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Promoting potato seed tuber management for increased ware yields in Kapchorwa, Eastern Uganda

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Abstract

The scaling-up of basic seed to provide for clean seed for farmers remains the primary constraint to potato production in Uganda. Consequently, most poor households fail to access healthy potato seed in the highlands of Eastern Uganda, resulting in poor yield and product quality. For this reason AT Uganda Ltd is establishing a sustainable system of farmer-led potato production that is suitable for planting [improved seed] in four sub-counties of the Kapchowa district; namely, Kaptanya, Kaproron, Kaserem and Bukwa. Production is focused on the implementation of locally driven and monitored quality-assured production methods that allow for the traceability of the tubers as they move through cycles of multiplication until delivery to the small-scale farmer. The project has focused on the establishment of 20 primary seed multiplies that undertake quality-assured, identity preserved multiplication for a second phase distribution of tubers suitable for planting and further multiplication by more numerous small scale farmers. Since 2002 the project has established 20 primary potato multipliers and served over 800 small-scale farmers. In support of production by the primary potato multipliers the project has innovated various practices in crop management that aim to provide a best practice, quality assured, identity-preserved pathway of potato multiplication. The main management tools centers on Crop History Sheets that provide a written record of management practices and pest status at the potato stand level. In addition, recognizing the destructiveness of bacterial wilt in potato an on-farm post harvest incubation test for the interception of infected seed that can be implemented by farmers has been tested with promising results. These management materials and practices have evolved from project ideas to farmer- valued practices through several seasons of piloting. At the community level the project has also achieved good recognition. Firstly, the primary multipliers have registered as an association, the Kapchorwa Seed Potato Producers Association, and second the distribution of seed to the small-scale farmer has been integrated through the involvement of the Parish Development Committee to ensure effective targeting of the poorest of the poor.

Key words: Farmer led, primary multipliers, scaling - up

Introduction

Potato is becoming one of the major food security and cash crops in Uganda due to the emerging markets for chips and crisps. Farmers also value its short maturity period when compared to hybrid maize which requires 6-8 months to mature. In Uganda, potato production is centered in the highlands and is dominated by smallholder farms that operate intensive low input agriculture. Currently, on-farm yields and quality levels achieved by smallholders within Uganda is much lower than achieved under optimal conditions. Such low yields have been attributed to linked factors of continuous potato cultivation, a high incidence of pests, a shortage of disease-free seed and a decline in soil fertility. Diseases such as potato blight (*Phytophthora infestans*), bacterial wilt (*Ralstonia solanacearum*) and viruses are recognised as primary constraints to production (Lemaga et al., 1997; Barton et al., 1997. It is significant that these disease constraints are largely seed-borne, and the limited availability of quality-assured seed prevails as the primary constraint. Consequently, small hold farmers select seed from their previous harvest, local market or 'neighbour' that is of unknown health status (Barton et al., 1997) and there is no effective 'flush out' of old seed.

In Uganda the principle of certification is well established and embedded within national policy. But whilst the importance of certification is recognised, the practicalities of implementation are exacting in terms of infrastructure, human resources and costs and thus tend not to lend themselves to developing nations. This is the case for potato seed multiplication that largely proceeds without formal certification. Basic potato seed is made available for further multiplication a seed from the NARO research station at Kalengyere and this is considered to be of the highest quality potato seed available in Uganda.

As noted above, certified seed potato production in Uganda is vastly insufficient to meet national demand. The starting resources of nuclear seed are too small and the process of scaling-up to basic seed and beyond proceeds without rigorous checks on quality. These constraints have been recognised and addressed with varying success through a number of initiatives. Notable amongst these efforts have been the production of nuclear seed under the Foundation

Seed Programme[1] that aimed to provide clean starter material for scaling-up and the potato seed multiplication activities coordinated by Africare and the Uganda National Seed Potato Association (UNSPPA); Alacho et al., 2000). An adage [the next tier in production and distribution] to these systems has been proposed in the Seed Plot Technique (SPT), piloted in Kenya. Under the SPT on-farm seed and table production are separated spatially, with seed production concentrated on a small area of land at a high density of planting, maximizing the use of land and the providing a focus point for management practices. The SPT is most suitable for making use of undersized to small seed (Kinyua et al., 2001).

Current efforts in potato seed development have proved useful in diffusing new varieties or showing the potential of a new approaches to on-farm seed delivery, but continue to struggle to meaningfully address the needs in seed multiplication at the country level. Given the limited availability of basic seed within Uganda it is critical that this seed undergoes at least 2-3 further multiplication stages before it is fated for the table. Inherent in this is the need for engaging farmers as multipliers of seed, maintained seed quality, and a marketing and distribution structure that promotes seed production.

Best practice in potato seed production and marketing are the guiding principles to the DFID CPP project R8104, 'Promoting Potato Seed-Tuber Management For Increased Ware Yields in Kapchowa, Eastern Uganda'.

The overall project objective is to establish a sustainable system of farmer-led seed potato production, marketing and distribution for improved varieties in Kapchorwa District. It is accepted that the potato tubers produced will not be certified and therefore strictly not seed, however, the objective of the project is have a product that is recognized within the community as more suitable for planting than currently available tubers sold as seed informally. In this context the authors use the word seed as that material delivered to the farmers, noting this to be non-certified.

Project milestones include:

- establishment of a limited number of viable commercial seed producers
- establishment of distribution trees for seed produced through to smaller-scale (poorest of the poor) farmers
- provision of training to over 800 farmers and leaders in seed potato multiplication and storage
- establishment of informal pest threshold standards

Methodology

Seed multiplication and distribution

The project set out to develop a mechanism of disseminating improved potato seed to small scale farmers. At the project concept stage it was proposed that to achieve this outreach of seed there must be 1 or 2 multiplications of basic seed obtained from NARO by regional Primary Seed multipliers[2] that subsequently distribute seed to more numerous small-scale farmers for further multiplication as seed and for table consumption.

The second phase distribution of potato by the Primary Seed Multipliers is intended for a further multiplication by the small-scale farmers either by traditional ridge / furrow cultivation or by the seed plot technique[3]. A tuber potato distribution plan was developed by group members and agreed upon with the local authorities in each community. Second phase distribution of potato suitable for planting was overtly orientated towards the poorest of the poor.

Area of study

The project is being implemented in Kapchorwa district in four sub-counties of Kaptanya, Kaproron, Kaserem and Bukwa. From each of these sub-counties, AT Uganda Ltd. it was proposed to work with 10 groups, each consisting of 25 members, giving a total of 800 households in the project area.

Participation of key stake holders

In contracting and providing basic seed to the Primary Seed Multipliers, a repayment loan to the project of 3 times the tubers provided was agreed to guarantee 2nd phase distribution of tubers to the small-scale farmers. It was also a requirement of becoming a Primary Seed Multiplier that the farmer would contribute 50% of the real costs to the building of a diffuse light store for potato storage.

Implementing the project

AT Uganda was formally assisted by the NARO, Makerere University and CAB International, with additional support being received by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) on an ad hoc basis. The methodology used focused on maximizing the involvement of the target groups to ensure their participation cxdtcdfdfgygvdccand ownership of the project i.e. in planning, implementing, monitoring, and evaluation of activities.

Provision of seed to primary seed producers

Basic seed was procured from the NARO station at Kalengyere. Multiplication has focused on the use of the cultivar Victoria, although as the project has progressed other cultivars have been introduced for evaluation by the farmers, notably the NAKPOT lines. Each Primary Seed Multiplier was in receipt of seed through the project on 2 consecutive seasons.

Training of stakeholders

The project looked to provide training to farmers in potato production through a training of trainers approach. Accordingly, through attendance of a series of workshops and field days training was provided for sub-county extension staff, field assistants and the primary potato multipliers. These trained personnel in-turn have been responsible for

training the small-scale farmers at the point of delivery of tubers intend for next seasons planting.

Disease monitoring and Quality monitoring

Through the project various Best Practice potato production materials have been developed and trailed mainly by the Primary Seed Multipliers. These have sort to aid in the proper agronomic management of the crop and in the identification of pests. Most significantly these materials have looked to give guidance in pest risk mitigating actions (control measures) and provide for written verifiable monitoring of farm practices as may be overseen by an external inspection.

As the project develops over seasons it is the expectation that pest threshold levels will become established that are meaningful within the local environment of Kapchorwa. A particular focus has been given to the control of bacterial wilt, due to its significance in seed potato. Accordingly, attempts have been made to monitor bacterial wilt amongst seed lots by ELISA technology[4] and a field based incubation method[5].

Results and discussion

Farmer engagement, provision of training and the evolution of a farmers association. The project has initially focused on the building-up of the Primary Seed Multipliers, recognizing the success of these farmers as pivotal to the second phase distribution of tubers to the small-scale farmers.

Twenty primary

Seed Multipliers have been contracted in the sub-counties of Kaptanya and Kaproron. Discussions with farmers revealed that the sub-counties of Bukwa and Kaserem were largely unsuitable for potato multiplication, but were appropriate for table production. Consequently, Kaptanya and Kaproron have formed the focus for potato seed multiplication, with second phase distribution to all four sub-counties. All the primary potato multipliers have committed to the building of the diffuse light stores.

Training has been provided for the Primary Seed Multipliers and extension staff from the 4 sub-counties. Through workshops, field days, production of promotional material and before and end-of season reviews a high level of proficiency in potato multiplication has been achieved. A critical factor has been the understanding of the different practices associate with potato production for table consumption or seed; notably the need to maiximise tuber production of a size suitable for seed, rather than larger tubers best used as food.

Through these activities the benefit of working as a group became evident and as a result the Primary Seed Multipliers have formed and registered themselves as an association, The Kapchorwa Potato Seed Producers Association (KASPPA). This association is now recognized with the National Agricultural Advisory and Development Services (NAADS) as having the capacity to advise other farmers on potato production.

Primary Seed Multiplication and 2nd phase potato seed distribution

The distinct growing conditions of Kaptanya and Kaproron have impacted on productivity. Kaptanya is characterised by having a higher elevation, steep slopes with a soil type that is a dark heavy loam; whereas Kaproron has a notably flatter topography and a soil type that is red coloured, light textured and sandy. These differences, especially the soil types, have had an important impact on deciding what is the best practice of management. By example, it is evident that the fertilizer requirement of Kaproron will be higher and also events of water stress (shortage) are likely to be more severe for this sub-county. Pests types and incidence are also distinct. These differences have underlined the need to work closely with the farmers in both regions and to advocate management practices that relate to their particular environment.

Production data from the Primary Seed Multipliers is provided in Table 1, with a breakdown on the repayment asked of the farmers and additional tubers purchase by AT Uganda Ltd. From these data the redistribution of tubers to the second phase small-scale farmers is evident from the summation of the repayment and additional purchase by AT Uganda Ltd.

Second phase distribution of the potato produced by the Primary Seed Multipliers has been co-ordianted through the local Parish Development committee. By engaging at the parish level it has been possible to ensure that the second phase distribution is overtly targeted towards the smaller-scale farmers in the sub-counties.

Validation on the efficacy of second phase multiplication has been achieved through sampling a number of farmers per sub-county. These observations have reported that farmers are successfully multiplying the potato they receive from the Primary Seed Multipliers for both future planting and for home consumption / local markets. Most second phase farmers appear to prefer the ridge / furrow method of cultivation as problems have been encountered in ensuring only tuber that is below <25-35mm is used for the Seed Plot Technique. Previous experience has substantiated that the Seed Plot Technique is less suitable for larger tubers because of problems with planting.

Quality assured and traceable production. The central innovative area of the project was the implementation of management practices that were verifiable, allowed for the tracing of tubers back to the producing farm and potato stand and thus provided assurances of quality and identity (quality assured, identity preserved production). As an evolving process with the farmers, various materials in support of planning, pest identification, pest risk mitigation, and verification by external bodies have been piloted. Namely:

Seasonal planning sheet

This aims to promote forward planning amongst the Primary Seed Multipliers so that as a group (KASPPA) they can anticipate demand for resources and realise opportunity

in exploiting markets. With the seasonal planning is the expectation that economy of scale and leverage with suppliers / markets is to be realised in working as a farmer group.

Potato pest symptom class sheets

This does not aim to identify the pest, but aims to identify a symptom class [e.g. green wilt, miss-shapen foliage] and attributes this symptom class to possible causal agents. Additional, substantive non-technical tests are provided that will limit the range of potential pests. The sheets then assign a worst-case scenario as to the potential hazard to tuber health posed by the pests of that particular symptom class, relating this to only those pests known to be present in the area of productions. From this hazard identification, management steps are recommended to mitigate the risk posed. Critical in this is that the management step is not delayed by any need for a more precise pest diagnosis; emphasis is placed on risk mitigation.

Crop History Sheets, with supporting Crop History Field and Storage Map Sheets

This is arguably the main management tool for ensuring the quality of the potato stand in the field and tubers in storage. Each Primary Seed Multiplier is charged with maintaining a diary of his / her farm practice, providing detail of from whom the potato seed was purchased, production information [date of planting, agro-chemical inputs, dehaulming and harvest etc.], an overview drawing of the potato stand for mapping pest symptom classes as observed in the field and storage and a note file for what pest classes were observed.

Each Crop History Sheet relates to one potato stand only and is supported by a primary potato multiplication code (KASPPA code) that is unique. All paper materials in support of a potato stand are referenced by this code. Thus the code is the primary tool for providing traceability of the potato production.

The Crop History Sheets also allow space for comments to be placed by external observers, such as inspectors of crops.

Pest Symptom Class Risk Analysis Sheets

The project envisages that the Primary Seed Multipliers will implement some form of collective monitoring of pests symptom classes and look to accept or reject potato stand production as suitable for seed for further multiplication as seed or as seed for table production. For this purpose early efforts have been initiated with the primary Seed Multipliers to form a field inspection team to undertake field surveys at emergence, mid and late season and in storage. The objective of the inspection teams is to collate numerical data on the occurrence of the pest symptom classes and to align this with the risk known to that pest symptom class. Ultimately, it is expected that various tolerances will be established for the pest symptom classes and acceptance or rejection of the potato as suitable for multiplication or table production can be based.

Pest observations and management

Over the seasons of potato production, pest incidence data has been collated for the 4 sub-counties. These have overwhelmingly shown bacterial wilt to be the major concern, with other pests of virus, potato blight, aphids, and fusarium dry rot being of secondary concern. By example, it has been observed that most farmers are only needing to spray against potato blight once or twice per season, compared the 7+ applications reported from farmers in Kabale.

To counter the problem caused by bacterial wilt potato sourced for multiplication by the Primary Seed Multipliers and that produced by the Primary Seed Multipliers (KASPPA) has been analysed for infection by ELISA technology. However, it is recognised that this technology cannot be supported by the farmers and thus beyond the timeframe of the project an alternative methodology appropriate to farmers was needed. Accordingly, the project has trialed over 2 seasons a field based incubation method for the detection of bacterial wilt infected tubers. Examples of the data recorded from the testing of 2002b harvested tubers is given in Tables 2a and 2b. All these materials were intended for planting in 2003a and, in the case of the NARO and KASPPA generation 1 seed, for further multiplication during the 2003b season.

As illustrated by Table 2a and b observations on the levels of bacterial wilt have been highly supportive of the effectiveness of the management practices implemented by the farmers. Over the 2 seasons to date, amongst the Primary Seed Multipliers it has been agreed that only 3 potato stands were unsuitable for sale for further multiplication as seed with a bacterial wilt infections of above 2.0%. Significantly for these potato stands bacterial wilt was observed as a concern in the field, with supporting observations recorded by ELISA and field incubation tests and then, most importantly, in the subsequent table production. The corroboration of the ELISA technique with the farmer-appropriate field incubation is highly encouraging and suggests that farmers can implement intervention practices that will reduce bacterial wilt from the main sources of seed.

Pest monitoring has been overseen largely by the project partners, with additional oversight provided by the Ministry Agriculture, Animal Industry and Fisheries. These bodies have acted as external validators to the Crop History Sheets and Risk Analysis Sheets. A key part of the project is to encourage this activity to be undertaken through KASPPA and a district level authority. Currently, it is not envisaged that the production by the Primary Seed Multipliers will meet the standard asked of certification. Consequently, the attainment of certification and seed status by KASPPA remains a long-term objective, the realisation of which is highly dependent on national level change in policy and acquisition of infrastructure in support.

Marketing of seed tubers as suitable for further multiplication. During the project the Primary Seed Multipliers have experienced a few disappointments that have

Table 1. Multiplication of potato by Primary Seed Multipliers

Multiplier code	Estimated number of tubers received [loan]		Estimated yields (Number of tubers)		Estimated number of tubers for repayment		Estimated number of tubers sold to AT Uganda Ltd.	
	Season 2003a	Season 2003b	Season 2003a	Season 2003b	Season 2003a	Season 2003b	Season 2003a	Season 2003b
001	6,800	10,800	38,070	40,400	20,400	32,400	17,670	8,000
002	6,800	14,000	53,700	50,000	20,400	42,000	38,000	8,000
003	11,200	19,076	41,600		33,600		8,000	
004	4,500	5,600	21,600	21,300		16,800		4,500
005	5,650	11,200	30,128	41,600	17,040	33,600	13,200	8,000
006	4,000	5,600	14,133	14,000		14,000		
007	4,500	10,500	19,560	40,000	13,500	31,500	6,060	8,500
008	6,800	11,200	34,840	41,600	20,400	33,600	14,400	8,000
009	4,500	13,050	37,360	37,150	13,500	39,150	23,860	8,000
010	4,500	5,600	19,154	21,000		16,800		4,200
011	4,760		39,840	47,150	14,280	39,150	25,560	8,000
012	19,076		80,280		57,228		15,052	
013	9,250		17,000		15,000			
014	19,076		76,208		57,228		10,980	
015	21,851		83,053		65,553		17,500	
016	9,250		50,250		27,750		14,500	
017	9,250		40,000		27,750		2,250	
018	19,076		73,132		57,228		7,904	
019	9,250		46,000		27,750		10,250	
020	9,250		24,000		24,000			
Average Totals	9,467	10,663	41,995	35,420	30,153	29,900	14,074	7,244

Table 2a. ELISA data on bacterial wilt observations recorded on potato tubers planted in season 2003a. * Value set at 95% confidence limit

Farmer name / field locator as received	Source	Season code assigned	KASPPA code or equivalent	Variety	Sample size [No. of tubers]	Probability of detecting a 5% infection*	Probability of detecting a 1% infection*	Unit sub sample size	No. of sub samples	No. of negative reactions	Probable level of infection	Observed positives	Estimated % infection
NARO 35-45mm	NARO	20	No code	Victoria	100	0.99	0.63	10	10	10	0	0	0.00
NARO 45-60mm	NARO	21	No code	Victoria	100	0.99	0.63	10	10	9	0.0105	0	1.05
NARO >60mm	NARO	22	No code	Victoria	100	0.99	0.63	10	10	10	0	0	0.00
Total / mean	**NARO level**				**300**	**1.00**	**0.95**	**10**	**30**	**29**	**0.0034**	**0**	**0.34**
Boshi Alfred	KASPPA 1st	1	001	Victoria	25	0.63	0.18	5	5	5	0	0	0.00
Boshi Alfred 7b	KASPPA 1st	2	001	Victoria	25	0.63	0.18	5	5	5	0	0	0.00
Chemutia Fred 2.5b	KASPPA 1st	3	002	Victoria	25	0.63	0.18	5	5	5	0	0	0.00
Chemutia Fred 7.5b	KASPPA 1st	4	002	Victoria	25	0.63	0.18	5	5	5	0	0	0.00
Chemusto Wilson	KASPPA 1st	14	003	Victoria	46	0.91	0.39	5	9	9	0	1	2.17
Cheruto Edward	KASPPA 1st	5	004	Victoria	25	0.63	0.18	5	5	5	0	0	0.00
Kaptekin Miriam1b	KASPPA 1st	6	005	Victoria	25	0.63	0.18	5	5	5	0	0	0.00
Kaptekin Miriam 7b	KASPPA 1st	7	005	Victoria	25	0.63	0.18	5	5	5	0	0	0.00
Kwemoi Rose	KASPPA 1st	11	006	Victoria	43	0.91	0.39	5	9	9	0	0	0.00
Labou Juliet	KASPPA 1st	10	007	Victoria	44	0.91	0.39	5	9	9	0	0	0.00
Malinga Dick	KASPPA 1st	12	008	Victoria	50	0.91	0.39	5	10	10	0	0	0.00
mikwa Scovia [1] 6b	KASPPA 1st	8	009	Victoria	25	0.63	0.18	5	5	5	0	0	0.00
Somikwa Scovia 23b	KASPPA 1st	9	009	Victoria	25	0.63	0.18	5	5	5	0	0	0.00
Takwar Charles	KASPPA 1st	13	010	Victoria	48	0.91	0.39	5	10	10	0	0	0.00
Chemutai Phyllis	KASPPA 1st	[illegible]	011	[illegible]									
Sub total/mean					**456**	**1.00**	**0.98**	**5**	**92**	**92**	**0.0000**	**1**	**0.22**
Cheruto Edward	KASPPA 2nd	15	004	Victoria	25	0.63	0.18	5	5	5	0	0	0.00
Kwemoi Rose	KASPPA 2nd	16	006	Victoria	41	0.91	0.39	5	8	8	0	0	0.00
Takwar Charles	KASPPA 2nd	17	010	Victoria	50	0.91	0.39	5	10	8	0.0436	0	4.36
Sub total/mean					**116**	**0.99**	**0.63**	**5**	**23**	**21**	**0.0180**	**0**	**1.80**
Total / mean	**KASPPA Level**				**572**	**1**	**0.99**	**5**	**115**	**113**	**0.0035**	**1**	**0.53**
Juliet Labou	UNSPPA	18	No code	Victoria	45	0.91	0.39	5	9	9	0	0	0.0
Wilson Chemusto	UNSPPA	19	No code	Victoria	50	0.91	0.39	5	10	10	0	0	0.0
Total / mean	**UNSPPA level**				**95**	**0.99**	**0.63**	**5**	**19**	**19**	**0.0000**	**0**	**0.00**

Table 2b. Field incubation data on bacterial wilt observations made on tubers planted during the first season of 2003

Farmer name / field locator as receied	Source	Season code as assigned for ELISA	KASPPA code or equivalent	Variety	Number of tubers	Bacterial Wilt positive tubers	% Infection
Boshi Alfred	KASPPA 1st	1	001	Victoria	250	2	0.8
Boshi Alfred 7b	KASPPA 1st	2	001	Victoria	250	2	0.8
Chemutia Fred 2.5b	KASPPA 1st	3	002	Victoria	500	2	0.4
Chemutia Fred 7.5b	KASPPA 1st	4	002	Victoria	500	2	0.4
Chemusto Wilson	KASPPA 1st	14	003	Victoria	500	11	2.2
Cheruto Edward	KASPPA 1st	5	004	Victoria	500	0	0
Kaptekin Miriam1b	KASPPA 1st	6	005	Victoria	500	0	0
Kaptekin Miriam 7b	KASPPA 1st	7	005	Sample not received			
Kwemoi Rose	KASPPA 1st	11	006	Victoria	500	0	0
Labou Juliet	KASPPA 1st	10	007	Victoria	500	4	0.8
Malinga Dick	KASPPA 1st	12	008	Victoria	500	2	0.4
Somikwa Scovia (1) 6b	KASPPA 1st	8	009	Victoria	500	0	0
Somikwa Scovia 23b	KASPPA 1st	9	009	Victoria	500	2	0.4
Takwar Charles	KASPPA 1st	13	010	Victoria	500	0	0
Chemutai Phyllis	KASPPA 1st	No code	011	Victoria	500	0	0
Sub total/mean					**6500**	**27**	**0.42**
Cheruto Edward	KASPPA 2nd	15	004	Victoria	250	0	0
Kwemoi Rose	KASPPA 2nd	16	006	Victoria	500	0	0
Takwar Charles	KASPPA 2nd	17	010	Victoria	500	2	0.4
Sub total/mean					**1250**	**2**	**0.16**
Total / mean	**KASPPA Level**				**7750**	**29**	**0.37**
Juliet Labou	UNSPPA	18	No code				
Wilson Chemusto	UNSPPA	19	No code	Victoria	500	1	0.2
Total / mean	**UNSPPA level**				**500**	**1**	**0.20**

served to focus their attention as to what is important in purchasing seed and conversely where value is to be realised in the market. Firstly, it has proven a poor gauge of value to buy a bag of seed when sold by weight, as this gives no measure of tuber numbers and area that will be planted. Secondly, in the first season of the project the tubers sourced as seed and planted by the primary potato multipliers failed due to a high level of bacterial wilt infection[6]. In discussion with the supplier it was evident that the origin of the tubers provided could not be sourced and it was suspected that a good source of seed had been adulterated. As a result of these experiences KASPPA is working towards practices that market seed by size, stating an approximate number within a bag, with each bag supported by a KASPPA code that provides traceability back to the farmer.

Thus the quality assurance and identity persevered aspects of the project are critical to the sustainability of the farmers as Primary Seed Multipliers and KASPPA. For this to be achieved there has to be a farmer driven price differential between the cost of the potato multipliers product and the informal seed traditionally sourced by farmers. To realise this position in the market various activities have been recognised as necessary. These mainly focus around KASPPA and the promotion of the association as a source of quality potato material. In this context the paper in-support of production is seen as the major marketing tool. Ideas are in development for the use of a KASPPA label to be attached on the bags.

Furthermore, overlying the seed size categorisation is a policy of differentiating prices for each size class and with a premium placed on tubers of an optimal seed size. This practice is important as it encourages the Primary Seed Multipliers to produce tubers of a seed size rather than larger tubers that would be more suited to table consumption. Accordingl, variable pricing that places a premium on potato of a good seed size has already been used by AT Uganda in purchasing potato for distribution to second phase farmers.

To our knowledge this project represents the first attempt to implement such quality assured, identity preserved methods of production for potato in Uganda. The value that the approach is already evident through the ability to intercept material infected by bacterial wilt to secure the good name of the remaining KASPPA produce.

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