Developing a training system for Plant Health Clinics in the Pacific region by and for regional trainers

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Abstract. This article describes the development of a training manual for plant health doctors to operate plant health clinics in four countries in the Pacific region by regional trainers for their national trainers. It briefly reviews the advantages of a plant health clinic approach to agricultural extension services for farmers, and the need to provide extensive training for the clinics to be effective. The manual incorporates learning approaches based on the understanding and development of pedagogical content knowledge designed to engage trainees in high level cognitive learning. The paper also outlines key aspects of the manual.

Key words: extension, plant health clinics, training manual development

Introduction

Globally there is now high awareness of the many challenges that confront the agriculture sector, including crop losses due to increases and spread of pests and diseases, loss of arable land through impacts of climate change, population growth, depletion of soil fertility, pesticide and herbicide overuse and resistance, and access to global markets (Swanson 2008).

The Australian Centre for International Agricultural Research (ACIAR) which represents a significant part of the agricultural component of the Australian aid program, has been active in the Asia-Pacific region since 1982. It aims both to assist Pacific island countries to strengthen their ability to compete in global markets, and to improve the outlook in countries of the region, where subsistence farming remains the major source of food security (ACIAR 2019). ACIAR projects aim to develop sustainable plant health systems that align with the UN Sustainable Development Goals. They also reflect concerns over the high regional use of pesticides that constitutes a major threat to human, animal health and ecosystem health. To this end, the projects promote Integrated Pest and Disease Management (IPDM) approaches to reduce pesticide use and increase biodiversity on farms (Furlong 2016; Furlong et al. 2019). Here, we report on elements of the project 'Responding to emerging pest and diseases threats to horticulture in the Pacific Islands' (HORT/2016/185), which focuses on the development of plant health clinics in the Pacific countries of Fiji, Samoa, Solomon Islands and Tonga.

The changing nature of agriculture extension and advisory services

Effective agriculture extension and advisory services (EAS) have long been regarded as the key to empowering farmers to move to more sustainable and productive plant health systems and for poverty reduction for small-scale farmers worldwide (Swanson 2008). Over the last decades, EAS have seen an evolution from the top-down model of the expert visiting farmers and offering advice, to situating farmers at the centre of the system (Anderson et al. 2006; Swanson 2008; FAO 2019). Here, farmers are seen not as passive recipients of expertise, but rather as human resources and experts, central to the agricultural enterprise, and who are best placed to determine its effectiveness (Feder et al. 2001). The main models of farmer-centred EAS are farmer field schools (FAO 2019) and more recently, plant health clinics (Boa et al. 2016).

Plant health clinics

Plant health clinics (PHCs) represent a farmer-centred program designed to share information particularly around the use of IPDM approaches, as well as attempting to address the difficulties of farmer-to-farmer transmission. Plant health clinics are held at locations where farmers work or sell their produce, so they can bring samples of pest and disease problems affecting their plants to the venue. Trained staff, called 'plant health doctors', usually from Extension or Research services, provide one-on-one consultations where plant health problems are diagnosed, and farmers are provided with short and long-term management advice in the form of a prescription.

Plant health clinics in the Pacific islands

Several plant health clinics have been run in the Pacific region in Fiji, Samoa and Solomon Islands since 2012, and have experienced varying levels of effectiveness and stakeholder engagement. In 2013, an evaluation of pilot PHCs in Solomon Islands, the first country in the region to hold PHCs, was undertaken (see Furlong et al. 2019). This identified areas that needed improvement,

including clinic ownership, frequency of clinics, appropriate venues and expanding management beyond cultural controls and importantly, that more training should be held on specific pests and diseases.

Continued monitoring of PHCs held in Solomon Islands has provided further guidance for the development of training (Alabae 2017). Successes included a high level of farmer enthusiasm because the clinics were held where farmers gathered regularly; good access to resource materials such as fact sheets and information posters; and good communication between farmers and extension staff. Areas that required further improvement included awareness, a more efficient registration process and the need for a standard, easy to use prescription form. The advice provided by the doctors was not always clear to farmers, and farmers did not always bring whole samples of pests and diseases. Lack of confidence and experience in identification and diagnosis of plant pests and diseases are considered critical barriers to a successful PHC program.

Another glaring gap in the first Pacific PHCs was the lack of follow-up and debriefing on the effectiveness of the clinic. Notes and data were not always kept, and doctors did not always discuss and reflect on the experience, share their learning, or follow up with farmers about how they had accepted and used diagnoses and management advice. Early clinic experiences in Fiji echoed the lessons from Solomon Islands (M Mua 2020 pers. comm., 27 May).

Plate 1. One of the first plant health clinics held in Fiji

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Based on these learnings as well as a reading of the literature on the success of PHCs in other parts of the world (e.g. Boa 2016), the project HORT/2016/185 was designed to include the development of a regional plant health system-based PHC program. The initial aim was to increase the number and improve the PHCs already in place in Solomons Islands, Fiji and Samoa, and to establish a PHC program in Tonga.

The importance of effective training

Successes in empowering farmers through EAS remain patchy and continue to experience shortcomings. Srivastava (2013) suggested that reasons include the often-weak knowledge base of extension officers, effectiveness of communication of technical messages to famers, knowledge of how the messages are acted on, and the failure of national organisations to oversee, monitor and evaluate the activity. During clinics, plant health doctors may be afraid to admit to farmers that they are not able to diagnose a problem, which may in turn lead to incorrect advice or no advice being given.

It became clear that a rigorous plant health doctor training program was an essential element in the success of PHCs. The level of expertise required to become an effective plant health doctor cannot be overstated. It includes knowledge and skills to diagnose and manage plant health problems, understanding the complexity of a plant health system as an agro-ecological system and the many requirements for plant health. Doctors must also be well-versed in effective means of training and communication, monitoring and evaluation of programs and especially, developing good relationships with farmers.

Development of the plant health clinic program in the Pacific region

To progress the development of PHCs, a Project Advisory Group (PAG) was formed that included heads and senior personal of Research and Extension services from the four participating Pacific countries to promote a regional cooperative approach. Other PAG members included ACIAR plant pathology, entomology and education consultants.

The PAG members began by considering the overarching question: "how can we design effective plant health clinics in the Pacific region as part of an integrated plant health system?" Then followed an intensive three-day discussion addressing all aspects considered necessary for the program's success.

A training manual was identified as key, but drawing on previous experience in the region of manuals being little used, the regional trainers decided they should design and develop the manual themselves. By doing so, they considered this would ensure the development of a strong sense of ownership, where trainers would be motivated to use the manual in their national training. The sense of ownership would be bolstered by including names of the authors of each chapter of the manual as well as those who had tested it and had provided a review.

Development of the content sequence

The PAG spent time considering the structure, sequence and technical information to be included in the manual. Six chapters were proposed and sequenced as follows:

Chapter 1: Introduction to plant health clinics - background, need for PHCs, effective communication and pedagogy;
Chapter 2: Identification and diagnosis of plant pest and diseases;
Chapter 3: How to deal with unknowns including use of digital platforms such the Pacific Pest Pathogens & Weeds app (Lucid Central 2020), PestNet, CommCare app (Digimagi 2020), WhatsApp;
Chapter 4: Management Options 1: Cultural control (i.e. use of IPDM methods);
Chapter 5: Management Options 2: Using pesticides (considered necessary as most farmers continue to rely on them);
Chapter 6: Running a plant health clinic (setting up, running, data collection and post-clinic review and reflection – simulation and actual clinics).

A 7th chapter on monitoring and evaluation was also proposed but later omitted to allow the trainers to gain further experience in the field before deciding on how to proceed with this aspect.

Structure of the manual chapters

Next, the regional trainers selected a chapter and over two days, worked in small groups to draft the content. Crucially, they worked in inter-country groups which further strengthened the regional aspect of the program.

For each chapter, the task of the development team was to:

- Decide the content their national trainers need to know.
- Map the sequence for the training of each topic.
- Seek out and document supporting resources.

At this early stage of its development, the manual was designed as two volumes: a trainees' version containing the technical content as well as blank exercise templates to be completed during the training, and a trainer's version containing background information, answers to the exercises, photos of pests and diseases and pesticide labels to be used in the exercises, and other resource material. After initial testing in the field, two volumes proved too unwieldy to use and the decision was taken to combine all information into a single volume.

Training pedagogies

Training pedagogies (also known as androgogies – adult learning processes) in agricultural extension have often tended to be trainer-centred, based on providing mainly technical knowledge and delivered in expository lecture format to an often passive audience, along with some field work. Further, the conceptualisation, content and development of the training program and manuals may have been carried out by donor organisations in countries far from where the program is to be delivered, and rarely include direct input from in-country stakeholders. The CABI Plantwise program has attempted to address this, for example recently Plantwise has developed an online simulation and other materials for plant health doctor training (CABI 2019b).

In the Pacific region, anecdotally, trainers and advisors are known to complain that training is often not taken up or does not seem to be sustainable. Trainee attendance may be poor or sporadic. Training manuals are developed, often at great expense, but may never be used and

little or no change in practice is achieved. While there are many reasons for this, a key one would seem to be that there is little ownership or personal investment in the development and trialling the training process.

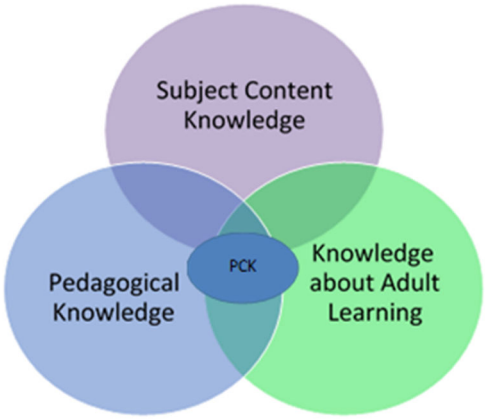
Pedagogical content knowledge

The development of the first draft of the manual represented an intensive and highly focused effort on behalf of the regional trainers to cover content they believed critical to effective PHC training. What was still required and considered necessary to strengthen the effectiveness of the manual, was the inclusion of learning processes that would move trainers away from the lecture format and reliance on surface level tasks such as recall. Hence, a key feature of the manual is the inclusion of focused learning exercises which are cognitively challenging and require higher order processing of the material (Biggs & Collis 1982; Bloom 1984; Anderson & Krathwohl 2001).

Hence to be effective, a trainer is required not only to be familiar with the technical content required to deliver PHCs, but also knowledge of how people learn for deep understanding, and the approaches to teaching and learning that are consistent with these. These elements of training are collectively referred to as pedagogical content knowledge (PCK), first described by Shulman (1986) and now commonly relied on in education systems.

PCK includes three domains. First, subject content knowledge such as technical knowledge about pests, diseases, identification and diagnosis, management methods, setting up and operating PHCs. Second, knowledge of how adults learn, including awareness that people learn in different ways and have different learning needs; and third, pedagogical knowledge of teaching strategies based on knowledge of learning that scaffold knowledge acquisition and engage learning at a deep level (Figure 1).

Figure 1. The three domains of learning leading to the emergence of pedagogical content knowledge (PCK)



Those involved in training instinctively understand that PCK is important even if they are not familiar with the terminology. During testing of the manual in Tonga, for example, when asked to list the qualities of a good trainer, regional and national trainers included elements of all PCK domains, such as good subject content knowledge, but also planning (pedagogical knowledge), communication skills and empathy towards learners (knowledge about learning).

A further task of the manual, then, was to overtly include PCK. To this end, a consultant with a background in adult education worked with the first draft of the manual to develop learning exercises designed to align the PHC training with pedagogical content knowledge to enable deep learning throughout. Background information on PCK for trainers was also include in the manual.

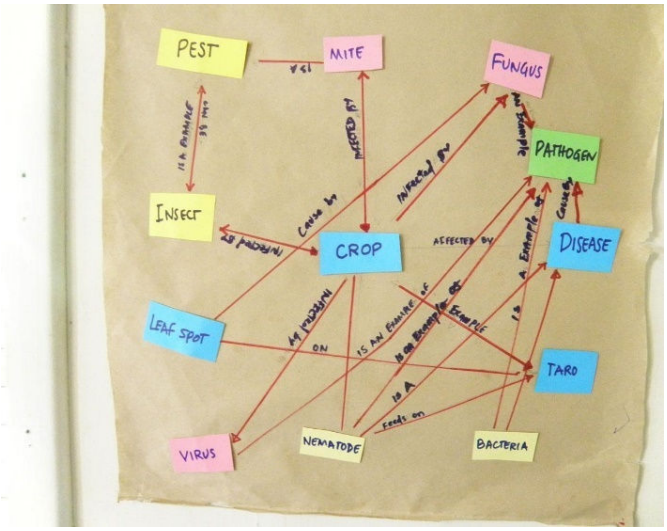
The learning exercises in the manual include:

- brainstorming in a small or whole group
- small group discussion
- cause and effects diagrams
- short information lecture (e.g. PowerPoint)
- quizzes
- concept mapping (Figures 2 & 3)
- completing elements in a table
- gleaning information from pictures/photos and justifying the decisions

- using digital resources
- practical and field work, e.g.
  - observing pests and diseases in the field
  - collecting and identifying pest and disease samples
  - making up home-made pesticides
  - preparing samples to send away for diagnosis
- role play and simulation of a PHC
- setting up and running a PHC with local farmers
- review, reflection and decisions on changes after the PHC (Figures 4 & 5).

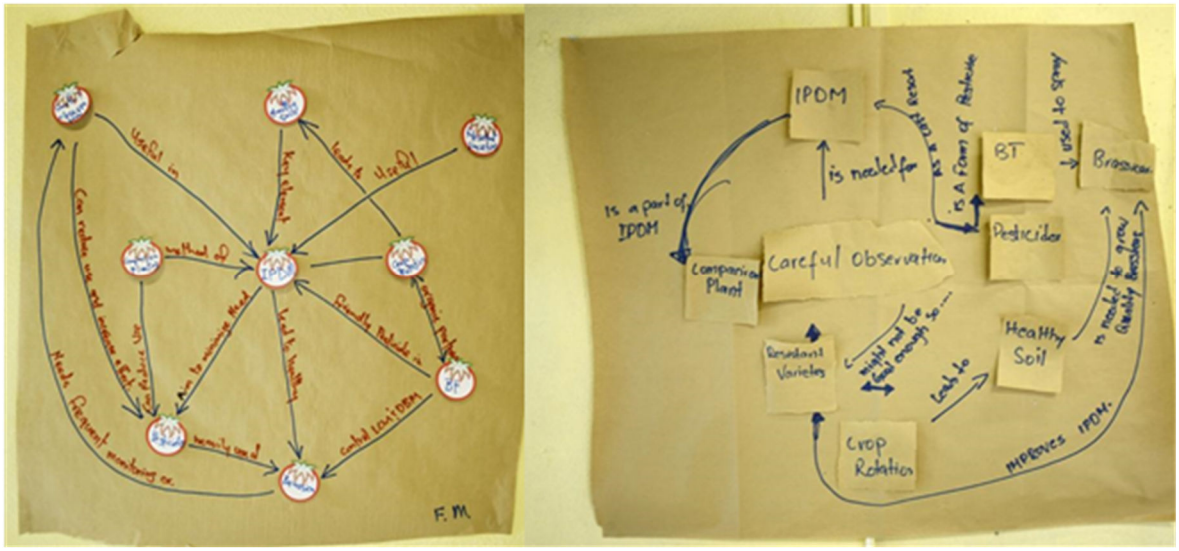
Figures 2 and 3 show examples of concept mapping developed during PHC training.

Figure 2. Concept map linking insect pest, pesticides, food crops, food supply, resistance varieties, good plant hygiene, monocropping, beneficial insects, oil price



created in Solomon Islands

Figure 3. Concept maps linking IPDM, companion plants, pesticides, Bt, resistant varieties, healthy soil, brassicas, crop rotation and careful observation

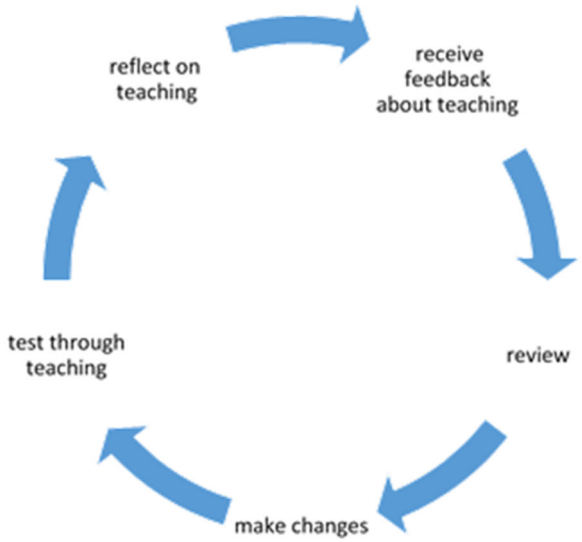


created in Tonga

Reflective Practice

A further dimension critical to effective learning is reflective practice, where both trainers and trainees reflect on their teaching and learning, receive feedback and use this to improve their practice for continuous improvement (Figure 4).

Figure 4. The reflective learning cycle



Reflection is particularly important at the end of a plant health clinic when the plant health doctors bring their samples, prescription sheets and farmer interview data back to the classroom to analyse their diagnoses, discuss their recommendations, consider what further learning is required and which farmers need to be followed up.

Key innovations

Four key innovations in the training and development process have been included in the manual:

1. Prescription form

A prescription form with carbonless copy pages adapted from CABI's Plantwise program (CABI 2019a) records farmers' data at the clinic to provide a diagnosis and management suggestions and a record for monitoring and evaluation. The copy of the form is retained by the doctor for reflection purposes after the clinic.

2. Digital platforms

If the technology is available, an ongoing innovation is the use of digital platforms. The Pacific Pests, Pathogens & Weeds facts sheets (full and mini Fact Sheets) (Lucid Central 2020), with some 500 entries, has been made available as a downloadable app to the trainers to use during training and at the clinics. PestNet also remains a very useful resource (PestNet community).

Instead of the prescription form, the CommCare app (Digimagi 2020) can be used with a smartphone to record the data at the clinic, and is currently being trialled with some success. It allows two-way SMS messaging between the doctor and the farmer, and enables the doctor to fill in the prescription form offline and download later when a wi-fi connection becomes available. CommCare incorporates multimedia and importantly for the project, supports multiple languages. Because it is typed rather than handwritten, it also avoids problems with hard-to-read handwriting.

WhatsApp platforms have also been developed for PHCs in all four participating countries. These are actively used by trainers and plant doctors to share information, as well as to seek assistance while a clinic is running, where experts are asked to stand by to provide advice. The manual includes information and exercises on using these platforms.

3. Farmer feedback interview

A farmer feedback interview and questionnaire is administered to farmers directly after they have consulted the clinic. Questions include whether the farmers' problem was diagnosed, whether they understood the diagnosis and were able to carry out the doctor's recommendations, whether they would recommend the clinic to others, and ideas for improvement. The clinic manager or another person who speaks the farmer's language conducts the interview and completes the form. The manager collates the information from all the forms to present and discuss at the reflection after the clinic.

4. Reflection and evaluation process

A rigorous reflection and evaluation process follows the clinic. Using copies of the prescription forms matched with samples of pest and diseases and summaries from the farmer feedback forms, the plant health doctors share and discuss their diagnosis and recommendations. They then reflect and report on successes and well as issues that require further improvement, using the template in Figure 5.

Figure 5. Post clinic reflection template and example

What went well?	What didn't go so well?	What training is still needed?	What improvements will be made for the next PHC?
A lot of farmers came	Only a few women came	Identification and diagnosis	Make sure awareness targets women in particular. Arrange for more diagnosis practice before clinic

Progress on PHC training and clinics operating since the start of the project

Once the training manual became available in a usable form, leadership of training was transferred to the regional trainers responsible for the training of their national plant health doctors. Trainers provided feedback to the project team regarding modifications and edits. Publication of the manual is now in process.

Within the region, some variations between countries have already been noted, with Fiji, as the largest and most developed of the four participating countries making the most progress and now emerging as the regional leader. It is encouraging to see that each country has now included plant health clinics in their annual workplans, and that ongoing training is recognised as an integral element of the plant health system.

Pathways are also being developed to integrate plant health clinic education into agriculture education at Fiji National University (FNU) and Solomon Islands National University (SINU) to ensure sustainability of the program.

Concluding remarks

Plant health clinics represent a relatively new approach to the management of pests and diseases where farmers have direct access to extension officers trained as plant health doctors. The development of a training manual for PHCs by those who use it, which explicitly draws on PCK to foster deep learning is an attempt to develop a sense of ownership over the process of advancing successful EAS across the region, and considered key to its sustainability. The next steps will include monitoring and evaluation to understand more clearly the quality of the learning that is taking place among trainers and trainees, and the extent to which farmers are able to use and act on the doctors' advice. With continued participation and engagement of regional and national trainers in providing reflection and feedback, continuous improvement in crop protection is considered achievable.

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