Chapter 7
Can Schools be Agents of Urban Agriculture Extension and Seed Production?

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Introduction

With increasing recognition of the role of agriculture in the livelihoods of urban and peri-urban communities all over the world, attention is focusing on it as one possible mechanism toward achievement of the Millennium Development Goals on hunger, poverty and the alleviation of urban slum conditions. This chapter describes an experiment aimed at improving urban and peri-urban agriculture outputs in the city of Kampala by working with schools.

It is estimated that, if figures from East and Southern Africa are projected to the region, 200 million people could be directly depending on food (both crop and livestock products) produced in urban and peri-urban areas of Africa by 2020 (Urban Harvest 2003; Denninger et al. 1998). In the 1990s about 35 percent of residents in the capital city Kampala were reported to be engaged in farming with up to 70 percent of the city's poultry products being produced in the urban area (Maxwell 1994; KUFSALCC & Urban Harvest 2004). This local production has been recognized for its role in supporting the food needs of the urban poor, who otherwise have difficulty in buying food. Kaweesa (2000) found that up to 72 percent of the inhabitants in one part of the city experienced food shortages, with a prevalence of stunting, underweight and wasting in children at 19, 12 and 4 percent, respectively. She pointed out that increased urban production could help fill this gap.

Urban Harvest, a program of the Consultative Group on International Agricultural Research (CGIAR), first established linkages with Kampala organizations in 2000, with the aim of improving food security and living standards of the urban poor through urban agriculture research and development. In 2002 it supported the project "Strengthening Urban Agriculture in Kampala", in which a number of institutions collaborated, led by the International Center for Research on Tropical Agriculture (CIAT). This chapter concerns the component investigating technical interventions to support urban agriculture (UA).

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The questions addressed by this research on technical interventions were as follows:

- Can schools function as effective extension channels for UA?
- What are the most feasible extension approaches and methods to be used by urban schools?
- Is it feasible for urban schools to produce seed commercially for planting purposes?
- How can schools engage farmers in the process?
- What are the constraints and the outcomes of this process?

The action research project was carried out in two phases: the first involved dissemination and extension of crop technologies demanded by schools, while the second tested schools' commercial seed production for urban and peri-urban communities. The first phase was carried out in the second growing season of 2002 (September to December) and the second phase during the first growing season of 2003 (March to June).

By the end of the project in 2004, although findings on commercial viability of seed production were less than positive, the questions raised and the preliminary findings had generated a lot of interest leading to follow-up interventions. Based on several favourable conditions – the farmers' demands, the lessons learnt in the process and an already existing institutional collaborative network – there was an immediate follow-up project that took advantage of the schools connection. Supported by technology transfer funds of Farm Africa, this project, which ran from 2004 to 2006, successfully promoted the growing of pro-vitamin A orange-fleshed sweetpotato at 11 schools working in farming communities in two divisions of the city. This chapter focuses on results from the research between 2002 and 2003.

Background and Rationale for the Study

Uganda has a national policy that schools should teach and practice agriculture as a subject at primary and secondary level, the purpose being to develop a strong public awareness of the importance of agriculture to the national economy, as well as providing school pupils with the basic knowledge and skills to practice it. In the 21st century the teaching of agriculture in schools was projected to move toward vocational education, whereas before it was seen more as an extra-curricular activity for school agricultural clubs. Yet there has been little research and development to explore how the policy goals could be achieved through effective programs in the schools.

In particular, practical ways of integrating agricultural activities in urban and peri-urban communities to meet food security needs have not been either promoted or tested through applied research. This is mainly because urban agriculture

has been a policy blind-spot for Uganda, much as it has been in the whole Sub-Saharan Africa region. There have been important studies on urban agriculture in Uganda, including those by Maxwell in the 1980s (Maxwell 1994), David (2003) on bean production, the recent work of Urban Harvest (e.g. Cole et al. 2008), and numerous non-governmental initiatives, such as that of Environmental Alert in the 1990s which helped build the capacity of Kampala City Council's Agriculture Department. Despite all these, there is as yet no official urban agriculture policy in Uganda.

Most urban farmers lack extension services, especially information on the food items they produce. For example, David's study revealed that only 13 percent of the bean farmers in Kampala were growing modern bush and climbing bean varieties in the year 2000. Since beans are an essential part of the diet in Kampala and are becoming an important low-value cash crop in Uganda in general, urban and peri-urban farmers should be able to access information on them (David 2003; Hoogendijk & David 1997).

There has been no interaction between schools and communities concerning farming activities. Urban farmers in Uganda generally aim to satisfy their food and income needs at home with insufficient extension support, while urban schools only teach basic learning and skills development for agriculture without actively linking them to the surrounding situation.

The project was developed as a response to the national policies on agriculture and education. With the education policy incorporating agriculture in schools and the Plan for the Modernization of Agriculture focusing on commercial and productive agriculture, it was apparent that the two stakeholders, namely the schools and the farmers, needed to be brought together. Schools can play a useful role in their communities not only by educating the children but by actively reaching out to their parents as well, becoming community change agents.

It is suggested that schools can conduct agricultural extension by acting as sources of useful agricultural knowledge and skills to the pupils, who can then transfer them to their homes. Institutions such as parent–teacher associations have the potential to sustain a more or less permanent but dynamic interaction between schools and parents, particularly those involved in farming. Schools with organized agricultural activities could also provide extension services through school demonstrations and mini agricultural shows.

Schools in Africa in particular embody resources of economic and social capital that should not be underestimated as focal points of development. It is the essence of education that the time and attention of staff and students are devoted to issues of public concern, while schools have skilled personnel as well as the more concrete physical capital of land, buildings and (sometimes) water that can be applied to such purposes as agriculture. This has been demonstrated in a number of projects and programs directed toward environmentally sound and sustainable development (Lee-Smith & Chaudhry 1990; Vandenbosch 2003).

In addition, schools may be motivated to invest in an activity that can bring some financial benefit, such as the sale of seed and planting material. Several studies have cited the lack of inputs, especially seed, as one of the constraints to urban agriculture

(Maxwell 1994; Lee-Smith et al. 1987), suggesting that schools could perhaps take on the role of seed producers for those crop enterprises demanded by the community.

The Urban Harvest project provided a means of exploring ways of applying these ideas, and the Urban Schools Agricultural Initiatives Project (USAIP), involving several institutions, was established as a result. Its aim was to support urban and peri-urban schools in the provision of agricultural services demanded by their communities. The communities in this case included farm families living in the school surroundings or those who could come to the school for agriculture-related learning activities. While the educational benefits for school students were considered an important aspect of the intervention, they were not however the subject of the research described here.

Methods Used for the Research

The USAIP took an innovative direction for research in its structure at all levels and in its approach to gathering and applying knowledge. The method used was action research. Two understandings, both related to challenges of African research at the start of the 21st century, informed this direction. First, there was recognition of schools as key institutions of knowledge and resources for development in communities. Second, there was an understanding of the potential of committed teams of individuals in different institutions collaborating to accomplish research and development goals. Both of these are based on the lack of resources of all types to carry out research and development, and on making the most of some very real and positive resources that are available (Lee-Smith & Chaudhry 1990).

Led by the Department of Agriculture Extension and Education at Makerere University, the interdisciplinary team from different local government, civil society and academic institutions set out to:

- Provide farming skills to pupils of the schools;
- Provide agricultural extension services to the community;
- Encourage the schools to generate income through agriculture; and
- Monitor and assess the effectiveness of these interventions.

In addition, USAIP had an implicit fifth objective, to create a platform in schools for the dissemination of health and other important urban agriculture messages, and to gather information from communities about these same issues as part of a research method. This objective was implicit in its commitment to the goals of the Urban Harvest-funded project of which it formed an integral part.

USAIP therefore took part in the Participatory Urban Appraisal (PUA) conducted in 2002 and helped other project components select schools as study sites as well as helping in their execution through contacts with the schools. In particular the Health Impact Analysis of UA in Kampala described in Chapter 9 was closely integrated with USAIP activities (see also Cole et al. 2008).

Phase One: Technology Dissemination and Extension

The Feasibility Study and Selection of Schools

The feasibility study to select participating primary schools in Kampala assessed seven schools from four of Kampala's five divisions, leaving out Central where agricultural activity was limited. The schools were designated as being in urban or peri-urban areas following Kampala City Council's classification system of agricultural areas within its boundaries.

A checklist was used to collect pertinent information about the schools and their agricultural activities. Three teachers, including the head teacher, were interviewed in each school, for a total of 21 respondents. The following criteria guided school selection:

- Ability to demonstrate accountability, transparency and control;
- Being as far as possible government-aided schools;
- Having land up to at least half a hectare for farming;
- Evidence of school farming practices;
- Willing to collaborate and commit two staff members to oversee the activities;
- Having farming in the surroundings;
- Being in areas where non-governmental organizations (NGOs) in the team operate;
- Approximately equal distribution of schools in urban and peri-urban areas (Table 7.1).

The three schools selected on this basis were as follows: Lubiri Nabagereka Primary School in Rubaga (urban), Valley St. Mary's Primary School in Kawempe (peri-urban), and Reach-out Primary School in Makindye (peri-urban).

Despite being in an urban setting Lubiri Nabagereka Primary School had about 1.5 ha of arable land and was surrounded by a farming community because both the school's and surrounding land belong to the Kabaka – the King of Buganda. The land has a special status because farming is integral to the kingdom's traditions and this also meant that the school had an active farming program even though it had no outside support from the City or NGOs.

Table 7.1 Location of the schools surveyed during the feasibility study

Division	School	Location: urban or peri-urban
Rubaga	Lubiri Nabagereka Primary School	Urban
Kawempe	Kawempe Church of Uganda Primary School	Urban
Makindye	St. Kizito Senior School	Urban
Nakawa	Kyanja Moslem Primary School	Peri-urban
Kawempe	Valley St. Mary's Primary School	Peri-urban
Makindye	Reach-out Primary School	Peri-urban
Makindye	Munyonyo Primary School	Peri-urban

Valley St. Mary Primary School had about 0.6 ha of land available for farming, as well as farming in its surrounding community and extensive school farming activities. It was also linked to Plan International, one of the NGOs involved in USAIP. Reach-out Primary School, with almost 1 ha of arable land in a peri-urban setting, was actively collaborating with Environmental Alert, the other NGO involved in the project, and already had ongoing school farming activities involving the community. Schools not selected had very little land, inactive farming activities, or no contact with a support NGO doing urban farming.

Participatory Planning for Community Entry and Selection of Enterprises

In early September 2002 the USAIP team organized a workshop for school representatives and community leaders to establish a work plan and guidelines for field activities. A memorandum of understanding between the schools and the USAIP team was drawn up and debated and preparations made to introduce the project to the communities. Mobilization was planned to be led by community leaders with teachers assisting.

The mobilization included announcements on local community radios and village notice boards, as well as local leaders moving to individual homes to invite people to the schools for the first project meetings. These were held in late September for the communities of Valley St. Mary's and Reach-out Primary Schools respectively, and in October for the community around Lubiri Nabagereka Primary School.

The meetings were used to conduct a group appraisal of community farming activities, assess demand for seed and select the crops to be worked with. Two checklists were used, one to guide the participatory appraisal of the farming activities in the area and assessment of seed demand and the other to guide monitoring the implementation of the selected enterprises after they were established. Participants identified a number of crops for which they needed technical support and these were then prioritised as the critical ones for which USAIP support would be provided through the schools.

Technical support was offered in the form of training for schools and communities on the agronomy, post-harvest management and marketing of the selected crops. The trainers, from Namulonge Agricultural and Animal Research Institute (NAARI) and Kawanda Seed Project, conducted "lecturettes", group discussions, and method demonstrations including the setting up of demonstration plots. The first of these were established at the schools in October, in time for the second rains. There was a second round of planting in February, in time for the first rains of 2003.

The training of teachers was passed on to school students, who were involved throughout, the demonstration plots and the process of community involvement providing subject matter for agriculture classes. However, monitoring and evaluation only covered crop performance and not educational or community engagement objectives.

Monitoring and Evaluation of the Crops' Performance

Participatory monitoring and evaluation involved collaboration among the USAIP team, the schoolteachers and the community. Two evaluation meetings were held each season, one in the middle and the other at the end of the season. Additionally, two community meetings per school were held to review the progress of the project. The following issues were given priority in monitoring:

- Level of field preparation;
- Planting and spacing;
- Seed rate (kg/unit area) and germination percentages;
- Weed control (weed types, method of control and weeding dates);
- Pests and diseases identified on each crop (incidence and severity, cause, and control strategy);
- Date of flowering or tasseling (in the case of maize);
- Date of cob, beans or tuber development;
- Yields of beans, maize or sweetpotatoes.

Assessment of Crop Enterprises and Land Availability

Crops for which technical advice was needed included sweetpotatoes, maize, beans, onions, ground nuts, cassava, cocoyam, *matoke* (cooking banana), tomatoes, sugar cane, eggplants and vegetables. The farmers in two of the communities around Valley St. Mary's Primary School to the North of Kampala and Reach-out Primary School to the South prioritized sweetpotato, maize and beans as the ones they wanted advice on. The farmers close to Lubiri Nabagereka Primary School chose to be advised on maize, beans and tomatoes.

With the exception of tomatoes – commonly grown for sale – farmers wanted advice on their annual food crops, indicating their concerns about household food security. Nevertheless, the potential to sell off crops in excess of what is produced is high in urban and peri-urban areas, as is the need to promote small-scale enterprises for such crops. Other factors affecting the selection of these annual food crops were farmers' access to enough arable land and the type of land tenure. Seventy to eighty percent of the participating households near the three schools were small farmers with around 500 m^2 arable land. In all three communities those with more than half a hectare of arable land were few, about 5 percent in each location.

Seed-Demand Assessment in Schools

The farmers near the urban-located Lubiri Nabagereka Primary School bought 95 percent of their seed, compared with the two peri-urban locations where 60 and 55 percent respectively of seed was bought, the rest being home produced. The fact

that over half the peri-urban farmers bought their seed implies a high demand for good quality, reliable and affordable seed, but it also reflects farmers' consumption habits – eating most of what they grew with nothing reserved as seed for the next season Fig. 7.1.

Farmers bought about the same amount of seeds for maize and beans, about 3 kg of seed per household for each crop. The average price per kilo was higher for beans (600–800 Ugandan shillings (USh)/kg or 35–46 US cents) than for maize (about 300 USh/kg or 17 US cents).

Peri-urban farmers always bought seed from retailers, such as grain merchants or farm supply stores, while those in the urban area frequently bought seed wholesale from a factory. Apart from the farm supply stores, these sources were not selling seed specifically for farming but rather for other purposes such as milling or livestock feed. Farmers said that some of the seed bought in such places failed to germinate and expressed concern that they were buying seed without knowing the type or variety. Some feared they had bought uncertified seed merely dusted with purple or green colour to look like the real certified ones.

Farmers in all three areas were willing to buy seed from the school as long as it was of good quality, indicating their willingness to pay about 600 USh/kg (34 US cents) for maize or bean seed. They were interested in new varieties, wanting the Longe 5 variety of maize, an open-pollinated, quality protein strain, locally known as Nnalongo. In addition, they requested planting material for the yellow or orange-fleshed sweetpotato varieties with high amounts of beta-carotene, a precursor of Vitamin A, as well as fruits such as oranges, guavas and papayas. They said their sources of agricultural information were NGOs and community-based organizations.

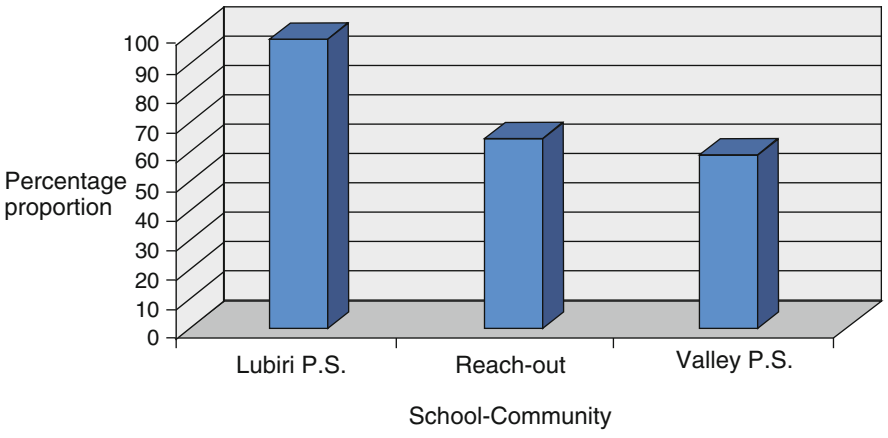

Fig. 7.1 Proportions of households in the school's communities buying seed

Using Schools for Agricultural Extension

Between 15 and 22 community members, two-thirds of them women, attended the initial field activity where demonstration plots were set up and farmers received training on the basic agronomic practices of the selected crops. Both farmers and school staff participated actively by way of asking questions related to agronomy, such as spacing, varieties and control of pests and diseases.

On 14 October 2002 farmers and teachers planted the varieties Longe 5 maize and K132 beans on the demonstration plot at Lubiri Nabagereka School. Farmers subsequently visited the school-based demonstrations and teachers working with the project took them around and answered their queries. At the end of the first season 11 of the 15 original participants who started off at the beginning were present to share their observations. The teachers said they found what the agronomists had shared with them very helpful and they passed this on to farmers who were encouraged to manage their crops better.

Farmers and teachers at Valley St. Mary's School planted the maize variety Longe 5 and four varieties of sweetpotatoes, including Tanzania, Kakamega SPK 004, Ejumula and Sowola (398A) on 23 October 2002. Teachers mobilized farmers for meetings and encouraged regular visits to the demonstration plot where they explained developments. Some farmers took planting materials to try out and compare with what was being done at school. They were keen to apply the practices demonstrated, especially in sweetpotato production, and tried out skills learned at school.

Longe 5 Maize Variety at Lubiri Nabagereka Demonstration Site

Although poor rainfall affected crop growth, the new maize variety was observed to be fast-growing. At the time of weeding the plants were strong and had a dark green colour, except in one area with poor rocky soil and a thin layer of topsoil deficient in nutrients. Although it took a long time to germinate, the maize had a 100 percent germination rate and the maize stalk borer, which attacks local varieties, was not observed because the maize seed was treated (seed dressed). Farmers observed that rodents did not eat any of the maize, possibly because the risk was spread as many people in Lubiri had planted maize. Farmers said Longe 5 performed better under low rainfall conditions than the local varieties, with most plants putting on two to three grain-filled cobs, while local varieties had only one or two, with only the top cob having good grain-fill and the lower one being smaller with a lot of gaps. The maize matured in 3 months and was also seen to dry faster than local varieties.

The harvested maize had an average fresh weight yield of 0.5 kg/m^2. Since a wet ear of maize contains about 57 percent of dry grain (Basalan et al. 1995), this gives a dry weight grain yield of 0.285 kg/m^2 or 2.9 tonnes of grain yield per hectare. This output was lower than the expected five tonnes per hectare yield predicted by

the National Agricultural Research Organization (NARO 2003), the cause of this low harvest being the delay in onset of the second rains and shorter than usual rainy season (FEWSNET 2002).

K132 Bean Variety at Lubiri Nabagereka Demonstration Site

Participants observed that the K132 bean variety introduced by the project was similar to K20, locally known as *Nambale*, a variety released in 1968, which is widely grown by farmers in Uganda (David 2003). Germination was observed to be good, due to heavy rains in the early days of crop establishment, although the leaves became yellow due to too much water and inadequate aeration in the root zone. Later, when the rain reduced, the plants regained their green colour.

Weeding was hard for some of the farmers because of close spacing within the line. To facilitate the weeding of beans, one farmer suggested that a spacing of 15 × 60 cm be used instead of 10 × 75 cm as advised by agronomists. Other community members advised their colleagues to use the recommended spacing but try to prepare land well and practice early weeding to prevent competition for nutrients. At this school the beans were harvested after about 3 months, had an average of 27 pods per plant (vine) and a fresh weight yield of 600 g/m^2, equivalent to about 1.24 tonnes of dried beans per hectare. The normal yield for this K132 bush bean variety is 2 tonnes per hectare.

Longe 5 Maize Variety at Valley St. Mary's Demonstration Site

Maize was harvested 3 months after planting, with an average fresh weight yield of 0.35 kg/m^2 equivalent to a dry weight grain yield of 0.12 kg/m^2 or 1.2 tonnes per hectare. Community participants observed that late planting affected crop growth and yield, that vermin and termites ate up the maize after sowing so that about 40 percent of the maize crop had to be gap-filled, that maize grains were small and there was a high incidence of maize stalk borer (locally known as *Ndiwulira*). One farmer observed that the attack by the maize stalk borer could have been a result of late planting and the dry spell that hit the crop soon after planting. The soils in the fields were also of low fertility and roaming livestock frequently ate the crops, all of which contributed to the low yields.

Despite those problems, the community members acknowledged that the new maize variety had a good vegetative growth at the start and was fast growing. In addition, it gave a high yield with about 2–3 well-filled cobs compared to the local varieties, so that overall the farmers were very much interested in adopting it.

Sweetpotato at Valley St. Mary's Demonstration Site

Three sweetpotato varieties (SPK 004, Ejumula and Sowola) had no serious shortcomings, but the Tanzania variety was attacked by wilt and was not resistant to the

drought. Yellowing of leaves seen on the same variety was identified as a lack of nutrients, particularly nitrogen, in the soils at the school garden. Generally the new sweetpotato varieties were observed to be high yielding and good for consumption. No yield measurements were kept for sweetpotato due to logistical limitations. The community requested the team to continue with the extension aspect of the project during the second season.

Further, they requested that new farmers be given some or planting materials to try at their homes while continuing with the school-based demonstration. Although funds were insufficient to give out planting materials to all the farmers who requested them, a follow-up project was developed and funded based on the demand for the crop; meanwhile farmers were advised to purchase planting materials themselves. The schoolteachers involved, and some participating farmers, were requested to share information about the new varieties and management practices with other farmers. It was agreed that the new farmers be contacted through village leaders, or through invitation letters written by the school head teachers to churches, friends and neighbours.

Phase Two: Schools as Commercial Seed Producers

Phase two started in the first season of 2003 with sensitization on commercial seed production followed by training, setting up of fields, follow-up activities and field monitoring. During this phase, technology-dissemination activities were also continued.

Participatory Planning of School-Based Commercial Seed Production

The process started with community meetings at the schools where farmers discussed the role of schools in growing and selling seed and planting materials to farmers. This phase involved only Lubiri Nabagereka and Valley St. Mary's Primary Schools. Neighbouring farmers expressed interest in buying seed produced by the schools provided that it was of good quality. In Lubiri Nabagereka, farmers even collected funds and gave them to the school to buy seed for them from reliable sources. Crops selected for commercial seed production were beans, maize and sweetpotatoes, but due to limited resources the whole exercise of planting and cost estimation was only carried through for beans.

Three training workshops conducted by staff from NAARI were organized for teachers, the first, held on 14 February 2003, focusing on the agronomy of commercial crop enterprises. The second and third workshops consisted of training on the profit implications and on commercial seed production practices, led by an agro-enterprise specialist from CIAT. The following stages of setting up a commercial seed business were examined:

1. Assessing the need for a seed business in the area;
2. Assessing one's ability to produce a good quality seed;
3. Assessing the knowledge and skills possessed for successfully running a seed business;
4. Finding out what one needs to invest;
5. Analyzing and reflecting on information collected and making conclusions about estimated profitability and chances for business success;
6. Planting a seed plot for at least one season;
7. Selling seed on a trial basis;
8. Identifying whether one can sell seed profitably or not;
9. Making a decision to start a seed business.

It was agreed that profit estimates be confirmed through actual production costs and yields during the trials. Participants were cautioned on the importance of proper post-harvest handling and storage of seed for commercial purposes and a handbook on Commercial Bean Seed Production (David 1998) was distributed.

Participants were asked to estimate the production cost of bush bean seed in their schools and calculate the selling price based on a 20 percent profit mark-up. It was reported that Valley St. Mary's could sell bush bean seed at 1150 USh/kg (60 cents US) while Lubiri Nabagereka could sell at 1410 USh/kg (72 cents US). Both of these were much higher than the price that farmers had indicated they were willing to pay for bean seed (about 600 USh/kg). A bean yield of 1500 kg/ha was forecast.

Teachers' training workshops on harvest and post-harvest management of beans and sweetpotatoes were followed up by technical sessions to check crop performance and guide the process of seed crop management. Teachers were advised to keep records strictly, as this was fundamental in commercial seed production and farmers were encouraged to visit the seed production fields to ensure their engagement with the process.

Results of Commercial Seed Production in Schools

Although drought affected the crops, there was a moderate yield of bush beans at both schools, as shown in Table 7.2.

The selling price of bean seed was estimated for Lubiri Nabagereka Primary School as 5430 USh/kg and that of Valley St. Mary's as 11 150 USh/kg, both very

Table 7.2 Commercial bean seed yields from the two schools

School	Size of plot	Fresh Yield (kg)	Number of pods/ plant	Yield / ha (kg fresh weight)	Yield / ha (kg dry weight)
Lubiri Nabagereka Primary School	20 x 20 m	91.0	40	2275	469.5
Valley St. Mary's Primary School	5 x 10 m	12.0	30	2400	495.2

high compared to what the farmers were ready to pay. Table 7.3 outlines the process of estimating the selling price.

The high costs of production seen in Table 7.3 are due to the high cost of urban manual labour as well as difficulty in judging its price. Lubiri Nabagereka's lower costs appear to be due to the economies of scale in its labour pricing.

Table 7.3 Estimating the selling price of the bean seeds

School	Lubiri Nabagereka Primary School	Valley St. Mary's Primary School
Activity	**Cost (USh)**	**Cost (USh)**
Seed costs	–	–
Land clearing	30 000	5000
Planting	10 000	5000
Weeding 1st and 2nd	30 000	10 000
Harvesting	15 000	3000
Total	85 000	23 000
Plot area	400 m^2 or 0.04 ha.	50 m^2 0.005 ha
Total cost per hectare	2 125 000	4 600 000
Total yield (kg) per hectare	470	495
Cost of production UShs/kg	4526	9289
Profit costs: 20% of production costs	905	1858
Selling price per kg	5430	11 150

Constraints

Logistical difficulties as well as limited funding, especially for transport, made it hard to get the schools, communities and the USAIP team all together for the initial training, which included setting up the demonstration plots. This resulted in varying planting dates for the three schools, with longest delays at Reach-out Primary School. Although planting was done eventually, there was no follow up by staff responsible for the demonstration at Reach-out, one reason being that the demonstration was put on a more extensive school farm plot about 4 km away from the school. This was not easily accessible to interested community members or the teachers. As a result, the crop at Reach-out failed, and only the other two schools' demonstrations were used in the subsequent discussions on yields and profitability of a seed enterprise. In all cases the many other demands on the time of teachers affected their ability to adequately monitor the project.

Lack of project resources also meant there was insufficient technical backstopping. Mobilizing the communities and keeping them interested required commitment on the part of the teachers who had limited incentive to be engaged in such an amount of work. This resulted in low morale. In one case a teacher who kept project records got a job in another school and left without handing the records over. Besides these constraints, there were also challenges of poor soils in the case of Valley St. Mary's, while the drought affected all the schools.

Despite these challenges, and the failure to demonstrate economic viability at the first attempt, the schools had been initially highly motivated to produce commercial seeds so long as guidance was provided, while the farmers were also interested in buying them from schools. It is possible that schools could be an important source of seeds for farmers if this experience is taken into account and future projects are well-grounded and supported.

Conclusions and the Way Forward

Although this action research was unsuccessful in demonstrating the viability of commercial seed production by schools for the selected crop, it was more successful in using schools for agriculture extension and also provided a learning experience from which lessons can be drawn. Despite the challenges of using schools as technology-dissemination centres, the farmers in the communities had a keen interest in the project and were comfortable with the schools, which are their neighbours, as a source of useful information and technology.

Numerous institutions in Kampala and elsewhere were struck by this, and by the enthusiasm with which farmers took up the crops and agronomy, especially sweetpotato. This resulted in a follow-up project on orange-fleshed sweetpotato promotion in Kampala. Apart from the Makerere University Department of Agriculture Extension, the partners included the International Potato Center (CIP), NARO, civil society, and Kampala City Council. Working with eleven schools and communities in the city, two varieties of sweetpotato were being promoted – Ejumula and SPK004 (Kakamega) – which are orange-fleshed and have high β-carotene content, a precursor to vitamin A. Research to assess the nutritional impact of these measures was also undertaken. The World Agroforestry Centre (ICRAF) "Farmers of the Future" and the related Education for Sustainable Development Program, based in Nairobi, are among other institutions that have learned from the study.

In terms of whether urban and peri-urban schools can function as agricultural extension service providers, the project experience demonstrates potential for this to happen but within certain limits. Some key elements are vital for success: commitment of the schools, training and motivation of the teachers, involvement of the community, presence of supporting institutions, and adequate funds.

Schools need not only to be willing to serve the community in a new way by promoting improved farming, but must be willing and able to provide their resources including time, land, personnel, pupils, and readiness to host community or farmers' meetings at the school. The project experience is that teachers mobilized local leaders and the community to participate in the project, managed the demonstrations and answered questions from farmers who visited the demonstrations outside of training and joint learning sessions, but they needed more appreciation of their efforts. The response of urban farmers suggested a demand for such a service aimed at improving food security in homes through learning.

The approach and methods used successfully engaged farmers in identifying their priority crops and setting the scene for the rest of the activities. The multi-institutional, interdisciplinary team was the core of this approach as it provided the different types of expertise farmers needed. Leadership of such a team requires technical expertise in extension and crop production and USAIP provided this, organizing regular meetings for learning, checking on the demonstrations and discussing progress on all aspects among participants. However, resource limitations resulted in inadequate school mentoring, monitoring and documentation and limited transport to get to the schools.

Looking at the way forward, it seems there must be an intervening agency such as USAIP that works as a mentoring institution, identifying the best trainers (researchers and extension workers) to provide the farmers, schoolteachers and pupils with the needed knowledge and skills. Innovative training techniques are required to promote participation, such as discussions, observations, question and answer sessions, practical involvement, team work, exchange visits between schools and promoting interaction among learners and their hosts. While the required people and institutions were available, the financial resources to make it all happen were not.

Involving schools in commercial seed and planting material producers was initiated but would need more intensive inputs, especially training, in order to be effective. The training of teachers and farmers would be best done together in order to ensure transparency. The buyer (farmer) needs to know about the production process and what will come out of it.

It was also the experience of this study that strong institutional linkages were built between schools and the communities that these can be used to pass on other important policy messages. The question is whether the schools can withstand the rigour of producing commercial seed given its agronomic, monitoring, record-keeping and proper data-collection needs. Results of this study, based on a small seed grant, suggest that more research and development funds need to be invested for such a system to be developed through schools.

The farmers (who it should be remembered were mostly women, and therefore concerned about feeding their families) selected and took up crops that improved their household food security. Although the emphasis of the second phase of the project in particular was more on production for a market, the lesson should be drawn that both food security and production for the market are important to farmers. Urban farmers, especially women, need more help in balancing these two aspects.

Finally, a major issue and indeed one of the project's objectives, that of benefits to school students in terms of their knowledge of agriculture, was not examined here as a research question. Our study also did not explore whether informing school pupils can have multiplier effects. There are several possibilities of multiple pathways here, involving interactions and exchanges between students, parents, family and other community members over shorter and longer terms. These processes could not be assessed within the resources and time frame of the project, since a complex evaluation research model would be needed to describe and assess different types

of outcomes. This study made a limited assessment of an innovative and complex technical intervention – to enhance the benefits of urban agriculture through working with schools – by mobilizing available resources in a creative manner.

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