spinach is grown in a small area and people eat the leaves. For her spinach next year, the plant doctor recommends the fungicide mancozeb and treating the soil and applying organic fertilizer, and another fungicide: Bavistin and removing the affected parts of the plants, and regular field monitoring. The plant doctor knows that she does not want to use chemicals, but still feels that fungicides are the best option for managing the problem.

Lemon. Mrs Gaha also presents a lemon branch. She says that the leaves crumple up and the fruit falls off. It might be because of one of the insects (*kira*), she adds. That is a good observation, because the problem really is due to tiny mites—almost too small to see, which cover parts of the leaf. (Strictly speaking mites are arachnids, not insects, but they are classified as insects by most folk entomologies—Bentley and Rodríguez 2001, Brown 1984).

The plant doctors ask questions to learn more, e.g. that both of Ms Gaha's lemon trees have mites, and that she has not used chemicals, and has not pruned her tree. The plant doctor writes "mites" (in English) on the prescription form.

He adds that there is also leaf miner and nutrient deficiency on the same sample, but he is reluctant to do the additional paperwork of filling out two more prescription forms. The plant doctor recommends pruning and then applying Dimethoate, an insecticide (O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] dithiophosphate).

	
A plain, printed fact sheet (not associated with Plantwise) about mites	Ms. Gaha stays and reads the mite fact sheet, even though she is in a hurry

Ms Gaha says that her fruits have decayed and fallen off. Knowing which problems are common in the area, plant doctor Santosh says it is probably because of fruit fly. He has a pad with many copies of a one-page paper about fruit flies. It is a fact sheet, but not from Plantwise. However, being cheap, it is abundant. Santosh has enough of the paper to share, and he gives a copy to Ms Gaha.

By now there are many farmers sitting nearby, listening. One comes forward to say that he also has a problem with fruit fly. Santosh tears off another copy of the fruit fly paper and gives it to him: instant communication, in writing, thanks to the magic of a 575-year-old technology, the printing press. Even though she is busy, Ms Gaha sits and reads the paper before she leaves.

Potato. Churu Bakadur Barale is next, and like the others, his farm is small, just two fields. He grows potatoes in one. Plant doctor Santosh asks Mr Barale what size his field is, but he is not sure, so Santosh asks Mr Barale how much seed potato he planted. “30 kg,” he says. That’s half a *ropani* (i.e. 250 square meters). Forming a farmer friendly question about seed to estimate the area planted reveals a certain experience and gift of communication.

Santosh goes on to ask several other questions, learning that the farmer has only applied liquid organic fertiliser (and no pesticides), and that the previous crop was maize (so the crops are being rotated), and the potatoes have not had this disease before. Listening to the farmers is important communication.

Santosh asks if Mr Barale has seen this same disease on the tomato. Another question about symptoms suggests to Santosh that the disease has spread from the tomatoes to the potatoes. Santosh diagnoses the disease as black stem rot, a fungal disease. The plant doctor recommends crop rotation, but not of crops from the same family, even though the farmer is already rotating his potatoes with maize, because Santosh suspects that the problem has spread from nearby tomatoes. The plant doctor wants to make sure that he has communicated his point that potatoes should not be rotated with tomatoes. He asks the farmer if he has understood. “Yes,” he says, without asking for a chemical recommendation.

Santosh seems unsure, so he quizzes the farmer, and is satisfied that the client really has understood, and bids him goodbye.

Litchi. V.C. Raya Majhi came with a litchi sample. The plant doctor starts with some background questions, and learns that the farm only has five litchi trees, which have not had the disease before. But the problem is spreading to the mangos, which worries the farmer. The plant doctor looks at the mites with the aid of a hand lens and recognizes the problem. “It’s on every litchi and mango in the area,” plant doctor Santosh says. The diagnosis is mites (*salsule*, in Nepali).

Red mites are so small they look more like a disease than an animal population

The plant doctor says “after harvesting, use Dico-4” (probably an acaricide, but the authors have been unable to verify). Spray it when the plant is going to bloom, before and after. The plant doctor adds background information: when the flower is blooming there will be bees and if one applies pesticide the plant will die (he probably meant that the bees would not be able to pollinate the flowers). He advised the farmer to spray once when the fruit is like a pea, and before it flowers.

The plant doctor does give background information, explaining not to spray when the tree blossoms, because the insecticide will kill the bees, which pollinate the plant. He says to prune the plant and destroy the residues and asks if the farmer has understood.

Papaya. Then it is the turn of Dil Bahander Gaha, the leader of the cooperative. He has a strange disease on papaya, with large, sticky, black lumps.

The plant doctors are not sure what the problem is. Novin Giri, the first farmer who attended, has been watching and listening. He says that he has had this same problem. He splashed cow urine onto it, and the problem went away. Mr Giri attributes the disease to *akha lagne* (literally “the eye went there”), a common folk disease known as “evil eye” or “eye disease” (Weller and Baer 2001). This belief spans the old world from East Asia to Spain (and from there to Latin America). It is a belief that disease can be caused by an admiring or jealous eye. A supernatural disease would logically be cured with the urine of the revered cow.

The plant doctor Santosh is culturally sensitive enough to respect this idea, especially because Mr Giri says that the urine cured his papaya. Santosh recommends a bactericide and a fungicide, because he is not sure if the disease is caused by a fungus or a bacterium.

An unknown papaya disease

He also suggests trying a dose of cow urine. However, as in the previous case with spinach, the plant doctor does not take a sample to send to the lab. Asking for help to diagnose unknown diseases would give the plant doctor’s more accurate information to communicate.

Orange. A farmer brings a sample of an orange branch. Santosh looks at the leaf, which is turning a pale yellow in the leaf tissue between the veins, and gathers that the problem is micro-nutrient deficiency, which he writes (in English) on the prescription form. To confirm his suspicion, Santosh asks the farmer what he has applied. “Only composted cow dung,” he says.

That casts doubt on the diagnosis, because composted cow dung is rich in micro-nutrients. But Santosh learns that the problem is not in every plant, so he goes on using his good interviewing skills to learn more from the farmer. Santosh asks if the soil is poor, or full of stones. He thinks that poor, rocky soil makes it difficult for the trees to absorb enough micro-nutrients. The plant doctor recommends a blend of urea, DAP, potash, apply zinc sulphate, copper sulphate and magnesium sulphate and agricultural lime (he gives the dilution rates for mixing these with water). That is a broad range of micro-nutrients that should address most deficiencies.

Citrus. Basanta Bahadur Kunwash has a problem with insects in citrus. He has brought a sample of fruit. The plant doctors slice it open to reveal some healthy fruit fly larvae. The recommendation: bury fallen fruits 60 cm deep, or put them in a drum with pesticides. The plant doctor adds crucial background information, that the pupa lives in the soil, so the farmer should treat the soil as well. The farmer is also advised to use (pheromone) traps.

Banana. The next sample is banana, and the farmer has brought in a whole, small plant. The plant doctors soon cut it open to reveal a weevil grub tunnelling inside. The plant doctor tells the farmer to remove leaves that touch the soil, and to apply a systemic pesticide around the plant in the soil. Cleanliness around the plant is the main thing, but the farmer should also manually kill insects, and avoid keeping three or four plants in the same place. The plant doctor's recommendations seem sound, although he could have also recommended weevil traps.

The farmer asks if he should plant the suckers with tapering leaves, or broad leaves. The plant doctors have obviously earned his respect for their general knowledge of local agriculture. Keep the suckers with tapering leaves, they say.

Tricky tomato. After waiting patiently for two hours, Novin Giri, the first farmer, is able to show his second sample. It is a mysterious disease that no one recognises. The farmer has thoughtfully brought many tomato fruits, ranging from the ones just turning colour to the desiccated tomatoes that look like prunes. The farmer is clearly keen to communicate by bringing in illustrative samples. In spite of these excellent samples, showing the whole progression of the disease, the plant doctors cannot diagnosis it.

Mr Majhi watches the plant doctor cut open a banana plant with weevils inside

They think it is a fungus and they recommend a fungicide. Mr Giri has already tried the Nepali version of one fungicide, so the plant doctors suggest the Indian version. Unfortunately, the plant doctors do not collect samples to send to the lab.

Last-minute consultation. Just as we finish, a man comes in with a sample of ginger. He has walked from two hours away, just to see the plant doctors. They are obviously surprised to see him. Announcing the plant clinics on the radio does draw farmers in, and the clinic is something that the farmers really want.

4.1.4 Bhalwari plant clinic

The plant clinic[7] is held in the shade of a *chautari*, a tree planted to provide a public space, with a platform around the trunk of the tree. A large banner is hung reading “crop treatment camp” (*bali upachar siwir*).

This plant clinic is organised around a cluster of five FFSs, which have been trained in training-of-trainers (ToT) and are now about to start training farmers in their own field schools. (This clinic is not supported by a cooperative).

This plant clinic has been running on a specific day of the month in the Nepali calendar, but they postponed the clinic for two weeks in order to coincide with the visit of the study team. The plant doctor, Ram Bahadur Khatri, was afraid that only four farmers would come—because it is the height of the rice harvest season, but a sizeable group did come, including several students from the on-the-job training (like interns from a university program).

The people have gathered as if they are in a formal meeting. There is a clinic table and a second table for registration. The FFS graduates are formally organised with positions of leadership such as a president, treasurer and a junior technical assistant who sits at the second table near the plant doctor and registers the clients. She gives each one a coupon with their name, the crop and their village. This clerical help speeds up the work, improves the client flow and lets the plant doctor fill in the forms a little faster. The plant doctor is respectful and asks farmers questions to learn more about their problems.

Writing a coupon with the farmers’ name, address, and crop at the reception table

The written coupon saves the plant doctors time

Plant health consultations

Lemon and more. The first farmer, Poshkanta Boshyal, has a lemon sample. While explaining that it is a leaf miner, Ram Bahadur Khatri, gives him a clue to help him diagnose it himself in the future: the leaf-miners look like writing on the leaf (that is effective communication about diagnosis). The farmer has three problems, which the plant doctor deals with rapidly, recommending several chemical and biological insecticides for the leaf miner and mite. This may

[7] Clinic code NPRD01

seem like overkill, but it also gives the farmer a menu to choose from. The recommended micro-nutrients and composed manure are good advice for micro-nutrient deficiencies; they are also a menu of options. One is synthetic, from the store and the other is organic, from the farm. Composted manure contains all the nutrients a plant needs, but in lower amounts than a packaged formulation.

Crop	Lemon	A large, sour citrus	Bitter gourd
Diagnosis	Leaf miner	Mites	Micro-nutrient deficiency
Recommendation	Spray a mix of neem paste and cow urine in water. Prune the plant properly. Irrigate. Apply fertilizer properly. Apply Altineem, or Emectin Benzoate	Same as for the lemon. Also spray a mix of urine, ash and neem. Remove the affected plant parts	Composted manure in large amounts. Apply micro-nutrients

Mango. Telchana Pun brings mango and it has a common problem: it bears no fruit. It is a general symptom and scrutinizing the leaf is unlikely to shed any light on it, so Ram asks her some questions to learn more, e.g. that the plant is not shaded by other trees. That it was not fertilised, and that it bore little fruit the previous year as well. It is also an insect, Ms. Pun adds. Recommendation: control the micro-nutrient deficiency and the insects.

Litchi and bean. Shamshur Singh Rana is the leader of the FFS group that hosts the clinic. He has brought a litchi sample. The tree has mites, a common problem in South Asia. Mr. Rana also has beans with a severe case of rust. Ram looks it up in his manual to double check it and recommends sulphur and crop rotation. (He doesn't, however, explain how crop rotation will manage the disease).

An alarming case of bean rust …

… which the plant doctor is able to reconfirm in the manual of crop diseases

Long bean. Bal Krishna Tiwari has aphids in his long beans, but he doesn't want to spray pesticides. He has made a pesticide himself out of cow urine, but is not satisfied with the results. Ram respects Bel's goal of avoiding pesticide, so the plant doctor recommends neem, or a homemade pesticide made from kerosene and a little detergent.

At that point the farmer mentions other insects on the plant as well. By their description, Ram diagnosis them as mites or scale insects. Ram suggests treating the plant (with natural pesticides, as mentioned earlier), but earlier in the season.

The farmer says that he has tried spraying vitamins and plant doctor Ram explains that vitamins won't solve this problem. That's an important part of the plant clinic advice—telling people when to stop using inappropriate products.

No sample. Another farmer comes without a sample and describes a problem in mango and pomegranate. Ram recognises it as fruit fly and recommends a pheromone trap, and Malathion. The love trap is a rather complex idea to try to get across in a plant clinic. Ram does an excellent job of explaining what to do.

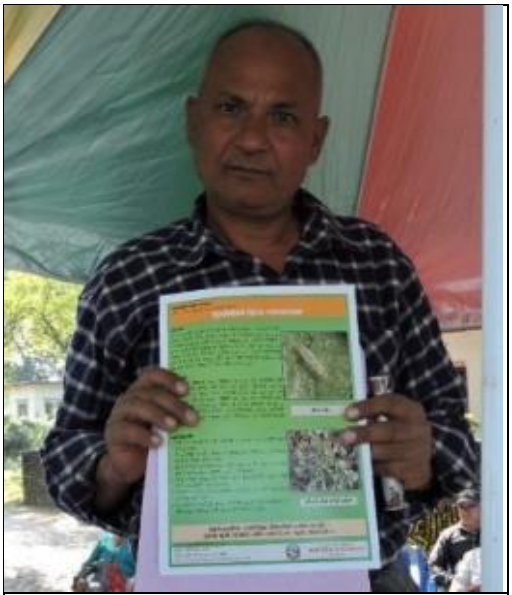
Chili. Ishwor KC's chillies are dying. The plant doctors are good at asking questions to find out the crop history. They learn that Mr Ishwor has already used two insecticides and that he has applied zinc (a micro-nutrient).

Ram diagnoses the problem as a mosaic virus, transmitted by Thrips (a small Homoptera). The plant doctors recommend two insecticides for the Thrips and a solution of cow's milk—an ancient local remedy for plant virus (Kumar et al. 2005). High concentrations of milk have been found to be more effective against powdery mildew than conventional fungicides (Bettiol 1999), but the use of milk to treat plant viruses is a topic for future research. The plant doctors suggest that vitamins will increase the plant's immunity and they also recommend crop rotation.

Fact sheets

Ram gives Mr. Ishwor a Plantwise fact sheet on Thrips, the first one the study team has seen in Nepal. The sheet is organized in three parts: 1) diagnosis, 2) background information and 3) management. The fact sheet was indeed made in collaboration with Plantwise in 2013, although it includes no logo for Plantwise or CABI.

The fact sheet is published by the Plant Protection Directorate in Kathmandu. The plant doctors at the other sites said that they have not seen fact sheets. Here in Rupandehi there is also a fact sheet on bacterial wilt.



Mr Ishwor takes away a Plantwise fact sheet on Thrips

Of 362 queries (data shared with the study team), farmers received fact sheets for 71 (20%), according to the records. That may reflect some over-reporting, especially since none of the farmers visited recalled receiving fact sheets. It is possible that some of the plant doctors ticked the box "fact sheet given" by mistake. The data show that farmers supposedly received fact sheets after consulting the plant clinic with a wide range of crops: guava, beans, tomato, chayote, colocasia, broad bean, paddy, onion, orange, cauliflower, bitter gourd, okra, cucumber, pomegranate, cowpea, brinjal, mango, pumpkin, chillies, pepino melon, pea, radish, sponge gourd, and broad leaf mustard. Fact sheets have not been made for all these crops.

Stimulating discussion with farmers

There is always room to innovate with communication at the plant clinic. Recall that the people had gathered as at a formal meeting, but there was so much space between the platform and the audience that the people couldn't hear much of the results. (Folks had spent much of the time quietly chatting among themselves).

At the end of the clinic session, in his loud, friendly voice, Ram Ram Bahadur Khatri, stood up and summarized the problems and the solutions that he had reviewed that day at the clinic. The farmers gave him their full attention and added a few comments. One asked how much detergent to use in a homemade pesticide.

Another farmer mentioned a pesticide he had used, Cobra (a herbicide), which didn't work. This type of event is important, allowing farmers to communicate with others about potential problems with pesticides. It is crucial for them to share information about insecticides that may not be appropriate. Farmers in India, for example are easily confused by insecticides with the same active ingredient are sold under different brand names, or when cotton seed of the same variety is marketed under different brand names (Stone 2010).

The talk by the plant doctor encourages the farmers to share other problems. One says that he has low soil fertility. He went to the shop and was sold a product called Umet. Ram tells him that Umet is an insecticide, which does nothing for soil fertility; instead, the farmer should try composted manure. Advice like that can help many farmers.

The plant doctor gives a summary at the end to all the farmers who have waited

4.1.5 Discussion of clinic visits

The plant doctors in Nepal generally tell farmers the dilutions rates for chemicals, but express them in unreasonably small amounts (grams in a litre of water). It is more realistic to give farmers a volume measure, rather than a mass measure, because farmers do not have scales to weigh out grams of chemical. For example, Mr Giri, a thoughtful farmer in Arye Bhanjyang asked “how much is two grams, and can I measure it in spoonful,” suggesting that even the best farmers may not be able to calculate how much pesticide to use in a sprayer. It might be best to say how many spoonfuls to put into a backpack sprayer, and not how many grams to add to a litre.

The plant doctors are apparently not submitting samples to the lab, not even for perplexing problems. None of the plant doctors observed collected a sample to refer to the laboratory. Of 362 queries from ten clinics (from data given to the study team), the plant doctors only forwarded four samples (1%) to a reference laboratory.

In general, the plant doctors know the local problems, and farmers respect the plant doctors’ knowledge, so the clinics are in high demand. The plant doctors speak respectfully with people and ask if people understand the explanation. Sometimes the plant doctors add background information into their explanations.

The plant doctors don’t like filling in all the prescription forms, or entering the data, but they do it. They may however only fill in one form and simply not report the other problems if a sample has more than one problem. The prescription is sometimes filled out partly in English, which the farmers can’t read.

It would be useful to have a fact sheet on crop rotation, explaining the notions of botanical families and soil-borne inoculum, and print a suitable number of copies. Then plant doctors could hand one to a client every time the plant doctor recommends crop rotation, which is often.

The background information for some advice (e.g. pheromone trap), may be more complex than the plant doctor can give in a moment or two. To use a pheromone trap, farmers need to know why the flies are attracted to the trap (because it has a sexual attractant) and why killing the males solves the problem (because flies breed, just like birds, and the females cannot lay eggs unless they first mate with a male), and why they should put up the trap at flowering time (because the female flies lay their eggs on the emerging fruit). If farmers don’t understand the scientific reasons behind a technology, it may not be properly adapted. Yet there may not be enough time at a plant clinic to explain an intricate technique, so fact sheets or supplementary training may be important.

4.2 Visits to farmers

The visits to farmers in their homes, gardens and fields showed that in 11 of 14 cases (1-4, 7-10, 12-14), farmers used at least some of the advice on farm (Table 3). This is quite a high rate of acceptance (79%). However, in at least 21% of the cases (2, 7, 11) farmers adopted some of the recommendations and not others. Some of the farmers also reported adopting advice which did not solve their problem (cases 4, 12, 13, 14). This study revealed no cases where farmers rejected or botched a recommendation because of poor communication.

Table 3: Farmers visited. Queries taken to clinic, diagnoses, recommendations, & farmers' responses

Farmer, place	Crop, diagnosis, date of clinic visit	Recommendation	Farmer's response	Analysis
1. Female Gokarna, Kathmandu	Sponge gourd, Fruit maggots 22 Sep 2016	Spray Malathion. Use pheromone traps	Sprayed Malathion, which she already had. Did not use traps	It was too late in the season to use the traps
2. Female Gokarna, Kathmandu	Tomato, Leaf eaten by insect (& disease as well, pos. late blight) 6 June 2016	Change variety, use fertilizer, test soil pH, keep field clean, use pesticides only as needed. A 2nd Rx was prob. for fungicide, roguing & crop rotation	Applied insecticide & fungicide. Did not rotate crops or test for pH, but as tomato plants died she replaced them with cauliflower & spinach	She adapted the Rx, but may not have understood that the disease-causing fungus was soil-borne
3. Male Gokarna, Kathmandu	Cucumber, Fruit fly September, 2015	Pheromone traps when the plants are flowering	Bought a trap, tried it. Then made more traps for a larger area. Left the traps up for longer	Applied Rx creatively. Is in close contact with the plant doctors & the cooperative
4. Female Gokarna, Kathmandu	Tomato, No diagnosis 22 Sep 2016	Cleanliness, change variety. Apply Krilaxyl Gold, Agromin	She applied the fungicides; the crop died	Plant doctors did not recognize this invasive pest
5. Female Hemja, Kaski	Rice, Foot rot & stem borer 16 June 2016	Foot rot: dip root in Bavistin while transplanting. Stem borer: apply Furadan in sand or ash in whorl	Barely recalled the Rx. Did not apply	The farmer did not think the damage was important
6. Male Hemja, Kaski	Pumpkin, Fruit fly 16 May 2016	Bury the fruit. Make malathion-fruit traps. Wrap setting fruit in newspaper. Pheromone traps	He did not remember the Rx or act on it	He eats the leaves & not the fruit, so he was uninterested in controlling the fruit fly
7. Female Hemja, Kaski	Tomato, Powdery mildew 19 July 2016	Crop rotation. Clean host plant. Apply a mix of sulfur & lime every 10 days for 3 times. Copper sulfite every 10 days	She thought sulfur would damage the tunnel [a] plastic, so did not spray. Used another pesticide which did not work. Uprooted tomato & planted cilantro	The only part of the Rx she used was crop rotation, but she did that because of the season of the year, not to manage disease
8. Female Hemja, Kaski	Cucumber, Fruit fly 6 May 2016	Bury damaged fruit. Use pheromone traps. Cleanliness	She used the traps until hail ruined the crop	Learned about pheromone traps in a previous FFS
9. Female Arye Bhanjyang, Palpa	Tomato, Late blight September 2016	Remove affected parts. Mancozeb with Metalaxyl, once every 10 days. Next year treat soil with solarization	She took the Rx form to the shop. Applied fungicide & fertilizer she made from buffalo urine & plants	The liquid fertilizer is the creative use of information from FFS

Farmer, place	Crop, diagnosis, date of clinic visit	Recommendation	Farmer's response	Analysis
10. Female Arye Bhanjyang, Palpa	Tomato, Pith rot September 2016	Cleanliness. Copper oxychloride. Treat soil next year with solarization	Also took the Rx to the shop, applied the fungicide & liquid fertilizer	Same as above
11. Female Arye Bhanjyang, Palpa	Chili, Root rot September 2016	Crop rotation. Copper oxychloride. Treat soil next year with Bavistin	She avoided fungicide, but used liquid fertilizer. The crop did well	She planned to eat the fruit herself, & did not want pesticides. FFS grad
12. Male Bhalwari, Rupandehi	Mustard, Aphids February 2016	Ash, spray soap water. Dimethoate when the problem is bad	He applied the insecticide but it was not effective because of fog	He preferred chemicals to soapy water
13. Male Bhalwari, Rupandehi	Lentils, Blight February 2016	Mancozeb every 7 days, 3 times	Applied, & the plants grew, but never formed pods	Misdiagnosis. Probably wrong variety for the area
14. Female Bhalwari, Rupandehi	Onions, Thrips February 2016	Field monitoring. Cow urine in water & imichloropid	She bought the chemical & applied it, but the onions died	Applied insecticide at 25 times the proper rate, i.e. trouble calculating the dilution rate

*Like a greenhouse, a structure with a plastic roof, but the walls are usually left open

4.2.1 Gokarna

Farm visit 1. Decaying sponge gourd

Farmer visited: Ratna Maya Strestha (woman)

Date visited the clinic: 22 Sep 2016

Place: Gokarna

Crop: Sponge gourd (ghirola)

Problem: insects are seen on the gourd and it is deformed

Diagnosis: disease which decays, i.e. phal (fruit), kuhaune (decaying), osa (a local term for a kind of an insect, a fly larva)

Recommendation: Pheromone trap with Malathion and Cuelure*, 4 to 5 per ropani (508.74 square meters). Cuelure 2-3 drops (pheromone that attracts) and 2 ml of Malathion in 1 litre of water. Spray on the crop. (The trap has Malathion and pheromone on cotton on a wire).

*Cuelure is the commercial name of an insect bait, p-acetoxyphenylbutanone-2, a sexual pheromone

Ratna lives directly across the road from the cooperative store, the site of the plant clinic. She is a native speaker of Newari, a Tibeto-Burman language which was the original tongue of the Kathmandu Valley (Whelpton 2005), but Ratna is bilingual in Nepali as well.

She had a problem with sponge gourd (*ghirola*). Her gourd patch is miniscule, perhaps six plants growing over a short trellis in a garden with ginger, sweet potato, various gourds, and other vegetables. The prescription form mentions insects and rot, and indeed the sponge gourds still have tiny maggots squirming just under the skin of the fruit, which is turning a deep black.

Ratna (left) cleaning wheat next to her gourd patch

Ratna was advised to use a pheromone trap and Malathion (insecticide). She did have some Malathion at home, so she applied it twice to the gourd and then ran out. She says that the pesticide killed the insects, but the next day they came back. She must have meant the adult fly, because she is a careful observer, and she noted that the insect had a red tip, a mouth. The insect made a hole in the fruit and liquid oozes out. And then the fruits start decaying. Once the insect had been there, she knew that the fruit would decay.

Ratna reasoned, probably correctly, that it was too late in the season for the pheromone traps to work. She did not want to use the traps because the gourd season was already ending. She added that she should have gone to the clinic sooner.

Farm visit 2. Insects in tomato

Farmer: Bhumi Raj Bhandari (man)

Date visited clinic: 6 June 2016

Village: Uttar Bahini

Crop: Tomato

Diagnosis: Leaf eaten by insect

Recommendation: 1. Change variety, 2. Use fertilizer, 3. Soil treatment (take soil for pH testing), 4. Keep the field clean, 5. Don't use too much pesticides (he has used them before), 6. Only use pesticides when needed.

The study team called on Bhumi, but he was away, explained his wife, Gita. She said that he had gone to the plant clinic to find help with a tomato disease. However, the prescription form mentioned only insects, so perhaps there was a second form for the disease.

Gita explained that the plant doctor told Bhumi that the disease was caused by a virus, and he brought home "the medicine" and applied it, but she doesn't know what the product was. The plants improved for a while and then they died.

She said that the plant doctor recommended digging up the plants by the roots, putting medicine in the soil, changing to a different crop and testing the pH. She is interested in testing the pH after the season ends, i.e. taking the soil to the plant doctor to test. She applied the medicine every 15 days to the tomatoes and when they started to die, in October, she stopped. Gita added that her husband got a paper at the clinic and although she didn't read it, he told her about it. Gita said that she had a medicine for the insects and one for the disease, which she applied separately.

The plant doctors do seem to have given the family a recommendation for a disease and for an insect pest as well. Gita showed her visitors a small Lepidoptera larva (possibly the newly invasive *Tuta absoluta*), and said it had only been a pest for the past two years.

Invasive Lepidoptera, the leaf-miner, *Tuta absoluta*

The disease looked like late blight, and Gita recognizes that the insect and the disease are two completely separate problems, but the tomatoes do have both problems at once, and they are killing the plants.

Gita said that the clinic advised the household to rotate their crops. She did not seem to understand that this was because the disease-causing agent lives in the soil. She knew that the plant doctors said that the soil quality might be bad, which is why she should test it. Gita has grown tomatoes for several years in a row in a "tunnel" (as people call these open-sided structures, with plastic ceilings). No doubt the soil has accumulated some *Phytophthora*.

Gita seems to have understood the recommendation, as communicated by her husband. (As this study has shown elsewhere, sometimes farmers share the results from the plant clinic with their household members, and sometimes they do not). The clinic advised the family to rogue their diseased plants. Yet Gita was unwilling to sacrifice them; they were still bearing some fruit. She did not understand the reason why the recommendation would work (the background information): that the disease-causing agents were living in the soil

So she adapted the advice: as the tomatoes died, Gita replaced them with cauliflower and spinach plants. But she left the dead tomato plants up in the tunnel, providing a source of disease for other plants, although Gita was not aware of that.

Gita had used an insecticide and a fungicide which her husband, Bhumi, bought. She knew that he had a prescription form from the clinic. Bhumi obviously gave Gita much information about the disease, or she wouldn't have remembered it.

She wanted to test the pH of her soil (per the recommendation) and she was changing tomatoes, albeit gradually, to another crop. So Gita was creatively adapting the recommendation, even if she had not taken out all of the tomatoes immediately. It is hard for farmers to destroy any of their harvest.

The tunnels have only become popular in Nepal over the past few years. They are a capital investment, but it seems to be money well spent on a small farm. The tunnels make the land more valuable, and so encourage farmers to plant over and over in the same soil. This changes the environment in many ways, and no doubt encourages soil-borne disease.

Besides the tunnels, Gita has other innovations as well, such as applying micro-doses of urea and DAP (chemical fertilizer) to her spinach. (Click here to watch a video on micro dosing: www.accessagriculture.org/micro-dosing). This case shows that an innovative, commercial family farm takes the plant clinic seriously enough to share the advice with household members, and to use the ideas creatively.

Farm visit 3. Love traps for cucumber worms

Farmer's name: Rajendra Shrestha
Date of visit to plant clinic: September 2015
Crop: Cucumber
Diagnosis: Cucumber fruit fly
Recommendations: Pheromone traps

In 2015 Rajendra Shrestha had taken cucumbers to the clinic, because they had a small worm. He just had a few plants. He learned about bait-and-kill traps which attract male fruit flies with a pheromone bait and then kill them with a few drops of Malathion placed on a cotton ball inside the trap. Extension workers have taught Nepali farmers to call these devices "love traps," a graphic term that helps people to remember that the male insects get lured into the trap by the para pheromone which is mimicked as an attractant. Once inside the trap, the insects are killed by Malathion. Rajendra also sprays Malathion on the cucumbers, to kill any moths there.

Pheromone traps from the store …

… and a homemade trap, which works well, and is cheaper

In Rajendra's case the communication had been excellent. He knew that Malathion is only a contact insecticide and would not kill the larvae inside the damaged fruit, which is why it is important to use pheromone traps, to kill the male insects before they can mate with the insects.

The plant doctors told Rajendra to apply the pheromone trap when the cucumbers were flowering and when the baby cucumber fruit was forming, because that is when the insect (*kira*) will come and lay its eggs. They told him that the adult female would lay its eggs inside the fruit and that those would hatch into worms. In other words, the plant doctors gave Rajendra accurate background information, which seemed to help him to adapt the information creatively and profitably. He understood that the pheromone trap is a bait that attracts the males only, and that they are killed by the Malathion drops on the cotton.

Rajendra realized that the male flies are attracted to the pheromone, and that if the males are all dead then the females will not be able to mate and lay eggs. That is a lot of information for a

smallholder to take on board. Smallholders are not always aware that insects have sex (Bentley and Rodríguez 2001). A previous study in Nepal found that farmers did not have a clear concept of insect metamorphosis (Gurung 2003).

After experimenting with the pheromone traps in 2015 on a few cucumber plants, Rajendra tried it on a commercial level. He planted cucumber in almost 500 square meters of tunnel. He recalled that he had been advised to put up four traps per 500 square meters at flowering time. He did that, using one trap he bought and others he made himself. He observed that more fruit flies continued to die in the traps, although he noticed that the pheromone gradually faded away.

Rajendra harvested 500 kilos from his plot and was pleased with it. He had no damaged fruits at all, until towards the end of the season, when he had a few. He says he was advised to destroy the damaged fruits (one of the most common plant doctor recommendations, but one which farmers don't like). Instead of burying or burning the wormy fruit, Rajendra will sort through it, eat some of the good parts and feed some to his cows. Smallholders are loath to burn or bury damaged fruit, because even a worm-eaten cucumber can be salvaged (to say nothing of the work of collecting firewood and cremating cucumbers).

Farm visit 4. Stubborn tomato problems

Farmer's name: Sabita Thapa Pandit

Date she visited the plant clinic: 22 September 2016

Crop: Tomato

Diagnosis: (blank)

Recommendations: 1) Cleanliness, 2) Use a different tomato variety, 3) Treat the nursery, 4) Krilaxyl Gold* 1.5 g in 1 litre of water every 15 days, 5) Agromin 2.5 g in 1 litre of water every 15 days

*Krilaxyl Gold is a commercial name for Metalaxyl 8% WP + Mancozeb 64% WP

Sabita Thapa Pandit had gone to the plant clinic on 22 September 2016, because insects (probably *Tuta*) were eating her tomato leaves. She had been applying cocktails of insecticides and fungicides to the tomatoes in her tunnel. (She also had a problem with a disease, but this was not mentioned on her prescription form, and she only showed the team one form).

The clinic could not diagnose Sabita's problem, but the plant doctors advised her to spray two fungicides. Plantwise prescription forms only deal with one problem each, so it is not clear from the prescription form if the plant doctors diagnosed the disease or not, but they definitely did not recognize the leaf mining insect. She bought the fungicides, using the prescription to demand the product at the shop, just like patients do with medical prescriptions; these written prescription forms can successfully communicate with dealers, as well as with farmers. Sabita had used the whole package of fungicide and then disposed of the wrappers (so she could not show it to the study team).

The plant doctors gave Sabita little background information. They just said, "apply the medicine and it will be OK." But it wasn't OK; the plants died. Sabita uprooted the crop, bought fresh seedlings and replanted, but those plants dried up as well.

As Sabita explained her experience, she was clear that she had two problems: the disease and insects. At this point in the discussion, Hari Karki (the plant doctor) suddenly rose to his feet and told about how in 2015 people were coming to their plant doctors with this odd, new insect, a leaf-

miner in tomato. PPD sent the samples to the NARC (National Agricultural Research Centre), but it took six months to get the insect identified. In the meantime, plant doctors were not sure what to recommend to farmers. (This probably explains why the diagnosis was blank on Sabita's prescription form).

A review of the POMS data given to the study team, of 65 cases of tomato, none are diagnosed with Tuta or leaf miner, although there was one for fruit borer, three for melon fruit fly, three for "sucking pests." If the plant doctors had been more familiar with this pest, they may have diagnosed it more frequently.

The tomatoes also had insect pests, besides the disease

During the visit, *Tuta* and late blight were both clearly visible in the tomatoes. Sabita understood that the two problems were separate, and that the recommendation from the plant clinic (fungicides) did help to manage the disease, if not the insect. In this case, the farmer applied the recommendation, but the problem had not been properly diagnosed, and the advice was not a total success. The crops consulted during this follow up visit, e.g. tomatoes, and cucumbers, are among the species most frequently consulted by farmers at the plant clinics (see Table 2).

4.2.2 Hemja

In June, 2016, the plant doctors had conducted a mobile plant clinic in Hemja, and most of the people the team selected to visit turned out to have been visited by the mobile clinic. Like the farmers who were visited by a mobile plant clinic in Malawi, these Nepali farmers remembered less about the plant clinics than those farmers who attended a regularly scheduled clinic. "Demand-driven" may sound like a tired bit of jargon, but a farmer who takes the time to take a sample to a clinic and express demand for plant health information is more motivated to remember the advice than a farmer who is surprised in her garden by a cluster of plant doctors.

Farm visit 5. Rice on its own

Farmer: Santi Thapa

Date visited by the mobile clinic: 16 June 2016

Crop: Paddy (rice)

Diagnosis: Foot rot

Recommendation: for foot rot, Bavistin 2 g per litre of water and dip root for 10 minutes while transplanting.

Recommendation: for stem borer, use Furadan 300 g per ropani mixed with sand or ash, applied in whorl 15 days after transplanting.

When the study team met Santi at her home, it took her a while to realise what her visitors meant by “plant clinic”, but she eventually recognized Shiva Baral, and recalled the time he came and visited her in her rice field. She did not at first recall the diagnosis or the recommendation.

Santi Thapa was not too concerned about the rice pests

Finding remains of stem borer in the rice stubble

Santi did not try any of the ideas from the recommendation because she didn’t think the problems were very important. For example, she misremembered the advice about treating the seedlings with Bavistin, and thought she had been told to treat the seed (not the seedlings) with another fungicide, Dithane.

She said that only a few plants had been attacked by pests and diseases, although when the team went to her field Shiva Baral, the plant doctor, was quickly able to find evidence of both foot rot and stem-borer. The farmer did recognise the problems, e.g. she could describe the stem-borer and where it lives. She just hadn’t take the problem very seriously.

The rice field had already been harvested and ploughed by a tractor. Shiva pulled up a few bits of rice stubble from the soil and found both problems.

Farm visit 6. As long as the leaves are healthy

Farmer’s name: Rajendra Karki

Date visited by mobile plant clinic: 16 May 2016

Crop: Pumpkin

Diagnosis: Fruit fly

Recommendation: 1) decayed fruit buried in pit 1 to 2 feet deep, 2) Take a mature pumpkin and mix it with Malathion and place it around the crop, hanging it in different places, 3) Wrap the setting fruit in newspaper, 4) Use Cuelure pheromone trap, 5) In the winter time dig the field deeply (proper field preparation)

The mobile clinic visited Rajendra in his field, where the plant doctors identified fruit fly in pumpkin. Rajendra didn't remember the diagnosis or the recommendation at all. He talked about a recommendation for powdery mildew which he must have received from some other source, not from the plant clinic.

Even when reminded, he could not remember the recommendation. He had little interest in the fruit fly, because he does not grow the pumpkins to eat the fruit, but to make a sauce from the leaves. He cares little if the fruits have maggots or not: he is only interested in the leaves. Rajendra is a progressive farmer, open to change. He was an early adopter of tunnels for vegetables, and has had one since about 2004, and now has several.

Farm visit 7. Tomato

Farmer's name: Bhagwati Poudel

Date visited by mobile plant clinic: 19 July 2016

Crop: Tomato

Diagnosis: Powdery mildew

Recommendation: 1) Crop rotation, 2) Clean the host plant, 3) Sulphur 1 g lime 2 g. Mix it up and apply it in 1 l water every 10 days for three times, 4) Copper sulphite 80% 3 g in 1 l water every 10 days

Bhagwati is a young farmer who is serious about her vegetables. She is also an FFS graduate who received a training-of-trainers course. So she is qualified as an FFS IPM (integrated pest management) farmer trainer. Bhagwati grows tomatoes and other vegetables in plastic tunnels behind her house. When the mobile clinic came to see her, they found disease.

She doesn't remember all of the recommendation, but she does recall being told to apply sulphur for the powdery mildew. She was afraid that the tunnel plastic would be damaged by the sulphur, so she didn't spray it. Instead, she sprayed a Chinese pesticide, which she thinks was called Kin Sin Yem. It did not work and she uprooted the plants.

She says she was also advised to cut off the lower leaves so they are not in touch with the soil, which is a source of disease, however, that recommendation is not in the written record. It may be that the plant doctors told her this, but did not write it down (or that she learned the advice somewhere else). She remembers that she was told to clean the knife blade with kerosene to avoid spreading the disease. She says that she did this.

Bhagwati Poudel is a progressive, IPM farmer, but remembered little of the recommendation

She also removed her tomato plants at harvest, and then planted coriander—so she did rotate her crop, as recommended. After harvesting the coriander she will plant something else, not coriander or tomato. The team asked her why she would do that.

“Because every crop has its own season”, she said. She did not mention crop rotation as a way of managing the disease. She said that the disease was in the air.

The farmers chosen to be visited were considered to be commercial, progressive farmers, and were chosen by local leaders. Few of them were very interested in the diagnoses. Farmers may ignore advice that they do not ask for.

Farm visit 8. Cucumber

Farmer’s name: Debu Triphati

Date visited by the mobile plant clinic: 6 May 2016

Crop: Cucumber

Diagnosis: Fruit fly

Recommendation: 1) Bury decaying cucumbers 2 feet deep, 2) Use Cuelure pheromone trap with four drops of Malathion and 1 drop of pheromone. 4 traps per *ropani,* 3) Cleanliness

Debu is a middle aged farmer who also took an FFS. The clinic visited her at home and inspected her cucumber field next door. She didn’t remember the diagnosis or the problem very well, but she did describe pheromone traps, which she had already learned about in the FFS, and she did use the traps in her cucumber. The cucumbers were doing beautifully when a hail storm wiped them out.

Debu Triphati learned about pheromone traps in a FFS

There is an advantage of training, as in an FFS, to generate a core group of farmers that knows how to use a new technology, like the love traps (as pheromone traps are called in Nepal). It is easier for plant doctor Shiva Baral to recommend the traps in the clinic, if farmers already know how to use them. He also goes aground to agrovet shops to see if they carry the pheromone and if they don’t, he encourages them to do so.

4.2.3 Arye Bhanjyang

Farm visits 9, 10 and 11. Tomato and chilli

Farmer’s name: Junu Gaha

Date of visit to plant clinic: August 2016

Crop: Tomato

Diagnosis: Late blight

Recommendations: Remove affected parts. Next year treat the soil with solarisation, Mancozeb with Metalexil, once every ten days. 2 g in 1 litre, drenching

Farmer's name: Siri Sara Bhogale

Date of visit to plant clinic: August 2016

Crop: Tomato

Diagnosis: Pith rot

Recommendations: 1. Cleanliness around the area. 2. Treat soil next year with solarisation. 3. Copper oxychloride 2 g in 1 litre water every ten days

Farmer's name: Dhana Maya Bhogale

Date of visit to plant clinic: August 2016

Crop: Chilli

Diagnosis: Root rot (fungus)

Recommendations: Proper management of the field. Treat the soil next year with Bavistin 2 g in 1 litre water. Crop rotation. Copper oxychloride 2 g in 1 litre water. Spray it on the leaves and branches

The three female farmers, Siri Sara Bhogale, Dhana Maya Bhogale and Junu Gaha, were quite similar. They had brought tomatoes (one brought chilli as well). They all had diseases on their crop. They were all given a recommendation to use fungicides and cultural controls as well. The fungicides are what they recall the best, although one or two refused to use the pesticides (because of what they learned at an FFS).

Siri Sara kept the prescription, and recalled the recommendation

They do use the prescription form to buy the pesticide at the shop, when they buy it. They all grow vegetables, especially tomatoes, in tunnels. Because tomatoes are so intensive, people are motivated to keep the crop up as long as possible. Sara Siri had an innovation where she replaced each tomato plant with beans as the tomato plants died (which we have seen above in Gokarna, with Gita).

All the farmers recall the botanical insecticide they learned in field school and are open to applying that instead of what they learned in the clinic. The FFS left a lasting impression on these farmers.

4.2.4 Bhalwari

Farm visit 12. Mustard

Farmer's name: Shamsher Singh Rana

Date of visit to plant clinic: February 2016

Crop: Mustard

Diagnosis: Aphid

Recommendations: Ash, spray soap water. demethoate 30% when the problem is bad 1.5 ml in 1 litre Boram Kaphle water

Shamsher Singh Rana is the leader of the FFS group He went to the clinic in February 2016 with aphids in mustard. He says that the clinic actually gave him pesticides, which killed his aphids, but the mustard didn't do well, because of the foggy weather. Mr. Rana rotates mustard with rice.

Farm visit 13. Teacher not at home

Farmer's name: Boram Kaphle

Date of visit to plant clinic: February 2016

Crop: Lentils

Diagnosis: Blight

Recommendations: Indophil 45 (= Mancozeb) 2 g in one litre of water every 7 days, 3 times.

Lila Kaphle was not at home. She was at school, teaching, but the team met her mother, father, brother and sister. They had a strange case where they had received lentil seed from the extension workers and planted it. Until then, they had not been able to find seed, so they were delighted to get 10 kg of it. They planted it on six *kattha* (each kattha is 338.63 m² so six kattha is about 2000 square meters). At first, the family was pleased. When the plants came up, they were thicker, and more vigorous than local varieties. The plants flowered well, but never formed pods. All the neighbours had received the seed and had the same problem. Lila took the legumes to the plant clinic and the plant doctor diagnosed the problem as blight, and prescribed fungicide. This may have been a misdiagnosis, since the plants were healthy, except for their lack of fruit, explains Boram, who is Lila's father.

Boram Kaphle points out where they planted the doomed lentils

The extension workers gave the household mancozeb fungicide, which the family sprayed to no effect. The villagers and the plant doctors eventually concluded that the crop variety had been poorly suited to the area.

Even a year later, the problem was still fresh in everyone's memory. All of the family members talked about it loudly, and with the concern and disappointment still in their voices, to have planted so much and harvested nothing.

By the end of the season the plant doctors (or the extension workers) communicated well enough, to finally arrive at a credible diagnosis, and this was some small consolation to the Kaphle family. Farmers, like everyone else, do want to know what went wrong with their projects. This case shows that follow up visits can be important in order to achieve satisfying communication.

Farm visit 14. Over-treated onion

Farmer's name: Laxshmi Gyeveli

Date of visit to plant clinic: February 2016

Crop: Onion

Diagnosis: Thrips

Recommendations: Apply cow urine in water at a ratio of1-to-5 once a week. Spray imichloropid 7.8% EC 1 ml in 5 litres water

Laxshmi Gyeveli took onions to the plant clinic, where they were diagnosed with Thrips. She had noticed white spots on the leaves when the onions were small. The plant doctors prescribed regular field monitoring and using pesticides and cow urine. She bought the pesticides at the shop, using the prescription as an aide de memoire. Pesticides often make the most lasting memory of all the recommendations.

Farmers seem to have a hard time understanding the dilution rates. She says all her onions died. When asked how much pesticide she applied she said a capful in 2 litres of water, about 10 g of chemical in two litres of water instead of 1 g in 5 litres, i.e. 25 times more concentrated than it should have been. The overly concentrated pesticide may have poisoned the crop.

Laxshmi found the dilution rate hard to understand

The plant doctors need to ask how much water the farmer will use and tell them how many grams to use, explaining to them how to measure that amount.

None of the three farmers from Bhalwari got a fact sheet. Mr. Rana said that the plant doctors have only recently begun to distribute them at the clinics. The team did see a pamphlet published by the PPD in 2016 on *Tuta absoluta* (not in the Plantwise style).

4.2.5 Discussion of farm visits

Farmers may judge that it is too late in the season to adopt a recommendation (case 1) or they may modify a recommendation to avoid uprooting valuable tomato plants (case 2). Farmers may understand, but ignore recommendations from mobile plant clinics, which offer unsolicited advice. A plant clinic where the farmers choose to come and seek help for problems is demand driven. If a mobile clinic chooses the farmers and the problems, the farmers may be less interested, and less motivated to remember the advice.

Sometimes the plant doctors give wrong advice, which farmers follow to no avail (e.g. cases 4 and 13). There was only one case (14) where a farmer misunderstood the advice, and applied a pesticide at an incorrect dilution rate.

Table 4 shows that farmers accepted advice to spray pesticides (e.g. insecticides and fungicides) in eight cases, and rejected such recommendations five times (an acceptance of 62%). Farmers are less likely to accept advice for cultural or biological control (or for pheromone traps). Such advice was accepted on three occasions and rejected on 6 (accepted 33% of the time) (see Table 4). Acceptance rates were depressed by the visits from mobile plant clinics, where farmers generally rejected the advice.

Table 4. Farmers' technical responses by type of technology [a]

Farmer response	Cultural and biological controls and pheromone traps	Chemical controls
Used the advice	Crop rotation (case 7) Pheromone trap (cases 3, 8)	Insecticide (cases 1, 12, 14) Fungicide (cases 4, 9, 10, 13) Insecticide & fungicide (case 2)
Rejected the advice	Pheromone trap (cases 1, 6) Crop rotation (case 2—partially adopted) Test soil for pH (case 2) Bury diseased pumpkin fruit and wrap growing fruit in newspaper (case 6) Bury damaged fruit (case 8) Field monitoring (case 14)	Insecticide & fungicide (case 5) Chemicals (case 7) Fungicide (case 11) Ash and soapy water (case 12) Biological insecticide i.e. cow urine (case 14)

[a] The case numbers refer to Table 3

A second analysis (Table 5) compares the adoption of recommendations by type of plant health problem (e.g. disease or arthropod pest—including insects and mites). Farmers tended to adopt some of the advice, especially for arthropod pests. (The more advice farmers are given, the less likely they are to use all of the recommendations). Using just some of the advice is not a problem, as long as the farmer is satisfied with the results. There were two cases of mis-diagnosis, in which farmers followed the advice, but it did not solve their problems.

Table 5. Farmer's technical responses by type of problem [a]

Farmer response [b]	Disease (fungi, virus, bacteria)	Arthropod (insects, mites …)	Disease and arthropod (mixed diagnosis)
Used all or most of advice (3)	Cases 9, 10	Case 3	
Used some of advice (6)	Cases 7, 8	Cases 1, 11, 12, 14	Case 2
Used none of advice (3)	Case 11	Case 6	Case 5
Unhelpful advice [c] (2)	Case 13	Case 4	

[a] The case numbers refer to Table 3

[b] The numbers in brackets are the total number of cases

[c] Unhelpful recommendation: problem was mis-diagnosed and farmer followed advice to no avail

5. Conclusions and recommendations

Listening with respect. The plant doctors are respectful and attentive with their clients and good listeners. They ask questions of the farmers, to help make a proper diagnosis. Questions such as: "What did you plant before this crop?" "Are the mango trees near the litchi trees?" and "What have you applied to try to manage this pest?" help the plant doctors to understand how the crop and its problems are being managed.

Language. The plant doctors and their clients communicate in plain Nepali. The personal, one-on-one communication is clear and open. Over 120 languages are spoken in Nepal, and some of the community members who visit the plant clinics are native speakers of minority languages. However, the farmers are also bilingual in Nepali, and can communicate well with their plant doctors. There were only a few cases where farmers rejected advice because of poor understanding. Product names may be written in English (because shop keepers can read them), but should be written in Nepali script as well, so the farmers know what the products are called).

The dilution rate is often expressed in grams per one litre of water. However, farmers do not have chemists' scales to measure one gram of powder. Dilution rates should be expressed in volumes that are easy to understand (e.g. a spoonful, a matchbox) and the water should be given in larger amounts, such as 10 or 20 litres.

Samples. Almost all farmers bring samples, possibly reflecting good communication from the plant doctors. Or farmers may simply realize intuitively that samples will help to communicate their problem to the plant doctor. Of data from 10 clinics available to the study team, farmers brought samples for 354 queries (98%). However, the plant doctors themselves send few samples on to laboratories, to identify unfamiliar problems. Sometimes plant doctors simply discard samples of strange problems brought in by the farmers. The plant doctors may feel frustrated with the slow pace of results; e.g. it took months to get an identification of *Tuta absoluta*, the leaf miner. The plant doctors should be encouraged to refer samples to laboratories, and the labs should to be made aware of the importance of returning timely responses to the plant clinics.

The prescription form. Normally the plant doctors in Nepal are in the good habit of writing down the problem (diagnosis) and the recommendation. Sometimes the diagnosis and part of the recommendation are written in English (which few farmers can read) (see above on language). The plant doctors' verbal recommendations are (naturally) longer and more complete than the written ones, but the prescription form is an aide de memoire that reminds one what to use, how much, when and how. Some of the prescription forms are written clearly, in neat, legible handwriting while others could be improved. Even though the plant doctors are under time pressure to advice clients and write a prescription, it should be written in neat handwriting so that people can read it.

Fact sheets. The programme published Plantwise-style fact sheets in 2013. Many of the plant doctors seem unaware of these documents and do not use them. Others do. The PPD has also published various other short papers on plant health problems (e.g. fruit flies, and the tomato leaf-miner). These have been printed on pads of inexpensive paper, making them affordable to distribute to farmers. Pest management decision guide were not observed at the clinic, neither was the Plantwise fact sheet app seen in use.

Books. The PPD has published an illustrated manual on plant diseases, and another on insect pests; both are written in the Nepali language. The Plantwise diagnostic guide has also been translated into Nepali. The plant doctors use this reference material at the clinic.

Farmer satisfaction. The farmers appear generally satisfied with the recommendations. The plant doctors to get the diagnosis right most of the time, and are confident giving recommendations. The farmers usually remember the diagnosis and the recommendation, and are commonly able to use at least some of it. However, attention should be paid to giving sufficient background information.

Promotion or awareness-raising of the clinics is mostly by word of mouth, less often by mass media. The plant clinics are called “crop treatment camp” (*bali ubachar siwir*). All of the clinics have a banner which the public can see it. Such promotion seems effective, but more could be done to make a mass audience aware of the clinics. Radio could be a promising way of reaching a wider audience. There is one account in this report of a community radio station in Hemja that uses the plant clinic to develop talk shows and stories. This example could be followed by other plant clinics. Many rural radio stations are hungry for content, and plant clinics could interact with them, giving them information worth broadcasting, and getting free publicity in return.

References

Babadoost, Mohammad 2013 “Early Blight, Septoria Leaf Spot, and Anthracnose of Tomato” Report on Plant Disease No. 908. Department of Crop Sciences, University of Illinois at Urbana-Champaign. http://extension.cropsciences.illinois.edu/fruitveg/pdfs/908.pdf

Bellos, David 2011 Is *That a Fish in Your Ear? Translation and the Meaning of Everything.* New York: Faber and Faber. 373 pp.

Bettiol, Wagner 1999 "Effectiveness of Cow's Milk against Zucchini Squash Powdery Mildew (*Sphaerotheca fuliginea*) in Greenhouse Conditions." *Crop Protection* 18(8):489-492.

Bentley, Jeff 2016 “The Whispered Translation.” Agro-Insight blog. http://www.agroinsight.com/blog/?p=1147

Bentley, Jeffery W. & Eric Boa 2013 “The Snowman Outline: Fact Sheets by Extensionists for Farmers.” *Development in Practice* 23(3):440-448.

Bentley, Jeffery W. & Gonzalo Rodríguez 2001 “Honduran Folk Entomology.” *Current Anthropology* 42(2):285-301.

Brown, Cecil H. 1984 *Language and Living Things: Uniformities in Folk Classification and Naming*. New Brunswick, New Jersey: Rutgers University Press.

Gurung, Astrid Björnsen 2003 “Insects—a Mistake in God’s Creation? Tharu Farmers’ Perceptions and Knowledge of Insects: A Case Study of Gobardiha Village Development Committee, Dang-Deukhuri, Nepal.” *Agriculture and Human Values* 20(4):337-370.

Khatiwada, Bed P. 2009 “Being Part of a Worldwide Network.” *ILEIA Magazine* 25(3):18-19.

Kumar, Arun, R. Raj Bansali and B. L. Gajja 2005 “Validating People’s Knowledge: The Role of Formal Sciences.” *Honey Bee* 16(4):4-5.

McAvoy, Gene 2016 “Beware the Warning Signs tor White Rust of Spinach.” *Growing Produce* http://www.growingproduce.com/crop-protection/disease-control/beware-the-warning-signs-for-white-rust-of-spinach/

Otipa, Miriam, Paul Kiige, Eunice Ringera, Philip Wendot and Benson Masinde, Peninah Munyao, Judith Oyoo, and Wilson Nabakwe 2014 *Tuta absoluta* (tomato leaf miner) on Tomato. Pest Management Decision Guide: Green and Yellow List. Plantwise. http://www.plantwise.org/FullTextPDF/2015/20157800311.pdf

Stone, Glenn Davis 2010 Field versus Farm in Warangal: *Bt* Cotton, Higher Yields, and Larger Questions. *World Development.*

Weller, Susan C., and Roberta D. Baer. "Intra-and Intercultural Variation in the Definition of Five Illnesses: AIDS, Diabetes, the Common Cold, Empacho, and Mal de Ojo." *Cross-Cultural Research* 35(2): 201-226.

Whelpton, John 2005 *A History of Nepal.* Cambridge: Cambridge University Press. 296 pp.

Annex. Study tools

1. Attending a plant clinic

Planning the visit

Attend a regularly scheduled plant clinic. Before organising the study tour, tell you hosts (e.g. the country coordinator or whoever is helping plan your itinerary) that you want to see a clinic that is functioning at its regularly scheduled time, day and venue. The idea is to see farmers and plant doctors behaving unselfconsciously. They may change their behaviour if they organise a plant clinic just for a visitor.

Make sure that the plant doctors understand that you want to see the farmers who attend the clinic because they have plant health problems and that the plant doctors should make little or no effort to invite farmers to attend just because you will be monitoring the clinic

At the clinic

Arrive on time, preferably when the plant doctors arrive, before the clinic starts. Chat with them and show interest in their work. Try to establish some rapport before the farmers arrive.

If you speak the local language, sit near the plant doctors and listen to the consultations. You may take notes and photos. You may ask short questions if you feel that you really need to, but such clarification is best left till the end. Try to remain unobtrusive and just let the plant doctors get on with their work.

If the plant doctors ask you a question (e.g. about help with a diagnosis), reply honestly, but try not to become a plant doctor. (The local plant doctors are usually more familiar with the local problems than the visitors are).

Translation

If you need translation, bear in mind that different translators have different skills. Some people who are perfectly bilingual may still have trouble interpreting. Some interpreters may need to listen to the conversation and then translate or summarize it during a pause. Others can do a simultaneous, whispered translation (Bentley 2016, Bellos 2011). This will enable you to follow the conversation in real time, but not everyone can do simultaneous translation.

Being a good observer

Pay attention to the problems farmers bring. Notice their body language. Do the farmers seem comfortable? Are the plant doctors addressing them respectfully?

Most important is to notice if the plant doctors are asking the farmers clarifying questions (e.g. to find out about the crop history—and to help in making a diagnosis). See also if the plant doctor gives a diagnosis and useful background information or if they only give recommendations. But be realistic; recall that the plant doctors have a limited time to serve the people who are waiting. Do the farmers seem to understand what is being said?

Observe if the farmers receive a written prescription or a fact sheet or other papers. Pay attention to the farmers, to see if they read it.

Notice other behaviours. E.g. if the plant doctors use photos or other visual aids to communicate. Do the farmers bring good samples?

You may choose, from time to time, to ask someone to hand a sample to you for closer inspection, if you feel that you have not seen it properly and that a close look would help you to understand the case better. Watch and listen and form an opinion about the quality of the communication at the clinic. Are the plant doctors communicating the right information and getting their point across?

2. Farm visits

Selecting farmers

Ask the plant doctors to see the clinic register. Select farmers from the register. You may have criteria, e.g. you may be interested in a certain place, or people who have brought in certain crops. It is best not to ask the plant doctors to select the farmers to visit, as the plant doctors may select people who are not representative. They may choose farmers who live nearby, or who are friendly and articulate, or people who come to the clinic often.

Choosing people from the register is one way to ensure that you speak with female farmers, and that you get a range of plant health problems (not only tomato, for instance). You can also select farmers who visited a year or two previously, who have had time to use the recommendation in their work.

Of the farmers from the log that you are going to visit, note the diagnosis and recommendations that each one was given. Compare this to the answers that farmers give in the field.

Pragmatics often limits how many farmers you can visit and where. For example, in this study there was not enough time to visit more than 10 farmers. The regions were chosen in consultation with local staff, with three or four farmers to interview in each region. In future studies, with more time, researchers can make more of an effort to interview a more or less random sample of farmers from all areas where clinics operate.

Meeting the farmers

Explain to the farmers who you are, your names, and that you work with the plant clinics and that you want to visit some of the farmers who attended the clinic.

Main questions asked on farm visits

These questions in this semi-structured interview are intended to build a narrative as to what happened: the farmer had a plant health problem, sought help from the clinic, received advice and then responded to this advice (e.g. used it I some way). The researchers can ask other questions as well, to clarify answers, to bring farmers back to the point, or to delve deeper into interesting areas. Try to get an idea of what the farmers learned at the clinic, how much they remember, and how this perception influenced the decision the farmer took to protect her crop.

1. What problem did you have?
2. What was the advice?
3. What did you do?
4. What were the results, what happened to your crop after you tried the advice?
5. Did you receive written material from the clinic? If so, what did you do with it?

Writing and checking notes

Take notes of what you see and hear in the field, writing down what people say in a way that preserves their original statement. For example, if a farmer says “We put up 4 pheromone traps per *ropani*,” write that down. You will have time later to figure out how many square meters make up a Ropani. Do not try to convert the numbers in your head.

The field notes are written in the style of “I am a camera”. That is, the field notes simply record events, with little or no analysis. That evening, type up your field notes. It is a lot of work, but it makes the notes searchable, legible and easy to adapt passages from them for your report.

The morning after conducting fieldwork, write a narrative of your observations from the previous day. This narrative can begin to interpret and analyse the events and statements from the field. As you write the narrative, you may realise that you have missing information. Later, you can ask your colleagues who worked with you that day if they can supply the missing information. They may well have understood something that you missed, especially if they speak the local language and you don’t. For example, they may have understood if the farmer said that the diseased crop remains were a source of inoculum (even if you don’t have it in your notes).

Photography for documenting information

Take photos of pesticide labels, forms, posters, signs and other written material you see, especially of documents that you cannot take with you. You can refer back to the photos later for chemical composition, names of organisations and other information.

Even photos of people and gardens may later help you to recall planting density, disease symptoms and other information.

The digital camera generates a serial number for each picture. Label all of your photos that evening after fieldwork, i.e. give the photo a meaningful name. For example, change “DSCN3497” to “symptoms of late blight in tomato” or “Lakshmi visits the plant clinic”. This way your photos are searchable and you will always be able to find them.

3. Follow up interview

The follow up interview is a classic ethnographic method. The researcher goes back for a second interview sometime after the first one. After thinking about the first interview, you may have better questions, or need some clarification. Rapport generated on the first visit may help to increase the interviewee’s trust for the second meeting.

A variation on this method is the phone interview. It is a good idea to collect the cell phone numbers from the farmers, plant doctors and other people you meet. Afterwards, if you think of another question to ask, you can ring up the person with a specific question. They may be pleased to hear from you again.

contact CABI

europe

CABI Head Office
Nosworthy Way, Wallingford, Oxfordshire, OX10 8DE, UK
T: +44 (0)1491 832111

CABI
Bakeham Lane, Egham, Surrey, TW20 9TY, UK
T: +44 (0)1491 829080

CABI
Rue des Grillons 1, CH-2800 Delémont, SWITZERLAND
T: +41 (0)32 4214870

asia

CABI
C/o Internal Post Box 56, Chinese Academy of Agricultural Sciences,
12 Zhongguancun Nandajie, Beijing 100081, CHINA
T: +86 (0)10 82105692

CABI
2nd Floor, CG Block, NASC Complex, DP Shastri Marg, Opp. Todapur Village,
PUSA, New Delhi – 110012, INDIA
T: +91 (0)11 25841906

CABI
PO Box 210, 43400 UPM Serdang, Selangor, MALAYSIA
T: +60 (0)3 89432921

CABI
Opposite 1-A, Data Gunj Baksh Road, Satellite Town, PO Box 8, Rawalpindi-PAKISTAN
T: +92 (0)51 9290132

africa

CABI
CSIR Campus, No. 6 Agostino Neto Road, Airport Residential Area, PO Box CT 8630, Cantonments Accra, GHANA
T: +233 (0)302 797202

CABI
Canary Bird, 673 Limuru Road, Muthaiga, PO Box 633-00621, Nairobi, KENYA
T: +254 (0)20 227 1000/20

americas

CABI
UNESP- Fazenda Experimental Lageado, Rua: José Barbosa de Barros, 1780
Botucatu – SP, CEP: 18610-307, BRAZIL
T: (14) 3882 - 6300 / 3811 - 7127

CABI
Gordon Street, Curepe, TRINIDAD AND TOBAGO
T: +1 868 6457628

CABI
875 Massachusetts Avenue, 7th Floor, Cambridge, MA 02139, USA
T: +1 617 3954051