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EVALUATION OF SELECTED ELITE POTATO GENOTYPES IN EASTERN UGANDA

G. KIMOONE, BERGA LEMAGA[1] and E. ADIPALA
Department of Crop Science, Makerere University, P.O Box 7062 Kampala, Uganda
[1]PRAPACE, P.O Box 22274, Kampala, Uganda

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ABSTRACT

Potato (*Solanum tuberosum*) yield in Uganda averages 7 t ha^{-1}, which compares poorly with the on-station production (>25 t ha^{-1}). This study evaluated the performance of eight elite and two local potato genotypes under farmer conditions in eastern Uganda. Significant ($P < 0.05$) genotypic, seasonal and location interaction effects were observed. In one season, genotypes 381471.18, Victoria and Nakpot 3 yielded better than the local checks, while during the other two seasons, 381471.18 and Victoria performed better than local checks. Yields across locations and seasons were 25.5, 14.1 and 19.9 t ha^{-1} for each of the 3 seasons. Genotypes 381471.18, Nakpot 3 and Rutuku had higher levels of late blight resistance than the local checks, but 388575.5 and Kabale were more susceptible. Farmer selection criteria of alternative genotypes relied largely on yield potential, market demand, maturity period, skin colour and tuber size, and least on processing qualities of the genotypes.

Key Words: Late blight, *Phytophthora infestans, Solanum tuberosum*

RÉSUMÉ

La production de patate douce *(Solanum tuberosum)* en Ouganda est en moyenne de 7 t par ha^{-1}, qui, comparé faiblement avec la production de champ qui est de (> 25 t ha^{-1}). Cette étude a évalué les performances de huit génotypes de patates douces élites et locale sous les conditions des fermiers dans l'Est de l'Ouganda. Les Génotypes signifiants (P<0,05), les effets d'interaction saisonniers et de location étaient observés. Dans une saison, les génotypes 381471.18, Victoria et Nakpot 3, s'étaient bien reproduits que la semence locale, tandis que pour les autres, deux saisons 38.5,14 et Victoria, avaient bien donné que les produits locaux. Les productions à travers les locations et les saisons étaient de 25.5,14.1 et 19.9 t ha^{-1} pour chacune des trois saisons. Les génotypes 381471.18, Nakpot 3 et Rutuku avaient les niveaux supérieurs de résistance retardée de mildiou que la production locale, mais 388575 et Kabale étaient plus sensibles. Le critère de sélection des fermiers pour l'alternative de génotypes dépendait largement sur la potentialité de la production, de la demande du marché, de la période de maturité, de la couleur de la peau et de la grandeur des tubercules, et enfin des qualités de traitement des génotypes.

Mots Clés: Mildiou retardé, *Phytophthora infestans, Solanum tuberosum*

INTRODUCTION

In eastern Africa, potato (*Solanum tuberosum* L.) is an increasingly important crop for both home consumption and commercial purposes. In Uganda, production increased from 7,000 ha in the 1960s (Mukiibi, 1972) to 64,000 ha lately (FAO, 2000). Currently, the country produces 443,000 tonnes, with yields averaging 7 t ha^{-1} (Adipala *et al.*, 2000). Nevertheless, these yields are far below the world average of 12.4 t ha^{-1} for developing countries, and the 25 t ha^{-1} commonly obtainable at research sites in the country (Hakiza *et al.*, 1997, 2000).

In Uganda, potato productivity and further expansion in production is limited by late blight (*Phytophthora infestans* Mont de Bary), bacterial wilt (*Ralstonia solanacearum*), lack of good quality or improved varieties/seed (Hakiza *et al.*, 1997, 2000; Alacho *et al.*, 2000; Adipala *et al.*, 2001; Berga Lemaga *et al.*, 2001), high cost of inputs particularly disease–free seed, lack of agrochemicals, pests and diseases (Low, 1997) and land shortage (Adipala *et al.*, 2000).

In eastern Uganda, limited availability of clean and improved varieties/seed is the most important problem (Alacho *et al.*, 2000); scarcity of improved quality seed has resulted in farmers purchasing local ware potato for planting. This has led to spread of bacterial wilt, thus limiting available land for seed potato production (Adipala *et al.*, 2002). Therefore, provision of high yielding, disease resistant and quality potato varieties for specific agroecologies is considered key to increased productivity.

Research on varietal development to address increased potato productivity has led to identification of a number of superior genotypes, including the recently released 381471.18, 387121.4, 388575.5, and Nakpot 3 (Hakiza *et al.*, 1997). However, these genotypes have not been tested on-farm especially in eastern Uganda which produces more than a third of the national potato crop (Adipala *et al.*, 2000). The region does not have a good source of planting materials and about 99% of the farmers grow unimproved potato varieties, hence the low yields (<7 t ha^{-1}) in this region (Adipala *et al.*, 2000). This study evaluated the performance of selected potato genotypes on-farm in different potato growing agroecologies of eastern Uganda.

MATERIALS AND METHODS

Study sites and experimental design. The study was conducted in three highland districts of eastern Uganda, namely; Kapchorwa, Mbale and Sironko, for three consecutive seasons beginning with the second (September to December) season of 2001, and during the first (April to August) and second (September to December) seasons of 2002. These seasons are subsequently referred to as 2001B, 2002A and 2002B seasons, respectively. The characteristics of the study sites are shown in (Table 1).

Four on-farm sites, three at higher altitude (>1800 m) and one at mid-altitude (<1800 m) were used for the study. These locations are subsequently referred to as Kapchorwa upper (at Kaptanya 2060 m) and lower (Kaserem 1550 m) for Kapchorwa and Wanale upper (Wanale, 1950 m) and lower (Budwale 1570 m) for Mbale. Additionally, one trial was conducted at Buginyanya Research Station, located at 2000 m. a. s. l. in Sironko District.

For each on-farm trial, a host farmer was identified, and he/she worked jointly with 5-10 other farmers to manage the field trials. To avoid effects of the previous season's treatments on soil fertility, each season had a new field, but in the same location.

At each site, the trials were established in a randomised complete block design (RCBD) and replicated three times. A spacing of 70 cm by 30 cm was used in each plot giving a plant population of 47,619 plants per hectare. One-metre wide alleys were used to separate plots. Normal agronomic practices were carried out including regular weeding, earthing-up, basal application of compound fertiliser at a rate of 80 kg ha^{-1} (N.P.K 17:17:17) and, depending on weather conditions, two to three prophylactic sprays of Dithane M45 (Mancozeb 80% WP, 2.24 kg a.i. ha^{-1}) were administered to control late blight damage.

Farmer selection. Farmers hosting the potato trials in Kapchorwa and Mbale were selected on the basis of willingness and ability to grow new potato genotypes. The other key consideration was possession of enough land to conduct the trials for three consecutive seasons. They, together with other participating farmers, were involved in the management of the trials from planting to harvesting. These and neighbouring farmers assessed genotype performance (i.e., growth and yield). They also listed and ranked the most important criteria used in selecting varieties for production. Farmers also provided qualitative information on the good and bad qualities of the genotypes tested and, hence, their acceptability.

Disease and yield data. Starting at the onset of late blight symptom appearance and thereafter, disease severity assessments were done at a weekly interval using a 1-9 CIP scale, where 1 is equivalent to no infection and 9 is 100% infection (Henfling, 1987). At crop maturity, plants in the two middle rows were harvested and records of tuber weight and plot yields taken.

Late blight severity data were used to calculate areas under disease progress curves (AUDPC) which were subsequently standardised to give relative AUDPC (Campbell and Madden, 1990). The RAUDPC, yield and yield components data were then subjected to analysis of variance (ANOVA) using Genstat 5 Release 3.2 package and treatment means separated at $P<0.05$ significance level. Data for each season and location were initially analysed separately but were subsequently pooled for across location and seasonal analysis. Furthermore, information from farmer evaluations was encoded and, subsequently, analysed using the Statistical Package for Social Scientists (SPSS) computer package. Factor analysis with varimax rotation and Keiser normalisation (Keiser, 1958) was then undertaken to identify any significant correlationships between the criteria variables.

RESULTS

Genotype reaction to late blight disease. Relative areas under disease progress curves (RAUDPCs) showed significant ($P<0.001$) interaction between genotype and location ($P < 0.05$), and location x season ($P < 0.01$) (Table 2). The disease was negligible during the first season of 2002, especially at mid-elevation sites, but was severe in 2002B. In the three high altitude sites, disease was recorded mostly on cv. Kabale and least on 381471.18, Nakpot 3 and Rutuku. Entry 388575.5 was highly susceptible at Buginyanya and Kapchorwa upper, but not at Wanale upper

TABLE 1. General characteristics of the five study sites in eastern Uganda

Location	District	Altitude (m.a.s.l.)	Rainfall (mm)	Minimum temperature ^{o}C	Maximum temperature ^{o}C	Soil type
Buginyanya	Sironko	2000	1500	13.4	24.9	Haplic Andosols (Red sandy-clay loams)
Kapchorwa upper	Kapchorwa	2060	1500	10.1	19.2	Vartisols (Red sandy-clay loams)
Wanale upper	Mbale	1950	1500	12.5	25.0	Mollic and Umbric Andosols
Kapchorwa lower	Kapchorwa	1570	1191	15.0	27.5	Haplic Andosols (Dark-brown humose loams)
Wanale lower	mbale	1550	1191	15.0	27.5	Mollic Andosols (Dark-brrown clay loam)

Source: Mukiibi (2001)

TABLE 2. Interactive effect of potato genotype and location on relative areas under disease progress curve (RAUDPC) of late blight in eastern Uganda

Genotype	Location			Mean
	Buginyanya	Kapchorwa upper	Wanale upper	
381471.18	8.6	6.8	6.1	7.2
387121.4	9.9	4.7	7.2	7.3
388575.5	15.7	14.1	8.7	12.8
Nakpot 3	6.1	3.9	6.6	5.6
Victoria	15.0	9.1	9.2	11.1
Kabale	19.6	12.8	16.5	16.3
Rutuku	5.4	4.3	7.7	5.8
Mean	11.5	7.9	8.7	9.4
SED (L x G)	-	-	-	2.4
CV (%)	-	-	-	44.7

(data not shown). Also, relative AUDPCs varied significantly among clones in the different locations (Table 2).

Tuber set. During 2001B, Nakpot 3 produced the highest number of tubers per plant at Buginyanya (14 tubers/plant) and at Wanale, but at Kapchorwa upper Victoria performed best (11 tubers/plant) (Table 3). *Alga,* a local check had the least number of tubers at Kapchorwa lower (2 tubers/plant). Overall, the best genotypes for 2001B were Nakpot 3 and Victoria, averaging 11 and 10 tubers, respectively; Kabale and Rutuku had the least tubers per plant. During 2002A, genotype 388575.5 and *Maboni,* a local check, had the highest tuber multiplication rate at Kapchorwa lower and Wanale upper. However, across locations, Victoria had the highest (6) and Rutuku and Kabale the least tubers per plant. In 2002B, Nakpot 3, 387121.4, Victoria and Kabale had the highest tuber numbers. Across locations and seasons, Nakpot 3 (8 tubers/plant) and Victoria (7 tubers/plant) had the highest tuber set, while Rutuku with 4 tubers/plant had the poorest tuber set.

Tuber weight. The three-way location x season x genotype interaction was significant ($P < 0.022$) on tuber weight (Table 4). In 2001B, Buginyanya produced the heaviest tubers (91.8 g) followed by Kapchorwa upper (81.0 g) and the least was in Wanale lower (46.1 g). Genotypes with the best tuber bulking were 381471.18, Rutuku, Kabale and Victoria with 101.1, 83.4, 76.2 and 67.9g across locations, while the poorest were Nakpot 3, 388575.5 and local checks (*Maboni* and *Alga*). Similar results were obtained in 2002. Genotype 381471.18 gave consistently highest tuber weights at all locations in the two seasons (2002A and 2002B), while Nakpot 3 and Local checks performed poorest. Across seasons and locations, 31471.18 recorded highest tuber weights followed by Rutuku (76.7 g); Victoria (71.9 g) and Nakpot 3 (45.9 g) had the least tuber weights.

Tuber yield. The genotype x season x location interaction effect was significant ($P<0.001$) (Table 5). In 2001B, genotype 381471.18 had the highest yields in Buginyanya, Kapchorwa upper and Wanale upper, while Victoria produced the highest yields at Kapchorwa lower. The highest mean yields were produced at Kapchorwa upper (28.6 t ha^{-1}) and Buginyanya (25.3 t ha^{-1}), and the least at Wanale lower (13.4 t ha^{-1}). During 2002A, Buginyanya had the highest yields, followed by Wanale upper. The highest yielding genotypes were 381471.18 for Buginyanya, Wanale upper, Kapchorwa upper and Wanale lower and 388575.5 for Kapchorwa lower. The poorest yielding genotypes were Kabale (8.8 t ha^{-1}) and *Alga*, a local check (7.1 t ha^{-1}).

The 2002B results revealed a different pattern from that of 2002A. Genotype 381471.18 consistently outyielded all other genotypes in all sites, except at Kapchorwa lower where 388575.5 performed better than the rest. The highest mean tuber yield was recorded at Kapchorwa upper, while the lowest were at Buginyanya (Table 5). The combined means over locations for 2001B identified 381471.18 (28.7 t ha^{-1}) and Victoria (28.2 t ha^{-1}) as the best performing genotypes and Rutuku (14.4 t ha^{-1}) as the lowest yielder. In 2002A and 2002B, genotypes 381471.18 (19.6 and 22.2 t ha^{-1}) and Victoria (17 and 24.7 t ha^{-1}), respectively, ranked best, while Kabale yielded 9.4 t ha^{-1} least in 2002A and Rutuku (13.7) t ha^{-1} in 2002B.

Across locations and seasons, genotypes 381471.18 (23.5 t ha^{-1}) and Victoria (23.3 t ha^{-1}) were the best yielders and Rutuku (12.9 t ha^{-1}) the least. The highest yielding local check was *Maboni* (18.1 t ha^{-1} at Wanale). In 2002A, it yielded higher than 387121.4, 388575.5, the new introductions and Nakpot 3, a recently released genotype. Generally, yields of most clones were lower in 2002A compared to yields in 2001B and 2002B seasons.

Farmer evaluation. Table 6 gives the criteria used by farmers to choose between alternative potato genotypes in eastern Uganda. Tuber yield, market demand and maturity period were the most important selection criteria. Most farmers preferred high yielding and early maturing varieties. Tuber size, shape skin colour and taste of tubers were also ranked highly by farmers. Although storage characteristic of the genotype was ranked highly by farmers in Kapchorwa, it was considered less important in Wanale. Attributes that were considered less important

TABLE 3. Interactive effect of season and location on number of tubers per plant of eight potato genotypes grown in eastern Uganda

Genotype	Buginyanya				Kapchorwa - upper				Wanale - upper				Kapchorwa - lower				Wanale - lower				Overall mean
	1B	2A	2B	Mean	1B	2A	2B	Mean	1B	2A	2B	Mean	1B	2A	2B	Mean	1B	2A	2B	Mean	
381471.18	6.5	5.6	4.0	5.4	8.9	4.7	5.7	6.4	5.8	6.8	6.3	6.3	5.0	5.0	4.0	4.7	6.7	4.7	5.0	6.1	5.7
387121.4	8.7	6.2	6.0	7.0	9.2	4.3	6.3	6.6	7.7	4.6	9.3	7.2	6.9	6.9	8.0	7.3	5.2	4.5	5.0	4.9	6.4
388575.5	7.5	5.0	5.7	6.1	8.5	4.5	7.0	6.7	7.9	5.2	4.4	5.8	6.4	6.4	8.5	7.1	5.4	4.1	6.7	5.4	6.4
Nakpot 3	13.5	6.8	9.7	10.0	9.3	4.5	8.3	7.4	9.8	4.7	9.6	8.0	10.0	10.0	10.3	10.1	10.9	4.4	7.0	7.4	8.2
Victoria	9.5	7.3	7.6	8.1	10.5	5.0	8.0	7.8	7.6	6.1	6.7	6.8	11.0	11.0	8.0	10.0	9.5	4.8	5.2	6.5	7.5
Kabale	4.5	3.7	6.7	5.0	7.6	3.3	8.0	6.3	6.4	4.9	6.0	5.8	6.5	6.5	7.0	6.7	5.5	4.7	5.0	5.1	5.5
Rutuku	4.2	4.4	4.0	4.2	7.5	4.2	8.0	6.6	4.3	4.0	3.7	4.0	5.0	5.0	3.7	4.6	4.9	3.8	3.7	4.1	4.4
Local[1]	-	-	-	-	7.5	6.0	5.3	6.3	8.2	5.6	5.0	6.3	2.0	2.0	-	1.3	5.7	4.5	5.0	5.1	-
Mean	7.8	5.6	6.2	6.5	8.6	4.6	8.0	7.1	7.2	5.2	6.5	6.3	6.6	6.6	6.5	6.6	6.7	4.4	4.5		6.2
SED	1.9	0.6	0.9		1.2	0.8	7.1		1.1	0.4	1.3		0.7	0.7	1.3		1.0	NS	0.8		1.1
CV (%)	29.7	13.5	18.7		17.1	20.7	15.3		17.8	10.3	24.3		16.7	16.7	22.2		19.1		19.1		21.5

[1]1B = second rain season of 2001 (September-December) ; 2A = first rain season of 2002 (March-June); and 2B = second rain season of 2002 (September-December),
[2]Local checks excluded from combined analysis means, as they are different varieties for different locations; [4]1 = *Alga* for Kapchorwa or *Maboni* for Wanale-Mbale

TABLE 4. Tuber weight (g) of eight potato genotypes in three seasons at five locations in eastern Uganda

Genotype	Buginyanya				Kapchorwa - upper				Wanale - upper				Kapchorwa - lower				Wanale - lower				Overall mean
	1B	2A	2B	Mean	1B	2A	2B	Mean	1B	2A	2B	Mean	1B	2A	2B	Mean	1B	2A	2B	Mean	
381471.18	116.3	85.3	120.0	107.2	126.0	126.0	120.4	124.1	118.2	101.6	108.8	109.5	72.2	103.4	92.3	89.3	72.8	57.2	67.5	65.8	99.2
387121.4	97.1	62.1	55.0	71.4	71.3	80.4	89.0	80.2	69.9	61.9	43.0	58.3	45.4	49.6	54.3	49.8	50.5	48.7	64.0	54.4	62.8
388575.5	78.9	50.3	48.6	59.3	64.5	72.3	62.9	66.6	60.8	44.6	75.1	60.2	40.3	64.8	65.4	56.8	38.2	48.8	65.6	50.9	58.7
Nakpot 3	48.1	46.8	31.0	42.0	56.8	69.9	55.8	60.8	51.7	40.4	35.1	42.4	43.3	58.7	37.2	46.4	32.9	44.7	36.4	38.0	45.9
Victoria	71.6	84.0	54.5	69.9	88.5	83.9	98.4	90.3	74.8	80.3	74.3	76.5	55.2	75.2	61.1	63.8	49.5	53.1	74.0	58.9	71.9
Kabale	115.6	65.7	57.0	79.4	73.7	112.0	64.8	83.5	84.4	38.8	54.3	59.2	57.0	96.0	55.3	69.4	50.3	47.7	73.2	57.1	69.7
Rutuku	115.2	71.7	75.0	87.3	98.6	96.7	89.8	95.0	99.3	62.2	65.2	75.6	61.0	83.1	79.1	74.4	42.9	47.2	63.4	51.2	76.7
Local[1]	-	-	-		68.6	41.5	63.1	57.7	57.7	68.3	51.0	59.0	24.5	39.4	-	21.3	31.6	43.3	35.9	36.9	-
Mean	91.8	66.6	63.1	73.8	81.0	85.3	80.5	82.3	71.1	62.3	61.4	64.9	49.9	71.3	63.5	61.6	46.1	48.8	60.0	51.6	69.3
SED	17.6	NS	10.1		12.6	14.9	8.6		6.9	9.7	6.6		14.8	NS	13.6		9.8	2.3	7.3		3.7
CV (%)	23.4		19.5		19.1	21.4	13.1		11.0	19.0	13.2		36.3		26.2		25.6	5.9	14.8		25.2

[1]1B = second rain season of 2001 (September-December) ; 2A = first rain season of 2002 (March-June); and 2B = second rain season of 2002 (September-December),
[2]Local checks excluded from combined analysis means since different checks were used in the different locations; [4]1 = *Alga* for Kapchorwa or *Maboni* for Wanale-Mbale

TABLE 5. [illegible] yield (t ha^{-1}) of eight potato genotypes in three seasons at five locations in eastern Uganda

Genotype	Buginyanya				Kapchorwa - upper				Wanale - upper				Kapchorwa - lower				Wanale - lower				Overall mean
	[1]1B	2A	2B	Mean	1B	2A	2B	Mean	1B	2A	2B	Mean	1B	2A	2B	Mean	1B	2A	2B	Mean	
381471.18	34.2	30.0	21.1	28.4	45.5	17.6	27.3	30.1	26.9	28.9	32.5	29.4	16.7	8.9	14.6	13.4	20.3	12.4	15.3	16	23.5
387121.4	31.3	17.1	16.1	21.5	31.7	10.1	23.1	21.6	23.4	13.0	17.8	18.1	9.8	5.0	19.7	11.5	11.5	8.2	15.5	11.7	16.9
388575.5	22.7	11.1	12.7	15.5	22.8	9.7	20.0	17.5	16.2	10.8	15.1	14.0	12.9	12.3	26.1	17.1	7.5	8.9	19.3	11.9	15.1
Nakpot 3	26.7	19.8	14.2	20.2	18.8	9.5	21.3	16.5	17.9	9.0	16.1	14.3	19.3	6.1	18.7	14.7	16.3	8.9	12.7	12.6	15.4
Victoria	25.7	27.7	19.5	24.3	40.2	13.2	38.3	30.6	26.0	23.5	24.3	24.6	26.8	9.6	22.3	19.6	22.6	11.3	18.9	17.6	23.3
Kabale	22.7	10.0	16.2	16.3	26.6	11.6	23.0	20.4	21.7	8.8	14.6	15.0	15.6	7.1	18.9	13.9	12.3	10.3	14.5	12.4	15.8
Rutuku	13.7	13.3	12.6	13.2	23.9	12.3	20.7	19.0	16.2	11.8	11.9	12.8	9.0	6.5	11.9	9.1	8.8	8.3	16.8	11.3	12.9
[2]Local	-	-	-	-	18.6	7.1	21.5	15.7	20.0	18.0	10.4	16.1	1.5	3.5	-	1.7	7.9	8.9	19.0	11.9	-
Mean	25.1	17.5	16.1	19.6	28.5	11.4	24.4	21.4	21.0	15.5	17.8	18.1	13.9	7.4	18.9	13.4	13.4	9.7	18.4	13.8	17.6
SED	5.1	2.2	2.9		5.9	2.2	3.1		3.0	2.6	2.3		3.1	2.5	4.0		2.7	0.8	1.8		1.1
CV (%)	25.1	15.1	22.4		25.7	24.1	15.8		17.5	20.2	16.0		27.7	38.8	25.7		24.3	9.6	11.9		29.0

[1]1B = second rain season of 2001 (September-December) ; 2A = first rain season of 2002 (March-June); and 2B = second rain season of 2002 (September-December),
[2]Local checks excluded from combined analysis means since different checks were used in the different locations; 1 = *Alga* for Kapchorwa or *Maboni* for Wanale-Mbale

included processing quality for Kapchorwa farmers and drought tolerance, processing quality and storage characteristics for Wanale farmers.

Since most of the potato attributes were considered important by farmers in their selection criteria, Principal Component Analysis with Varimax rotation and Kaiser normalisation (Kaiser, 1958) was performed to group the most correlated attributes. The results of the analysis revealed four factors that collectively accounted for about 75% of the variation in farmers' responses (Table 7). Factor 1 comprised of seven variables, among others which included tuber skin colour, tuber size, flesh colour and resistance to diseases, drought tolerance, storage characteristics and processing qualities of the tubers. Factor 2 comprised of two attributes, tuber shape and eye depth of the tubers. This factor had the least factor mean and, therefore, is less important compared to other factors considered. Factor 3 had three variables including maturity period, taste and suitability of the genotype to local growing conditions. Factor 4 captured two attributes, yield and market demand of the genotypes. Factor 4 with the highest factor mean and low % variation was the most important in influencing the farmers' selection/choice of a particular genotype.

The ranking of genotypes by farmers in terms of preference and acceptance was not consistent across locations (Kapchorwa versus Mbale-Wanale). Although 381471.18 and Victoria were considered best in both locations, genotypes 388575.5 and Nakpot 3 interchanged positions across locations (Table 8). Also, while *Maboni*, a widely grown local variety was ranked sixth in Wanale, the other local variety *Alga* at Kapchorwa was ranked lowest, while 387121.4, a new introduced genotype, was ranked poorest at both locations.

DISCUSSION

The significant genotype x season x location interaction observed for potato yield and yield components indicated that performance of the genotypes changed significantly from season to season and from location to location. This was probably due to different weather conditions experienced each season and soil types.

Overall, higher yields were obtained during

2001B and 2002B, despite high late blight epidemics compared to 2002A with negligible late blight. This could be due to the fact that the same conditions that favoured tuber bulking were also conducive for late blight disease development. Similarly, in a study conducted in southwestern Uganda, yields were higher in the early-planted potato crop, which also had higher late blight

TABLE 6. Criteria used by farmers in eastern Uganda to select a potato variety

Criterion	Kapchorwa		Wanale-Mbale		Combined means over locations	
	Mean score	[1]SD	Mean score	SD	Mean score	SD
Yield	4.95	0.23	4.93	0.26	4.91	0.29
Maturity period	4.89	0.32	4.60	0.51	4.76	0.43
Skin colour	4.05	0.23	4.90	0.35	4.38	0.49
Tuber shape	3.65	0.50	3.40	0.74	3.53	0.61
Tuber size	3.94	0.23	4.70	0.49	4.29	0.52
Flesh colour	3.74	0.65	3.00	0.00	3.41	0.61
Resistance to diseases	4.94	0.23	3.40	0.51	4.12	0.88
Storage characteristics	4.53	0.51	2.93	0.26	3.82	0.90
Taste	4.53	0.51	4.40	0.51	4.47	0.51
Market demand	4.74	0.65	4.90	0.35	4.79	0.54
Eye depth	3.42	0.51	3.40	0.51	3.38	0.55
Processing qualities	2.26	0.65	1.40	0.51	1.88	0.73
Drought tolerance	4.58	0.51	1.93	0.26	3.40	1.4
Suitability to environment	4.94	0.23	4.00	0.76	4.41	0.78

[1]SD = Standard deviation. Scale 1-5, where 1 = not important and 5 = very important

TABLE 7. Factors influencing farmer selection of a given potato genotype in eastern Uganda

Attribute	Factor			
	1	2	3	4
Drought tolerance	0.904			
Skin colour of tubers	0.878			
Storage characteristics	0.854			
Tuber size	0:842			
Resistance to diseases	0.777			
Flesh colour	0.736			
Processing qualities	0.592			
Tuber shape		0.850		
Eye depth of tubers		0.827		
Maturity period			0.780	
Taste			0.631	
Suitability of genotype to growing conditions			0.579	
Yield potential				0.852
Market demand				0.805
Factor mean	3.61	3.45	4.55	4.85
Eigen value	5.03	2.38	1.58	1.48
% variation	36.00	16.98	11.26	10.58
Cumulative %	36.00	52.87	64.13	74.71

Score scale = 1-5; where 1 = not important and 5 = very important

TABLE 8. Ranking of eight potato genotypes based on farmer acceptability in eastern Uganda

Genotype	Kapchorwa							
	Tuber size	Tuber shape	Skin colour	Flesh colour	Taste	Eye depth	Total score	Rank
381471.18	4.90	4.25	4.15	4.15	4.15	3.90	25.50	1
387121.4	3.60	3.60	3.40	4.00	3.20	3.15	20.95	6
388575.5	4.00	3.79	4.60	4.32	3.37	3.00	22.48	3
Nakpot 3	4.00	3.90	4.00	3.30	3.65	3.50	22.35	4
Victoria	4.85	4.30	4.15	4.05	3.85	3.55	24.75	2
Kabale	4.25	3.30	3.75	3.70	2.25	2.05	19.30	7
Rutuku	3.70	3.60	3.65	3.65	3.55	3.45	21.60	5
Local check	3.15	3.05	3.20	3.35	3.20	3.00	18.95	8
SED(0.05)	0.19	0.17	0.18	1.30	0.17	0.20		

Genotype	Wanale-Mbale							
	Tuber size	Tuber shape	Skin colour	Flesh colour	Taste	Eye depth	Total score	Rank
381471.18	4.95	4.57	4.66	4.57	4.70	4.95	28.10	1
387121.4	2.85	3.09	2.57	3.05	3.19	2.95	17.70	8
388575.5	3.86	3.95	4.66	4.09	4.47	3.29	24.32	4
Nakpot 3	3.48	4.33	4.60	4.33	4.38	4.31	25.43	3
Victoria	4.47	4.09	3.66	4.25	4.33	4.71	25.49	2
Kabale	4.14	3.52	3.14	2.47	3.62	2.14	19.03	7
Rutuku	3.05	3.95	3.95	4.14	4.90	4.10	23.59	5
Local check	2.95	3.33	4.43	4.38	4.52	2.71	22.32	6
SED(0.05)	0.20	0.17	0.99	0.15	0.08	0.14		

Score scale = 1-5; where 1 = not important and 5 = very important
Local checks = *Alga* for Kapchorwa and *Maboni* for Wanale-Mbale

attack (Kankwatsa, 2001). Furthermore, although Victoria had higher relative AUDPCs, it still out-yielded other genotypes like 387121.4 and Rutuku with lower relative AUDPCs. This could be because Victoria is an early maturing genotype and, hence, peak disease development occurred after tuber bulking.

Genotypes 381471.18, 387121.4 and Nakpot 3 were more resistant to late blight and gave higher yields compared to the farmers' local cultivars, *Alga* and *Maboni*. However, 38857.5 and Kabale, were not resistant to late blight as their relative AUDPC levels were higher than for other genotypes, including the local checks. The differences in disease severity are probably due to genetic differences among the potato genotypes. The results also suggest that some of the local genotypes have some desirable attributes, which could be improved through concerted research efforts.

The significant genotype x location interaction indicated that some genotypes performed differently at different locations. For example, although genotype 388575.5 was ranked in the bottom position (6-7), in most of high altitude environments on yield basis, the same genotype was ranked in the top position at Kapchorwa lower and Wanale lower, the mid-elevation sites. This could be due to the fact that at high altitude (Kapchorwa upper, Buginyanya and Wanale upper), this genotype was highly susceptible to late blight disease which caused significant yield reduction. The disease was negligible at Kapchorwa lower, a mid-altitude site; hence, the genotypes' assimilate accumulation was better. Contrary to this observation, 381471.18 which ranked first at all high altitude locations, was second and third last at mid-elevations. These findings are in agreement with Cock (1985) that stability in field performance of genotypes is influenced by prevailing biotic and abiotic stresses, such as differences in soil type, fertility and rainfall. Additionally, the significant variation in tuber yield observed among genotypes across altitudes reflected their varietal reaction to stress conditions. This suggests a genetic variability for assimilate partitioning to tubers at different stress conditions, thus, supporting early findings of Bhagsari *et al.* (1994), Mendoza and Estrada (1979) and Ewing (1981).

Results from farmer evaluations indicate that when confronted with new varieties, farmers often compare them with those currently being grown on the basis of the preference criteria, mainly productivity, maturity period and suitability of the genotype to growing conditions. Most farmers prefer high yielding, adaptable and early maturing varieties, which provide food and income early during the hunger periods in the early months of the planting season and also release land for other crops the following season. Marketability of the potato tubers was also ranked highly as farmers mentioned that consumers largely prefer large tubers and shallow eyes with white to cream skin colour. Consequently, tuber size, shape and skin colour were important in varietal selection. This suggests that consumer preference can ultimately affect farmers' adoption of a particular variety. Ndolo *et al.* (2001) working on sweet potato selection in Kenya reported similar results. Based on the above findings we recommend that genotype 381471.18 be promoted for adoption in eastern Uganda and *Maboni,* the local cultivar, be cleaned-up for farmer use.

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