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Dissemination of knowledge and skills of potato crop management through farmer field schools in Uganda

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Abstract

The Potato Program of the National Agricultural Research Organization (NARO) has generated a number of technologies on potato crop management for dissemination to farmers. Farmer field schools was one of the technology uptake pathways chosen through which farmers could "learn through discovery" the potato management practices with emphasis on controlling potato late blight. A survey was conducted through a structured questionnaire to assess farmers' knowledge and skills prior to farmers' enrohnent in the schools. Sixteen schools were established in Kabale district with enrolment of at least 24 participants per school. A curriculum was then developed to cover 15 weeks following the crop phenology and farmers' attendance in each school was restricted to once a week. Results from the survey revealed that potato was the third most important food crop and the best income earner in each of the communities surveyed. More than 80% of the farmers rated late blight and bacterial wilt as the two most important potato problems. More than 40% of farmers controlled late hlight through chemical application. Host resistance and integrated disease management as late blight control measures were hardly known. Farmers identified disease monitoring as the most efficient and economic means of managing potato late blight as well as attainment of higher yields and good profits.

Key words: Bacterial wilt, host resistance, IPM, improved seed, late blight, minimum fungicide application

Introduction

Late blight has become one of the most expensive diseases worldwide, both in terms of disease control and yield and post-harvest losses (Fry and Goodwin, 1997). While potato growers in industrial countries are severely affected, some of the world's poorest areas – notably sub-Saharan Africa and the highlands of Asia and South America – are even harder hit. Poor farmers often lack access to pesticides or the resources to purchase them at the time they are needed. Even where farmers do have access, they often apply the chemicals inefficiently and in ways that may be hazardous to their health and environment. Most farmers lack access to information on disease processes and how fungicides work. Their knowledge gap leads to errors in timing, dosage, and application techniques. To cope with late blight, farmers need access to resistant potato varieties, and to crop management techniques that complement resistance. Working with the International Potato Center (CIP), the national potato program under the National Agricultural Research Organization (NARO) has been developing mechanisms for improving farmers' understanding of disease systems, as well as increasing their access to improved potato varieties and other management options. CIP, in collaboration with National Agricultural Research and Extension Systems (NARES) in Peru, Bolivia, Bangladesh, China, Ethiopia and Uganda launched farmer field schools (FFS) in these countries (Ortiz *et al.*, 1999) with emphasis on integrated disease management (IDM) strategy to combat the late blight scourge. Potato farmers in Uganda have depended on pesticide vendors or radio advertisements for latest scientific information, particularly to the Frequency

Modulation (FM) radio being used extensively. One advantage with FM radio is the ability to broadcast in local languages in potato growing areas. To implement IDM effectively, farmers must adapt their management strategies and tactics to local disease complexes, cropping conditions, and operational constraints (Nelson *et al.*, 2001). This can only succeed if farmers are working closely with researchers and extension agents in a participatory manner. Improving farmers' ability to manage crop diseases requires both knowledge and capacity for innovation. Through farmer field schools, farmers have been able to learn about the nature of host resistance, disease development and environmental factors favouring late blight (Kirk *et al.*, 2001). Farmers have also participated in varietal evaluation and participatory breeding. The farmer field school approach represents a shift from centralized extension practices to the farmers' fields (Krishnamurthy and Veerabhadraiah, 1999).

Implementation of the project in Uganda was entrusted to NARO and Africare for a 3-year period starting in 1999 (CIP/IFAD, 1999). Kabale district was chosen as the pilot site for establishment of farmer field schools with a major focus on potato late blight management. The general objective of the project was to increase and stabilize potato production in Kabale, and to reduce the negative effects of pesticide dependency, through the development and implementation of integrated management methods for late blight in the highlands. One of the major objectives of the FFSs was to introduce new high yielding genotypes that have moderate to high resistance to late blight into the farming communities. Coupled with this, integrated late blight management was also introduced to emphasize minimum use of fungicides and deployment of host resistance to late blight. This IPM component is based on disease monitoring rather than application of fungicides on scheduled calendar basis.

Methodology

Site and farmer selection

The major potato production areas in Uganda are located in the highlands of Kisoro and Kabale (southwestern region), Mbale and Kapchorwa (eastern region), Kabarole and Kasese (mid-western region) and Nebbi (north-western region). The importance of potato production for low-income farmers, and the importance of late blight as a constraint to potato production and food security were considered.

In this study, Kabale district was chosen mainly because it is the largest producer of potatoes in the country and the environment favours the development of late blight (Hakiza *et al* 1999; 2000 a &b; 2001). Africare, a non-governmental organization (NGO), was already operating in many communities in Kabale under the Uganda Food Security Initiative project. Farmers who already belonged to farmers' groups were preferentially selected to participate in the study. Farmers' groups where Africare was operating were advantaged and were randomly selected for training in the farmer field schools. Additional farmers' groups were selected, with the assistance of the district extension agents. Farmers' field schools were established in the three counties in the district (Ndorwa, Rubanda and Rukiga). In each community, 25-45 farmers were selected to participate in these schools. Committee members were elected to run the affairs of each school, with the assistance of two full time hired facilitators. The field schools were held in the community where farmers live so that they could easily attend weekly and maintain the field schools studies.

In the first semester only four farmers' field schools were launched and in each of the subsequent seasons four more schools were added. Each season covering a crop phenology was equivalent to a semester of 15 weeks' duration. Any school that concluded two

Table 1. Curriculum for FFS

Session	Topic
1	Introduction to farmer field schools (FFS) work plan
2	Potato seed quality: selecting, handling and planting potato seed.
3	Knowledge, attitude and practices of farmers on late blight.
4	Basic concepts of experimentation (randomization, replication and sampling).
5	Crop management (plant emergence, weeding, plant hilling, and soil conditions).
6	Symptoms and diagnosis of late blight, bacterial wilt and other potato diseases/pests.
7	Disease development and late blight life cycle.
8	Bacterial wilt of potatoes: transmission through seed pieces/infected plants.
9	Bacterial wilt of potatoes: transmission through soil, control of bacterial wilt (& viruses).
10	Reaction of potato variety/clones to late blight under different fungicide management strategies.
11	Precautions in use, safe handling and storage of fungicides & other pesticides.
12	Harvest considerations, positive selection, tuber blight and variety selection.
13	Measurement of potato yield and gains (including crop loss assessment).
14	Dehaulming and harvest of potato.

semesters, following the developed field guide, was taken to have completed the course. It was expected that by the end of year 2001 sixteen schools would have been established and completed the course. The facilitators traveled to the site on the day of the field day and each facilitator was responsible for 4 farmer field schools every semester.

Curriculum development

The duration of farmers' field schools and season long training of trainers was based on crop phenology. Field schools assume that farmers already have a wealth of experience and knowledge. It is also assumed that there may be misconceptions and bad habits learned during intensification programmes. Consequently, two facilitators were trained and a curriculum, in line with the objectives of the project, was developed as a field guide.

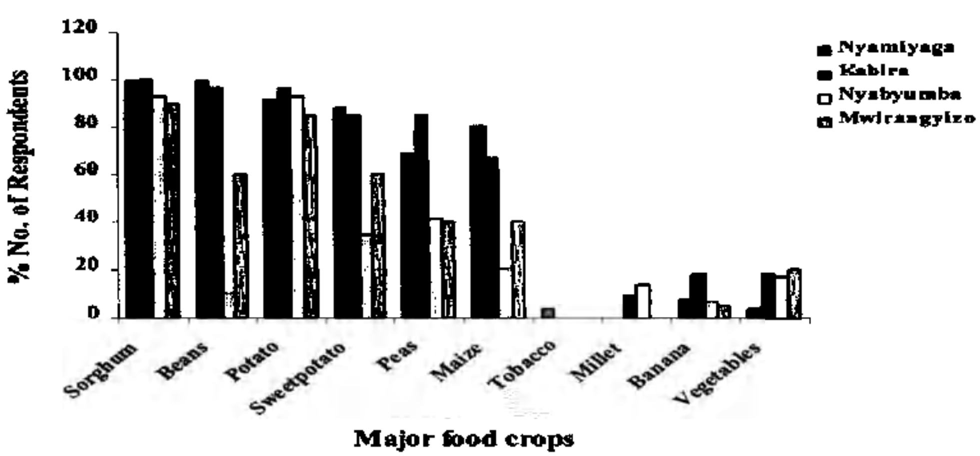
The curriculum was divided into 13 to 15 sessions based on crop phenology (Table 1). These sessions require careful planning and the facilitator's role is critical to promote an appropriate environment for research and learning (Nelson et al., 2001). Substantial training is needed for a person accustomed to conventional extension to be an effective facilitator.

Table 2: Farmer Field Schools located in Kabale district for late blight management

County/ sub-county/ parish	Community with FFS	Number of participants	Date of initiation
Ndorwa County, Kamuganguzi sub-county, Katenga parish	Nyabyumba	28	Sept 23, 1999
Ndorwa County, Kitumba sub-county, Mwendo parish	Mwirangizo	24	Sept 24, 1999
Rubanda county, Bubare sub-county, Nyamiyaga parish	Nyamiyaga	26	Sept 9, 1999
Ndorwa county, Kitumba sub-county, Bukoora parish	Kabira	33	Sept 22, 1999
Rubanda county, Muko sub-county, Kabere parish	Kayorero	44	March 16, 2000
Rukiga county, Rwamucucu sub-county, Burime parish	Kirera	24	March 21, 2000
Rukiga county, Kashambya sub-county, Bucundura parish	Karubanda	25	March 20, 2000
Ndorwa county, Kamuganguzi sub-county, Buranga parish	Rukaranga	27	March 17, 2000
Rubanda county, Hamurwa sub-county, Karukara parish.	Karukara	31	August 19, 2000
Rukiga county, Kashambya sub-county, Kamusiza parish.	Kamusiza	17[a]	August 17, 2000
Rubanda county, Ikumba sub-county, Ikumba parish.	Ikumba	30	August 14, 2000
Rukiga county, Kaharo sub-county, Nyakasharara parish.	Nyakasharara	25	August 16, 2000
Ndorwa county, Buhara sub-county, Mabungo parish.	Mabungo	28	March 28, 2001
Ndorwa county, Rubaya sub-county, Kagyera parish.	Kagyera	21	March 2, 2001
Ndorwa, Kitumba sub-county, Nyakibande parish.	Nyakibande	30	March 27, 2001
Rukiga county, Rwamucucu sub-county, Nyakatugunda parish.	Nyakatugunda	32	March 29, 2001

[a]When the school was established, there were 30 participants. However, the number reduced with time as some members kept dropping out

Figure 1. Major food crops grown in 4 farmer field school communities to Kabale



Understanding farmers' knowledge and skills

In order to assess the farmers' knowledge, skills and practices in late blight management, a structured questionnaire was used. Individual farmers in each school were interviewed before the commencement and after completion of the school. The information gathered before training was initiated served as a baseline to measure changes in farmers' knowledge and practices. The farmers were made aware that the information collected was to assess the knowledge changes accruing from participating in the farmer field schools rather than being an examination like those common in schools.

Role of host resistance in integrated late blight management

A set of released potato varieties and promising clones were evaluated in each of the farmer field schools. At Nyakibande FFS, for example, five released varieties (Rutuku, Nakpot 1, Nakpot 3, Kabale and Victoria) with different levels of resistance to late blight were evaluated under three spray regimes. The recommended spray regime of once every week using Dithane M 45 at the rate of 2.5 kg/ha was adopted. The IPM schedule was based on weekly monitoring of the disease severity, through percent leaf area blighted, before spraying is done. The third practice represented farmer practice in which no fungicide was applied.

Figure 2. Production constraints in the 4 first generation farmer fields schools

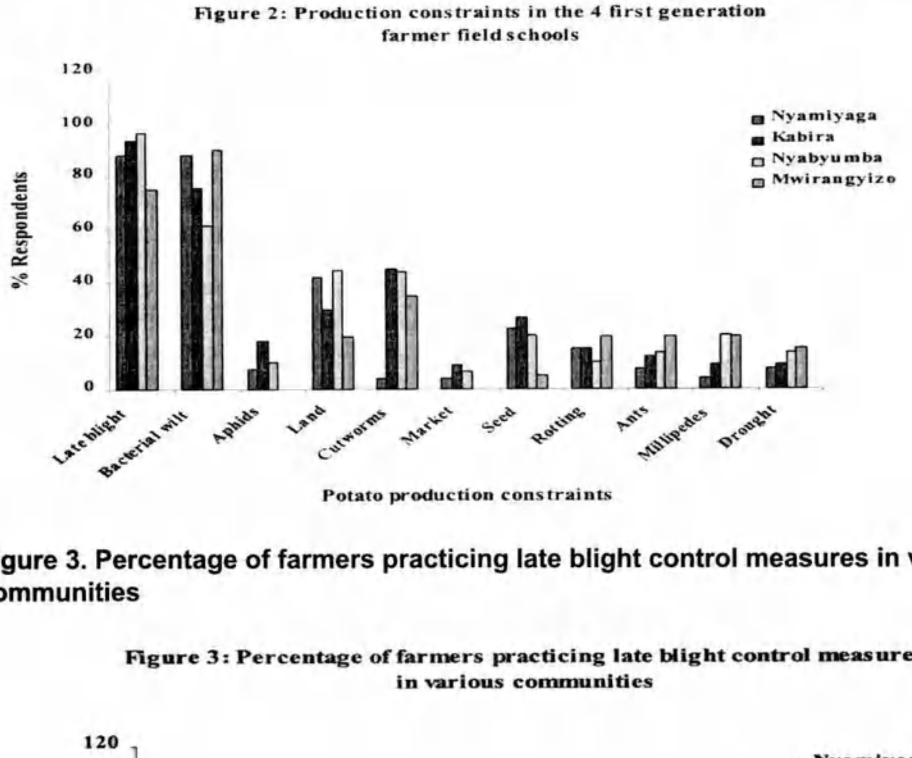


Figure 3. Percentage of farmers practicing late blight control measures in various communities

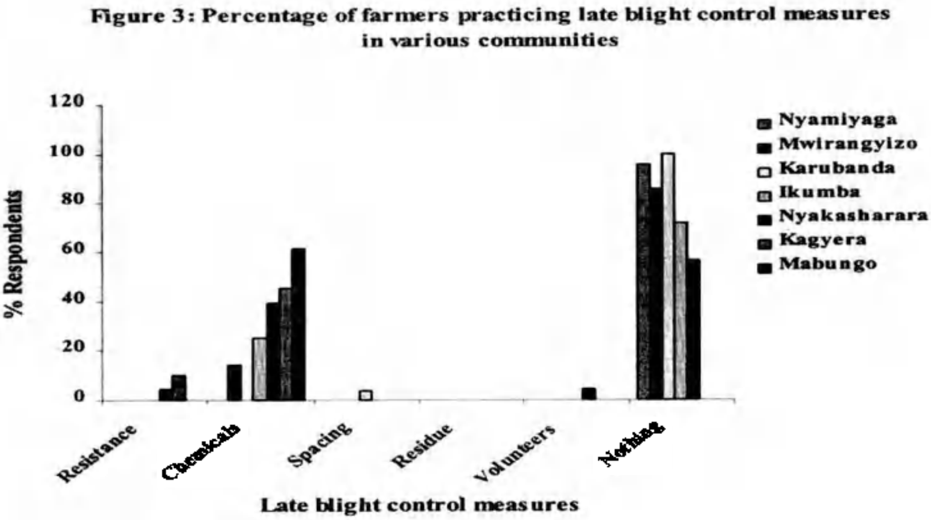


Figure 4. Reaction of different varieties to 3 spray regimes at Nyakibande farmers field school, Kabale, Uganda.

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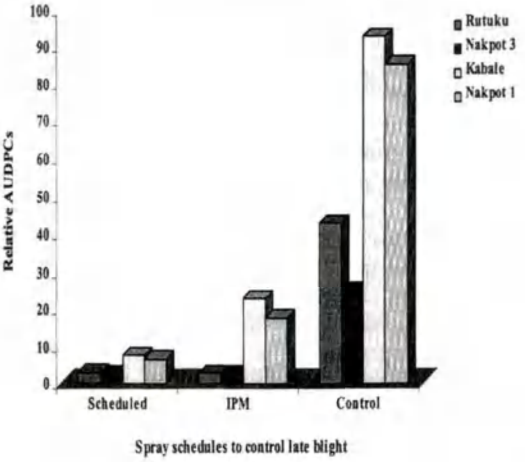
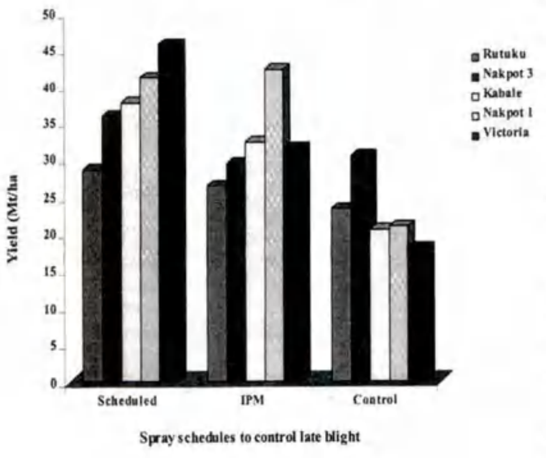


Figure 5: Yield (Mt/ha) of 5 varieties under 3 spray regimes at Nyakibande farmer field school, Kabale, Uganda



Results and Discussion

Table 2 shows that sixteen farmers' field schools were established during 1999 through 2001 with 445 participants from 16 communities, giving an average of 28 participants per school. Gender desegregation among the participants indicated that females were predominant to the tune of 114 males against 331 females. Some schools like Nyamiyaga and Nyakasharara were solely constituted of female participants. Participants' age distribution ranged from 15 to 70 years.

More than 90% of the farmers grew sorghum while more than 85% produced potatoes in all the communities (Figure 1). Whereas sorghum was mainly grown as a food security crop, potatoes were produced as a source of income and for food. In most communities, more than eight potato varieties, with varying levels of resistance to late blight, were being grown by most farmers. Other important food crops were beans, sweet potatoes, peas and maize.

The respondents indicated that late blight and bacterial wilt were the major production constraints (Figure 2). Land shortage, lack of market and seed were also mentioned as some of the constraints. Land shortage was rated low mainly because a number of farmers had many pieces of land and they were able to lend one piece to the farmer field school for a season or two. In places like Nyamiyaga, the farmers borrowed or rented land to cultivate. Market could have been a non-issue because the farmers were used to producing small quantities of potato, basically for domestic consumption. Seed was not regarded a major constraint probably because the farmers relied on home-saved seed, irrespective of their health status.

During the survey it was important to know how farmers normally control the disease. Most respondents were of the view that you either use chemicals to control late blight or do nothing about it (Figure 3). Very few farmers indicated that some control of blight could be made through use of wide spacing or removal of volunteer plants. There was no mention of host resistance being applied as a control measure. It is probable that these farmers did not understand what it means or they were already using resistant varieties and could not tell the difference.

It was apparent that introduction of new resistant varieties and reduced application of fungicides could increase potato production in these communities. During the semesters, therefore, it was important for the farmers to understand that different levels of resistance to late blight exist in the varieties being evaluated and that these responded to fungicide sprays differently.

Results in Figure 4 indicated that the relative area under disease progress curves (RAUDPCs) were very low under fungicide application compared to where there was no spraying. It also showed that under IPM, host resistance played a big role in controlling late blight. Rutuku and Nakpot 3, which are known to have very high levels of resistance to late blight, had RAUDPCs less than 3.

Without spraying, the two very resistant varieties also managed to suppress the disease tremendously. Under weekly schedule of spraying all the varieties gave high yields. However, the less resistant varieties (Kabale, Victoria and Nakpot 1) benefited more from fungicide application.

Under IPM, Nakpot 1 produced the highest yield although the yields were not significantly different. Without fungicide application, Nakpot 3 had the highest yields, which could be attributed to its high levels of resistance to late blight.

In order to find out which is the most paying practice in controlling late blight, partial budget analysis needed to be carried out using pooled data from all the farmer field schools. This will be done at the closure of the project.

Conclusion

Effective small-farmer participation in the technology development and transfer system has a positive influence on the system's priorities and programmes. Mobilizing farmers' organizations in support of research and technology transfer systems is often found to be essential because it facilitates the implementation of decentralized research and can speed up information flow. Farmers who participated in these farmer field schools benefited not only from late blight management, but also on recommended agronomic practices as well as marketing of potatoes.

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