SUBMISSION TO
THE VARIETY RELEASE COMMITTEE
FOR RELEASE OF SWEETPOTATO VARIETIES
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National Crops Resources Research Institute
(NaCRRI)
P.O. Box 7084
Kampala, Uganda

NATIONAL AGRICULTURAL RESEARCH ORGANIZATION
(NARO)

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R.O.M. Mwanga, B. Kigozi, J. Namakula, I. Mpembe, C. Niringiye, S. Tumwegamire
R. Gibson and C. Yencho

National Crops Resources Research Institute
(NaCRRI)
P.O. Box 7084
Kampala, Uganda

NATIONAL AGRICULTURAL RESEARCH ORGANIZATION
(NARO)

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INTRODUCTION

Importance of previously released cultivars

This is the fifth time for the National Sweetpotato Program to officially release sweetpotato cultivars. A total of 19 cultivars have been previously released in groups in different years by the Ugandan Plant Variety Release Committee. There were five cultivars released in 2007, namely, NASPOT 7 (Namulonge sweetpotato 7), NASPOT 8, NASPOT 9 O (Namulonge sweetpotato 9 orange-fleshed), NASPOT 10 O and Dimbuka-Bukulula (Mwanga et al. 2009). Those released in 2004 were two orange-fleshed sweetpotato (OFSP) cultivars, Ejumula and Kakamega (SPK004) (Mwanga et al. 2007). The NASPOT series 1 to 6 were released in 1999 (Mwanga et al. 2003). The first sweetpotato cultivars to be released by the program in 1995 were six, namely, New Kawogo, Sowola, Tororo 3, Bwanjule, Tanzania, and Wagabolige (Mwanga et al. 2001).

New Kawogo, Tanzania and NASPOT 1 have gained importance in local Ugandan markets and in export trade to Europe, especially the UK and the Netherlands. Ejumula and SPK004, NASPOT 9 O (Vita) and NASPOT 10 O (Kabode) are gaining importance as a result of promotions by different stakeholders to combat vitamin A deficiency (Yanggen and Nagujja, 2006; NARO, 2007; Mwanga et al. 2008). Wagabolige and Tanzania have been used as parents for high dry matter (>30%), sweetpotato virus disease (SPVD) (Mwanga et al. 2002a) and nematode resistance (Cervantes-Flores et al. 2002, 2008a, b) in hybridization schemes at the International Potato Center (CIP), Lima, Peru, North Carolina State University (NCSU), Raleigh, USA and NaCRRI, Uganda. The two parents are also known because of the genetic mapping work jointly conducted by NACRRI/NARO, CIP, NCSU, and the Austrian Research Center, Seibersdorf (ARCS) in Austria (Kriegner 2003, Mwanga et al. 2002b, Cervantes-Flores et al. 2008a, b). NASPOT 5, NASPOT 9 O and NASPOT 10 O are used in Uganda as parents for high dry matter, high SPVD field resistance and high beta-carotene. New Kawogo contains in its root latex, chemical compounds (hexadecacyl esters and hydroxycinnamic acids) that form the basis for resistance in sweetpotato to the sweetpotato weevil (SPW), *Cylas punticollis* that may be increased through breeding to develop high resistance to SPW (Stevenson et al. 2009). The remaining cultivars are of importance in specific agroecologies in the country

Background to sweetpotato participatory breeding (PPB) trials in Uganda

The National Sweetpotato Program in Uganda emphasises breeding for virus resistance, aiming to produce sweetpotato genotypes with desirable characteristics in a genetic background with resistance to sweetpotato virus disease (SPVD), the most devastating disease of the crop. The intention of using the PPB approach was to verify whether the breeding selection cycle would be shortened compared to the so called conventional breeding scheme used by the breeding program. Breeding populations (botanical seed) of sweetpotato were produced in a polycross nursery of 24 parents at Namulonge.

Selection rates in 2003/2004 varied from 0 to 94% in seedling trials on-station and in participatory breeding trials on-farm (Table 1). The selection rate of 0 was due to high virus pressure at Namulonge (NaCRRI) in Uganda, Kyaka and Nyungwe in northern Tanzania, monkeys at Kyaka, as well as drought at Nyungwe. The on-farm participatory

breeding trials in northern Tanzania were part of the collaborative project with the Natural Resources Institute (NRI), in the UK led by Dr. Richard Gibson. The Sweetpotato Program in Uganda under the McKnight Project generated breeding populations for the NRI project. The selection rates were tracked in breeding trials in the early cycles of sweetpotato plant selection on station under high SPVD pressure and moderate Alternaria pressure at NaCRRI, and under low SPVD and moderate Alternaria pressure at the National Semi Arid Agricultural Research Institute (NaSARRI), and in on-farm participatory breeding and selection.

Participatory breeding trials

In the sweetpotato participatory breeding (PPB) trials (Gibson et al. 2008), started May 2003, segregating populations (pre-germinated botanical seed) were given to six groups, three in each of three districts, namely, Luwero, Mpigi, and Kiboga in central Uganda, and three in northern Tanzania, to select superior sweetpotato clones. Each group, including the groups in Tanzania, received 2,000-6,000 seed of at least two families depending on the availability of scientific staff, technicians, and willingness of the groups to handle the PPB trials. The seeds were scarified at NaCRRI in the entomology laboratory using concentrated sulfuric acid for about 40 minutes, washed in running tap water, and were pre-germinated on moist filter paper in petri plates overnight. The pre-germinated seeds were given to the farmer group the following day to establish a nursery bed (seedling nursery). In the nursery bed the seeds were planted at a distance of 10 x 20 cm in 2003. Only vigorous, promising healthy looking mature seedlings were selected. Selection rates in these trials in the second year ranged from 0% where there were problems of drought (Kiboga in Uganda and Kanyigo in Tanzania), and monkeys (Kyaka in Tanzania) to 30.6% at Balikyewunya in Mpigi. The 0% selection rate on station at NaCRRI was due to SPVD high pressure unlike in the PPB trials where natural disasters were the cause of the 0 clones selection in those locations. The research team retrieved (rescued) eight remaining sweetpotato clones in Kiboga that the farmers had abandoned in the PPB trial due to severe drought. The 8 clones were multiplied at NaCRRI, and later taken back and evaluated by farmers in Kiboga.

In 2005, the selected remaining sweetpotato advanced clones were evaluated in PPB trials in two districts:

(a) Luwero [(number of farms that hosted trials = 3 (each farm had a group of 6-7 farmers), number of ridges = 3 (15 plants per ridge), 1 m between ridges, 30 cm between plants on ridge, number of replications at each farm = 3, check varieties: Dimbuka and NASPOT 1. Ranking was done by 12 farmers (8 females, 3 males): 1 = best (most preferred); 8 = least preferred (Taste evaluation based on pair-wise selection)].

(b) Mpigi [Number of farms that hosted trial = 1, number of farmers participating in trial = 17 (10 females, 7 male), number of ridges =3 (25 plants per ridge), 1 m between ridges, 30 cm between plants on ridge, number of replications at the farm = 3. Ranking was done by 11 farmers (8 females, 3 males): 1 = best (most preferred); 8 = least preferred (Taste evaluation was based on pair-wise selection, and selecting one at a time from all the entries].

Sweetpotato clones considered superior by the farmers and originally selected in Luwero in the PPB trials end with L in their clone name, and those originally selected in Mpigi end with M. These superior clones were exchanged at the third clonal generation (March 2005) evaluation stage. Towards the conclusion of the PPB trials clones selected in Kiboga and included in the multilocaltional trials end with the letter K. The parental sweetpotato clones that produced the seed in the polycross nursery were New Kawogo, Wagabolige and Bunduguza, abbreviated as NKA, WAG and BND, respectively. On each farm where the PPB trial was conducted, the most popular, high yielding farmers' sweetpotato cultivar was used as a check. The number of local checks varied across the farmer groups from one to three, but the most common checks were Magabari, NASPOT 1, Araka White, New Kawogo, Otada, Kyabafuruki and Dimbuka.

Promising clones in PPB trials. The promising advanced clones in the PPB trials in Luwero and Mpigi were NKA102M, NKA103M, NKA1081L, and NKA318L, and these were selected in both districts, NKA259L was selected in Luwero but not in Mpigi. BND145L was selected in Mpigi but dropped in Luwero. The reasons for ranking high and selecting the clones were: attractive skin color (purple/red) and flesh, plenty of vines, high yielding large straight storage roots, continuous yielding, less susceptible to weevils, drought tolerant, mealy, not fibrous (NKA1081L, NKA318L, NKA259L). In Mpigi, in 2005, the local check (Dimbuka) was out yielded by all promising PPB selections by 23-84%, and Dimbuka was ranked among the last in acceptability tests in the district (Table 10), clearly presenting considerable advantage in the PPB selections. There was no significant yield advantage over the local check (Dimbuka) or the released variety (NASPOT 1), in Luwero in 2005, Mpigi (2006), Soroti and Kiboga in 2007. However, NKA103M, and NKA259L were ranked better than Dimbuka and NASPOT 1 (Table 10). The reasons for ranking clones low were in different combinations: not sweet at all, very hard, low yielding, susceptible to drought, low vine yield, very susceptible to weevils and diseases (NKA41M, BND145L, Dimbuka). The superior clones selected in the PPB trials were evaluated in different agroeclogies on station between 2006 and 2009 (Tables 11-22) to establish their stability performance in Uganda.

Advantages and problems encountered in PPB trials.

These PPB trials demonstrate the potential for significant rapid progress in sweetpotato breeding especially in specific target environments. By year seven (2009), 90% of the farmers (36 out of 40) that were interviewed and had participated in the PPB trials had adopted at least two of the PPB sweetpotato selections. The 10% (4 farmers) that were not growing did not do so because they had lost the clones during severe drought. In the third year (2005) of clonal selection, participating farmers had started consuming sweetpotato from the promising PPB materials in their homes. In the fourth year (2006), PPB participating farmers started selling, NKA1081L, NK318L and NK259L in their local markets in Zirobwe, Luwero District. This is a big plus for the PPB approach in getting cultivars to the farmers and consumers rapidly and is in agreement with Witcombe et al. (2003) and Ssemakula et al. (2003). Sweetpotato consumption by participating farmers in the so called conventional breeding would normally start evaluating and tasting the clones in years 5-7 from the start of the evaluation of the clones (Mwanga et al. (2001, 2003).

These PPB trials also demonstrate the high risk of losing valuable genetic material due to such factors as drought, destruction by wild animals such as monkeys and hippos and domestic animals such as cattle and goats, thefts by neighbors, farmers abandoning PPB trials due to fatigue because of the long periods (several years) involved to be committed to conducting the trials, death of the most active participating farmer(s) in the group, inadequate budget support, and the type of starting (base) breeding populations. In National Program participatory on-farm selection trials (not PPB) we always select about 15 farmers to host the trials in each location in a district. In almost all cases we experience various combinations of the above-mentioned problems, and end up excluding 30-50% of selected farms from the analysis. In the PPB trials it is important to keep part of the populations under evaluation to resort to should those problems crop up. In the on-going PPB trials reported here, we started with very good, carefully selected parents and populations, otherwise all the populations would have been wiped out in the first two to three seasons of planting because we were working in agroecologies where SPVD pressure is high. Another factor to consider is that, in PPB coverage is very much limited compared to the conventional breeding schemes – but we have addressed this here by subsequent conventional multilocational trials.

PEDIGREE

During evaluation by the National Crops Resources Research Institute (NaCRRI) based at Namulonge, the clone was designated as NKA1081L (New Kawogo 1081 Luwero), representing the female parental clone, the seedling selection number, and the district where the farmer group did the selection.

'NKA1081L' is a seedling selection by farmers in PPB trials in Luwero, and was selected from bulked seed from an open-pollinated polycross nursery of 24 parents established during 2000-2001. The 24 parents in the polycross block consisted of 10 released cultivars (New Kawogo was one of the 10), 3 introductions, 5 advanced clones from the Ugandan sweetpotato breeding program and 7 landraces (Bunduguza was one of the 7). Details of the polycross nursery were described by Mwanga et al. (2009). The 24 parents were selected for improving one or more of their traits or as as sources of one or a combination of the following traits, adaptation to specific agroeclogy, resistance to sweetpotato virus disease (SPVD) and/or Alternaria blight, orange color (β-carotene), high dry matter (>30%), shape, vigor, biomass, and storage and taste of storage roots.

CULTIVAR DESCRIPTION

Details of important standard morphological descriptors [(International Potato Center (CIP), Asian Vegetable Research and Development Center (AVRDC), and International Board for Plant Genetic Resources (IPBGR), 1991] of cultivar NKA1081L are listed in Table 2.

SITE DESCRIPTION

In the PPB trials, specific sites where on-farm trials were conducted in the different districts are mentioned in the text below. Details of agroecological zones where the on-farm trials were located can be identified in descriptions given by Wortmann and Eledu (1999). Four sites, Namulonge, at the National Crops Resources Research Institute (NaCRRI), Kachwekano, at the Kachwekano Zonal Agricultural Research, where data for estimating genotype-by-environment (GxE) interactions were generated have been

described previously (Mwanga et al., 2003). The site descriptions are presented briefly below.

Namulonge: 1,150 meters above sea level (masl), rainfall bimodal (1,270 mm/year), mean maximum 28.4°C, mean minimum 15.9°C, and annual mean 22.2°C. Soils are ferralitic (red sandy clay loams), soil pH 4.9-5.0, tall grassland.

Kachwekano: 2,220 masl, rainfall bimodal 950 mm/year, sandy clay loam (latosolic), soil pH 5.8-6.2, short grassland.

Ngetta ARDC: 1,180 masl, annual temperatures, 30.4°C, mean annual rainfall 1,319 mm, sandy loam, soil pH 5.5, Savannah grassland.

Serere: 1,140 masl, rainfall is bimodal 800-1150 mm/year, annual temperature 26.0°C, soils are sandy loam, pH 5.2 – 6.0, Savanah grassland.

MATERIALS AND METHODS

Procedures presented in this report were for PPB trials conducted between 2003-2009, and included the following:

a) PPB trials conducted on farmers' fields and,
b) replicated on-station trials to evaluate promising clones selected in PPB trials briefly outlined below following standard protocols used by the National Sweetpotato Program to generate data for stability analysis

Planting method and material: Vine-tip cuttings about 30 cm long (or middle stem cuttings when there was a shortage of planting material) from symptomless mother plants were the source of planting material for on-farm and on-station experiments.

Preliminary PPB trials on-farm: There were 5 plants/ridge, per clone (entry), one vine cutting per planting point on the ridge at 0.3 m between plants, and 1.0 m between ridges, giving a plant density of 33,333 plants/ha. All plants were harvested for yield data. All outside rows of the experimental plots had boarder plants.

Sweetptato yield trials on station: There were 4 ridges, 5.4 m long, 1 m between ridges, one vine cutting per planting point on the ridge, 0.3 m between plants (18 plants/ridge) (plant density 33,333 plants/ha). All outside rows of the experimental plots had boarder plants. Trials to determine the yield potential of sweetpotato cultivars for release or selection of parents to include in the NaCRRI polycross nursery were conducted during 2007/2008 and 2008/2009.

Design: A randomized complete block design (RCBD) with 4 replications was used in planting on-station trials.

On-farm PPB trials:

Farmer selection. Farmer groups were selected to host the sweetpotato seedling nurseries and the first stages in the selection cycle as described above. For advanced promising clones, individual farmers, or farmer groups were selected on the basis of

being well organized, easily accessible, representative of the resource-poor, and willingness and ability to host sweetpotato trials. Ten to 15 individual and/or farmer groups (representing different sites) were selected per district. Each farm (site) was considered a replicate. The most popular variety in the area was used as a local check and varied among sites. The trials were planned by the researchers, district agricultural extension staff and lead farmers, and were farmer-researcher managed.

The main objective of evaluating promising clones on-farm was to test them for adaptability and acceptability and to identify superior ones under farmers' socioeconomic conditions. A total of 14 promising clones selected during PPB were evaluated in Mpigi, Luwero, Soroti, Kabale, and Gulu districts on-farm and/or on-station between 2006-2009. The districts represent highland, tall grassland and short grassland ecologies that correspond with southwest, central and eastern regions of the country. Each farmer was given a subset of at least 5 clones to test against at least one local check (i.e., most popular variety in the area). Each of the 14 promising clones appeared on at least five farms (reps) during evaluation on-farm.
Seedbed. The farmers selected the sites for the trials. Mounds (about 0.6 m – 1.0 m diameter) at 0.6 m x 0.6 m to 1.0 m x 1.0 m or ridges 1.0 m apart were used depending on the choice of farmers and gradient of the land. Three vine tip cuttings were planted on mounds singly in a triangle. The cuttings on ridges were planted singly at 1.0 m x 0.3 m. Depending on availability of planting material and land, the number of mounds planted varied between 20 per clone where the middle 6 fully bordered mounds (18 plants) were harvested to 30 mounds (gross plot, 30 m^2), where the middle 12 mounds (net plot, 12 m^2 of 36 plants) were harvested (mindful of farmers' concerns that they were food insecure and lacked ready market for the roots). Harvesting was done between 4.5-6 months after planting.

Taste tests. Acceptability of the clones (steamed roots) was measured by soliciting for farmers' response based on the following criteria: appearance, taste, flavor, starchiness and fibrousness. They were asked to give scores for the above criteria using a scale of 1 – 5, where 1 = very poor, 2 = poor, 3 = intermediate, 4 = good, and 5 = very good.

Disease, pest and other trait ratings:
Sweetpotato virus disease (SPVD) and Alternaria blight were scored at 2.5 and 4.5 months after planting (MAP). Sweetpotato weevil damage was scored at harvest. The disease and weevil damage, storage root sprouting, cracking and rotting ratings were based on a 1-5 scale:
1 = no apparent damage/not present 4 = considerable damage/numbers present
2 = very little damage/few present 5 = severe damage/very high numbers present
3 = moderate damage/numbers present

Dry matter content (DMC) of storage roots was expressed as the average percentage of dry weight of fresh weight. DMC was determined after weighing two replications of 500 g samples of sliced roots and oven- drying to a constant weight at 65^0C.

On-station evaluation of clones selected during PPB:

Fourteen PPB clones plus at least two checks were evaluated as described above (4 rows per plot, 4 reps) in four sites, Namulonge, Kachwekano, Ngetta, and Serere.

Acceptability evaluation. The farmers cooked (steamed) the roots of each cultivar at harvest and each farmer evaluated individually the post harvest qualities of the cooked roots. The post harvest qualities included ease of cooking, wateriness (dryness), firmness, sweetness, mealiness, fibrousness (absence of fibre), colour, appearance and general acceptability using a scale of 1 to 5 with 1 corresponding to very poor and 5 to very good. The farmers also identified desirable and undesirable attributes for each evaluated sweetpoto cultivar. Where possible, the participants were divided into males, females and children during the tests. The taste test evaluations were conducted using a questionnaire and the semi-literate and illiterate individuals were assisted to record their responses.

ANOVA. Analysis of variance (ANOVA) for sweetpotato trait means was done using the General Linear Model (GLM) of the Statistical Analysis System (SAS Institute, Inc., Cary, NC, Version 8.1 software, 2000).

Stability Analysis

The four sites: Namulonge, Kachwekano ARDC, Ngetta ARDC, and Serere, where data for determining genotype-by-environment (GxE) interactions were generated, have been described previously (Mwanga et al., 2001, 2003). Data for 10 sweetpotato clones for two seasons 2007/2008-2008/2009 common across the sites were processed for GxE interactions using the additive main effect and multiplicative interaction (AMMI) model (Gauch, 1992), regression analysis (Eberhart and Russel, 1996), and Tai stability test (Tai, 1971). Parameter estimates were obtained using procedures of GLM (SAS Institute Inc. 1990) and IML (SAS Institute Inc. 1990). Only 10 promising sweetpotato clones were subjected to the Tai test.

RESULTS AND DISCUSSION

Progenitors of NKA1081L. The open-pollinated seed (breeding population) generated from the polycross nursery of 24 parents of different attributes in 2000/2001 was screened through seedling nursery, observational/ clonal evaluation trials in farmers' field's and on-station. The corresponding selection rates during the early stages of evaluation in Uganda ranged between 0.0 and 41.7% (Table 1). Results of promising superior sweetpopato clones selected in PPB trials on-farm are shown in Tables 1-10, and in on-station evaluations in Tables 11-22.

Promising selections in PPB trials on-farm were progenitors of New Kawogo, Bunduguza, and Wagabolige. In subsequent seasons based on results of promising PPB selections superior clones were evaluated in standard on-station and on-farm trials. Based on performance in on-farm trials during 2005-2007 and on-station during in 2006-2009 NKA1081L was equal to or significantly better than all the checks, namely, Dimbuka, Magabari, NASPOT 1, Araka White, and New Kawogo, in almost all cases on-farm and on-station, from 2005-2009. In PPB trials on-farm, NKA1081L had a mean yield of 12.3 t/ha while Dimbuka-Bukulula yielded 9.6 t/ha (NKA1081L out yielded Dimbuka-

Bukulula by 28%). Dimbuka-Bukulula is one of the highest yielding farmer's cultivars. In on-station trials NKA1081L had a mean yield of 42.2 t/ha (range 20.8 – 55.8 t/ha) while Dimbuka-Bukulula had a mean of 37.3 t/ha (range 19.0-57.1 t/ha). The most outstanding unique character of the cultivar is its combination of dual field moderate resistance to SPVD and high field resistance to Alternaria blight with high storage root yield. This combination gives it an advantage over most of the previously released sweetpotato cultivars. Table 22 gives a summary of the outstanding characteristics compared to the local check cultivar, Dimbuka-Bukulula. The most important traits in NKA1081L such as dry matter content, disease resistance, root and biomass yield are acceptable and most of them are superior compared to most popular cultivars grown in Uganda.

On-farm variety evaluation trials. On-farm trials were conducted in the districts of Mpigi, Luwero, Kabale, Soroti and Kiboga. There was great variation among trials in yield and yield components of the sweetpotato clones evaluated on-farm in the districts. The candidate clone for release in most cases, had similar or significantly greater total and marketable root yields than other clones and than the check clones (Tables 1-10).

Palatability Tests. Palatability tests were carried out on the PPB selected clones in Mpigi, Luwero, Kabale, Soroti and Kiboga districts. Farmers were asked to award points (marks) to cooked samples of the clones, based on appearance, taste, flavour, starch and fibre content, and general appreciation. A scale of 1 – 5 was used, where 1 = very bad, 2 = bad, 3 = intermediate, 4 = good and 5 = very good. At the end of the exercise, respondents were asked to compare the clones using pair-wise ranking. The candidate clone was among the clones that had moderate to high acceptance among farmers and consumers.

Overall Acceptability of the Candidate clone
Overall acceptance of the candidate clone was moderate to high.

Stability of NKA1081L
Sites, seasons, clones, site x clone, clone x season, and site x clone x season interactions were highly significant on-station. No single clone was superior in all desirable traits across all the farms and the four on-station test sites over the two seasons for which data were used to do the stability analysis (Tables 11-22). The yields of the candidate cultivar for release, NKA1081L, was, according to Tai stability parameters, the candidate cultivar is best described as stable but with low reliability (Table 22, Figs 1-3).

The combined analysis of variance showed that each considered source of variation (environment and genotype) was highly significant (P<0.0001) (see Table below).

Source	DF	ANOVA SS	Mean Square	F Value	Pr > F
Rep	3	0.11875	0.03958333	0.23	0.8774
Site	3	31.86875	10.62291667	60.94	<.0001
Rep(Site)	9	0.80625	0.08958333	0.51	0.8617
Clone	9	7.78125	0.86458333	4.96	<.0001
Site*Clone	27	16.69375	0.61828704	3.55	<.0001

Environments accounted for 55.6% and genotypes 13.6% of the treatment sum of squares (SS). The genotype (G) by environment (E) i.e. G x E interactions accounted for 29.1% of the treatment SS and the mean square was highly significant ($P<0.0001$) indicating that genotypes responded differently to variations in the different environments. The variation may have resulted from different climatic conditions due to seasonal changes (rain, solar radiation), edaphic, biotic and abiotic stresses.

PROPOSED NAME

This is the first sweetpotato clone to be released in Africa and, to the authors' knowledge, the World that has been selected starting from true seed by farmer/researcher participatory plant breeding. The proposed name of the cultivar is therefore: NASPOT 11.

PRODUCTION PACKAGE

Land preparation. Deep cultivation for development of storage roots is necessary. Mounds may be used to reduce damage of storage roots by root rats, and ridges to reduce soil erosion on sloppy land or if mechanization is used. Stony soils must be avoided as they limit root expansion. Loose and well-drained soils enable the roots to expand. In sloppy areas, ridges should be made running along the contours to slow down speed of running rainwater, thus reduce soil erosion.

Seed rate. Mounds or ridges should be spaced at 70-100 cm. Three vines should be planted on each mound, while single vines spaced at 30 cm apart can be planted on top of the ridged seedbed, resulting in a plant density of 33,333 plants per ha. Overall yield per hectare does not vary much over a plant population range of 25,000 to 100,000 plants/ha.

Planting. Planting should be done at time convenient to the farmer and when there is adequate moisture in the soil. Tip vine cuttings of 30 cm long are used for planting. About 20 cm length of the vine or most of it is buried into mounds or ridges to leave only the tip exposed. Sweetpotato is usually planted in pure stands or intercropped. Short-maturing crops such as beans can be planted on sides of mounds/ridges. Vines with flowers and fruits (capsules) should be avoided. Storage of vine cuttings for 2 – 5 days before planting induces sprouting and better establishment.

Field management. Average soils will not require fertilizers. Compound fertilizers of phosphorus and potassium may be applied to increase yield where soil fertility is low. In the absence of local fertilizer experiments the following rates are suggested: N (34-45 Kg/ha), P_2O_5 (50-101 kg/ha), K_2O (84-169 kg/ha) or complete NPK 6:9:15 (120 kg/ha). Nitrogen fertilizers applied in large quantities are not recommended for root production because they increase vine formation at the expense of the roots. Weed promptly, 2-3 times or as need for weeding arises.

Harvesting. Sweetpotato is usually harvested piece-meal as required. This is because fresh roots store for only few days before they rot. In this method, mature storage roots

are harvested, leaving the young ones to continue growing. Mature roots are detected by cracks, which form in the soil. These roots are dug up using sharp sticks or fork and not by the hoe. First roots are ready in 3-5 months after planting (MAP) in short term cultivars or 6-9 MAP for long term cultivars. Some farmers wait until most roots are mature then harvest the whole mound/ridge. In ground storage lasts 1-9 months depending on cultivar, environmental conditions and location. Dry sliced sweetpotaoes may be stored for 2-4 months.

Pests

There are five major categories of pests of sweetpotato in Uganda, viz: sweetpotato weevils, millipedes, sweetpotato butterfly, vermin and rodents.

Sweetpotato weevils, *Cylas brunneus* and *C. puncticollis* cause the most serious problems because they destroy the roots and vines. Larvae bore and damage roots and stems. Damage is most serious during dry seasons. Pests can be managed by applying integrated pest management (IPM) methods such as planting healthy vines and avoiding planting stem bases, planting a new crop away from old infested field, crop rotation and destruction of infested plant parts. A new crop should be planted in good time for it to mature and be harvested before the dry season. Weed the crop carefully and hill up base of plants and cover soil cracks where weevils enter the roots. The crop should be harvested as soon as it is matures. Moreover, the method used for weevil control also controls a multitude of other soil pests and stem borers.

Millipedes bore and eat their way into the roots thus destroying root quality. To reduce millipede attack, sweetpotato and ground-nuts should not be planted one after another in the same field. Crops planted early when first rains commence tend to have more damage than those planted 1.5-2 months after the rains have started. Millipede traps have been developed.

Sweetpotato butterfly (*Acraea acerata*)- caterpillars of this pest chew and destroy foliage of the crop. Damage can be serious during the dry season when high temperatures increase the growth rate of young stages of the butterfly but suppress activity of natural enemies of the caterpillar the same time. To reduce pest damage by physical destruction of larval nests, planting crop early for it to escape destruction during dry season, and spraying contact insecticide when attack is high and/or a combination of the above are recommended**.**

Vermin-Major vermin pests are monkeys and wild pigs. To control damage by vermin, sweetpotatoes should be planted away from forests where the animals live. Crop can be planted in blocks and guarded against vermin and livestock by farming community. If damage is severe, farmers should consult staff of the Uganda Wildlife Authority to help control the animals. Wild life should not be poisoned or killed indiscriminately. Main pests categorized under rodents are rats and squirrels. Rats attack crops, which usually are weedy or are over-mature. Management methods include cultural control methods like weeding the field and surrounding areas, harvesting crop as soon as it is mature, digging up and destroying nesting sites, and trapping. ‘Mutoto Traps’ have been

developed for trapping root and mole rats. Domestic cats can be a useful biological control option against rats.

Sweetpotato Diseases

Sweetpotato virus disease- is caused by a combination of two or more viruses. Symptoms include discoloration (yellowing) and distortion of leaves and stunting of plants. Viruses are spread by whiteflies and aphid vectors and planting infected vines. Disease control is by planting resistant varieties and healthy vines, destroying diseased volunteer and host plants, crop rotation, roguing infected plants, and planting barrier crops to intercept the flight of vectors.

Alternaria blight- Symptoms include black lesions on leaves and stems, often leading to plant death. Control of the disease is by planting resistant varieties and following good sanitation practices.

CULTIVAR MAINTENANCE AND AVAILABILITY

NKA1081L is maintained in the field by NaCRRI in Uganda. Requests for planting materials within Uganda should be directed to: Sweetpotato Program, NaCRRI, P.O. Box 7084, Kampala. The cultivar is maintained as pathogen-tested plants in the screenhouse at the Kenya Quarantine Station, Muguga, Kenya. Requests for seed from other countries should be addressed to: Seed Unit, CIP, P.O. Box 25171, Nairobi, Kenya. Propagation and maintenance of these cultivars follows normal practice for sweepotato.

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Table 1. Selection rates in seedling trials conducted in Central Uganda and Northern Tanzania (Lake Zone) in 2003/2004.

Type of trial	Site	No. of seedlings in year 1	No. selected Year 1 (2003/2004)[b]	No. selected Year 2 (2004/2005)	Selection %[a]
CIP Lima 1st batch seedlings (high dry matter, orange-fleshed)	Serere	770	38	11	28.9 (1.4)
CIP Lima 2nd batch seedlings (high dry matter, orange-fleshed)	Serere	1,973	160	146 (Orange fleshed =16)	7.3
CIP Lima 1st batch seedlings (high dry matter, orange-fleshed)	Namulonge	68,874	203	0	0.0
CIP Lima 2nd batch seedlings (high dry matter, orange-fleshed)	Namulonge	2,338	324	278 (Orange fleshed =0)	11.9
Tusitukirewamu, Zirobwe, Uganda (Participatory breeding, on-farm)	Zirobwe	4,000	163	68	41.7 (1.7)
Balikyewunya, Mpigi, Uganda (Participatory breeding, on-farm)	Mpigi	6,000	121	37	30.6
Nakitembe/Watuba, Kiboga, Uganda (Participatory breeding, on-farm)	Kiboga	6,000	126	0	0.0
Kyaka, N. Tanzania (Participatorybreeding, on-farm)	Kyaka	2,000	398	0 (Monkeys)	0.0
Nyungwe (Kanyigo), N. Tanzania (Participatory breeding, on-farm)	Kanyigo	2,000	340	0 (Drought)	0.0
Maruku, N. Tanzania (Participatory breeding, on-farm)	Maruku	2,000	423	398	94.1 (19.9)
Total		89,955	2,170		

[a] Number in brackets is selection intensity based on original number of seedlings in year 1.
[b] All material with high storage root yield and/or enough planting material (visually free of sweetpotato virus disease (SPVD) symptoms), this included some clones that had SPVD scores of 4 (ie susceptible).

Table 2. Characterization of NKA1081L[a]

Code and character	Score (description)		Code and character	Score (description)
4.1 Twining	3 Slightly twining		**4.20 Flowering habit**	3 Sparse
4.2 Plant type	5 Semi-erect (75-150 cm)		4 Colour	4 Pale purple limb with purple throat
4.3 Vine growth rate	7 Fast (>100 cm)		4.22 Flower length and width	L 4.0 cm; W 3.7 cm
4.4 Vine internode length/diameter	IL 1 Very short (<3 cm); ID 9 Very thick (>12 mm)		4.23 Shape of limb	3 Semi-stellate
4.5 Vine pigment	Predominant vine colour: 1 Green Secondary vine colour: 6 Purple nodes		4.24 Equality of sepal length	1 Outer two shorter
4.6 Vine tip pubescence	0 Absent		4.25 No. of sepal veins	1
4.7 Mature leaf shape	General leaf outline: 4 Triangular Type of lobing: 0 No lateral lobes No. of lobes: 0 , Shape of central lobe: 0 Absent		4.25a Sepal shape	5 Obovate
4.8 Mature leaf size	3 Small (<8 cm)		4.27 Sepal apex	3 Obtuse
4.9 Foliage color	Mature leaf color: 8 All veins mostly or totally purple; Mature leaf: 2 Green Immature leaf color: 9 Purple both surfaces		4.28 Sepal pubescence	0 Absent
4.11 Petiole length	3 Short (10-20 cm)		4.29 Sepal color	3 Green with purple spots
4.12 Petiole pigmentation	5 Green with purple spots throughout petiole		4.30 Color of stigma	5 Pale purple
4.13 Storage root shape	Arrangement: 5 Dispersed; Shape: 5 Obovate		4.31 Color of style	3 White with purple at the base
4.14 Storage root (SR) surface defects	0 Absent		**4.32 Stigma exertion**	1 Inserted
4.15 SR cortex thickness	3 Thin (1-2 mm)		**4.33 Seed capsule set**	3 Sparse
4.16 Storage root skin color	Predominant skin color: 8 Purple-red Intensity of predominant skin colour: 2 intermediate Secondary skin color: 0 Absent		**5.1 Storage formation**	3 Open cluster
4.17 Storage root flesh color	Predominant flesh colour: 2 Cream Secondary flesh color: 0 Absent		5.2 Storage root stalk	5 Intermediate
4.18 Distribution of anthocynin in flesh	0 Absent		5.3 Storage root length	18 cm (Varies with environment)
4.19 Storage root sprouting	2 very little		5.4 Storage root diameter	34 cm (Varies with environment)
			5.5 Number of storage root per plant	4 (Varies with environment)

[a]Selected descriptors according to CIP, AVRDC, and IBPGR (1991)

Table 3-10. Performance of sweetpotato clones in participatory breeding trials on-farm

Table 3. Performance of sweetpotato clones in participatory breeding trials on-farm at Kituntu in Mpigi District (planted in August 2005, harvested in September 2006)

Code	Clone name	Total root yield (t/ha)	DMC[1] (%)	Mkt rt[2] yield (t/ha)	Vine yield (t/ha)	Biomass yield (t/ha)	SPVD[3]	Alternaria	Weevil	Cracking	Sprouting	Rotting	Appearance	Sweetness	Fibre	Mealiness	Acceptance	Flesh color	Ranking by farmers: In field	Ranking by farmers: Taste evaluation
1	NKA259L	18.0	36.5	12.1	19.3	37.3	3.0	2.0	2.3	1.0	1.0	1.7	2.3	2.3	2.0	1.7	2.5	3.3	3	5
2	NKA103M	17.6	36.6	13.6	42.6	60.1	2.3	1.7	1.3	1.0	1.0	1.0	2.4	2.5	1.9	2.8	2.5	2.9	7	2
3	NKA102M	19.5	34.2	14.6	35.0	54.5	3.0	2.0	1.3	1.3	1.0	1.0	2.6	3.8	1.4	1.7	3.4	3.3	6	8
4	NKA41M	17.4	35.3	11.1	40.7	58.1	3.0	3.0	1.0	1.0	1.0	2.0	1.6	1.5	1.3	1.9	1.6	2.0	10	1
5	WAG34L	13.9	36.0	12.7	49.8	63.7	2.3	2.0	1.0	1.0	1.0	1.7	2.2	1.7	1.7	3.1	2.5	2.4	5	7
6	**NKA1081L**	**27.8**	**36.0**	**23.1**	**49.6**	**77.3**	**2.3**	**2.0**	**1.3**	**1.0**	**1.0**	**1.0**	**3.1**	**2.1**	**2.1**	**3.5**	**3.2**	**3.3**	**1**	**3**
7	BND145M	3.8	35.1	1.4	9.5	13.3	3.0	5.0	1.0	1.0	1.0	1.0	2.3	3.1	3.0	2.9	2.6	2.2	9	4
8	NKA318L	30.1	36.5	24.9	23.6	53.6	2.3	2.3	1.7	1.0	1.0	1.0	2.3	2.9	2.0	2.8	3.2	2.5	2	3
9	**Dimbuka**	**4.9**	**36.0**	**2.9**	**41.5**	**46.4**	**3.7**	**2.0**	**1.0**	**1.0**	**1.0**	**1.0**	**3.5**	**1.9**	**1.9**	**3.4**	**2.6**	**3.6**	**8**	**7**
10	BND145L	18.1	35.5	12.5	27.7	45.8	2.3	2.7	1.3	1.0	1.3	1.0	2.2	2.5	1.6	2.6	2.5	2.3	4	6
11	NKA51M	5.7	33.8	4.0	12.2	17.9	2.7	2.0	1.0	1.0	1.0	1.0	2.4	1.5	1.5	2.6	1.8	2.4	8	4
Mean		16.0	35.6	12.1	32.0	48.0	2.7	2.4	1.3	1.0	1.0	1.0	2.4	2.3	1.7	2.7	2.5	2.7	NA	NA
LSD (0.05)		13.5	NA	10.6	23.1	32.5	0.8	0.7	0.9	0.3	0.3	0.4	0.8	0.7	0.5	0.8	0.8	0.7	NA	NA
CV (%)		49.5	NA	51.7	42.4	39.8	17.4	17.9	41.2	16.9	16.9	16.9	39.9	36.6	36.7	32.7	38.8	30.6	NA	NA

[1]DMC = dry matter content, [2]Mkt rt = marketable root, [3]SPVD = sweetpotato virus disease.

Taste evaluation (appearance, sweetness, fibre content, mealiness, flesh color, acceptance) scale is 1 – 5, where 1 = very poor, 2 = poor, 3 = intermediate, 4 = good, and 5 = very good.

SPVD and other disease & pest scored traits, rating scale = 1-5: 1 = no apparent damage; 2 = very little damage;
3 = moderate damage; 4 = considerable damage; 5 = severe damage

Number of farms that hosted trial = 1, number of farmers participating in trial = 17 (10 females, 7 male), Number of ridges =3 (25 plants per ridge), 1 m between ridges, 30 cm between plants on ridge, Number of replications at the farm = 3.

Ranking by 11 farmers (8 females, 3 males): 1 = best (most preferred); 8 = least preferred (Taste evaluation based on pair-wise selection and selecting from the all the entries (ranking in parenthesis).

Table 4. Performance of sweetpotato clones in participatory breeding trials on-farm at Manyama, Zirobwe, Luwero District, Uganda (planted in September 2005, and harvested five months after planting)

Code	Clone name	Total root yield (t/ha)	DMC[1] (%)	Mkt rt[2] Yield (t/ha)	Vine yield (t/ha)	Biomass yield (t/ha)	SPVD[3]	Alternaria	Weevil	Cracking	Sprouting	Drought	Rotting	Appearance	Sweetness	Fibre	Mealiness	Acceptance	Ranking in taste Evaluation[4]
1	NKA259L	17.2	33.8	13.5	14.7	31.9	1.7	1.3	2.7	1.0	2.3	1.3	2.7	1.8	2.1	1.6	3.0	2.2	3
2	**NKA1081L**	**12.2**	**33.5**	**10.3**	**18.0**	**30.2**	**1.3**	**1.3**	**2.3**	**1.0**	**2.0**	**1.3**	**2.7**	**3.5**	**1.9**	**1.8**	**3.8**	**2.5**	**6**
3	NKA147M	11.9	33.3	10.1	9.8	21.8	1.3	1.3	3.3	1.3	3.0	1.7	4.0	1.3	2.7	2.9	1.6	2.1	7
4	NKA318L	16.1	32.1	12.5	12.8	28.9	1.7	1.7	3.0	1.0	1.7	1.3	2.7	2.3	1.5	1.6	2.4	2	2
5	NKA103M	10.7	31.3	8.7	13.9	24.7	1.3	1.0	3.0	1.0	1.3	1.0	2.0	2.8	2.3	1.9	3.4	2.6	5
6	NKA102M	9.4	30.5	7.8	19.2	28.6	1.3	1.3	1.7	1.0	1.3	1.0	2.0	2.3	1.2	2.4	2.9	2.3	1
7	BND145L	17.6	31.9	15.0	16.1	33.8	1.3	1.3	2.7	1.3	1.7	1.0	2.3	1.6	4.2	2.0	1.5	3.3	9
8	**Dimbuka**	**17.9**	**31.3**	**15.2**	**26.6**	**44.5**	**1.7**	**1.3**	**2.0**	**1.7**	**1.7**	**1.0**	**1.6**	**2.2**	**2.3**	**1.7**	**2.6**	**2.8**	**8**
9	**NASPOT 1**	**16.7**	**31.1**	**13.3**	**15.5**	**32.2**	**1.3**	**2.0**	**3.3**	**1.0**	**1.0**	**1.0**	**2.3**	**2.5**	**2.1**	**2.1**	**2.8**	**2.3**	**4**
Mean		14.4	32.1	11.8	16.3	30.7	1.4	1.6	2.7	1.1	1.8	1.2	2.5	2.3	2.4	1.9	2.6	2.5	NA
LSD (0.05)		6.3	NA	5.3	6.6	10.0	0.8	1.3	1.2	0.6	1.4	0.7	1.6	0.6	0.6	0.5	0.7	0.7	NA
CV (%)		25.4	NA	26.3	23.5	18.8	33.6	47.3	26.5	30.2	44.0	34.0	38.2	34.5	34.6	35.1	32.8	37.8	NA

[1]DMC = dry matter content, [2]Mkt rt = marketable root, [3]SPVD = sweetpotato virus disease.

[4]Number of farms that hosted trials = 3 [(each farm had a group of 6-7 farmers), number of ridges = 3 per clone (15 plants per ridge), 1 m between ridges, 30 cm between plants on ridge, number of replications at each farm = 3, check varieties: Dimbuka and NASPOT1. Ranking was done by 12 farmers (8 females, 3 males): 1 = best (most preferred); 9 = least preferred (Taste evaluation based on pair-wise selection)]. All the participating farmers gathered at one central farm to witness the taste evaluation

Table 5. Performance of 7 sweetpotato clones in participatory breeding trials in Luwero District, planted in August 2006, harvested 5 months after planting.

Code	Clone name	Marketable root yield (t/ha)	Total Root yield (t/ha)	Vine yield (t/ha)	Biomass yield (t/ha)	SPVD[2]	Alternaria	Weevil	Cracking	Rotting
1	NKA259L	6.0	8.6	10.2	18.8	1.9	1.2	1.7	1.0	1.2
2	NKA103M	11.0	12.5	11.6	24.2	1.4	1.1	1.4	1.0	1.3
3	NKA102M	6.5	7.4	15.6	23.0	1.6	1.6	1.7	1.0	1.2
4	**NASPOT 1**	**13.4**	**15.2**	**13.7**	**28.9**	**1.9**	**2.6**	**1.6**	**1.2**	**1.1**
5	**Dimbuka**	**12.9**	**15.5**	**14.3**	**29.8**	**1.5**	**1.3**	**1.4**	**1.3**	**1.3**
6	**NKA1081L**	**11.6**	**13.3**	**17.5**	**30.8**	**1.3**	**1.1**	**1.4**	**1.0**	**1.0**
7	NKA318L	6.7	9.1	9.0	18.1	1.8	1.2	1.4	1.0	1.2
Mean		9.7	11.7	13.1	24.8	1.7	1.4	1.5	1.1	1.2
LSD (0.05)		3.9	4.0	3.1	6.0	0.7	0.6	0.3	0.2	0.3
CV (%)		42.6	36.4	24.9	25.5	41.6	44.8	21.4	23.0	28.8

[1]DMC = dry matter content, [2]SPVD (sweetpotato virus disease)
SPVD and other scored traits, rating scale = 1-5: 1 = no apparent damage; 2 = very little damage; 3 = moderate damage; 4 = considerable damage; 5 = severe damage

Table 6. Performance eight sweetpotato clones in on-farm participatory breeding trials in Mpigi District, planted in November 2006 and harvested at 5 months after planting.

Code	Clone name	Marketable yield (t/ha)	Total root yield (t/ha)	Vine yield (t/ha)	Biomass yield (t/ha)	SPVD[1]	Alternaria	Weevil	Sprouting	Rotting	Rank taste test
1	NKA103M	4.3	6.5	5.9	12.4	1.0	1.7	2.0	1.7	1.0	4
2	BND145L	3.8	4.7	7.8	12.5	1.3	2.3	2.3	1.7	1.0	8
3	WAG34M	3.5	4.9	7.0	11.9	1.0	2.0	2.2	1.3	1.3	5
4	NKA 318L	3.7	5.2	4.8	10.0	1.3	2.3	2.0	1.0	1.0	1
5	**NKA1081L**	**4.0**	**5.1**	**7.1**	**12.2**	**1.7**	**2.0**	**1.7**	**1.7**	**1.3**	**6**
6	NKA 259L	7.1	8.5	4.0	12.5	1.7	2.0	2.0	1.3	1.0	2
7	NKA 102M	3.0	4.0	5.6	9.6	2.0	2.0	2.0	1.0	1.0	5
8	**Local check**	**2.6**	**3.6**	**5.5**	**9.1**	**1.8**	**2.0**	**1.8**	**1.3**	**1.0**	**3**
Mean		4.0	5.3	6.0	11.3	1.5	2.0	1.9	1.4	1.1	4
LSD (0.05)		4.3	4.5	3.1	6.4	NS	NS	NS	NS	NS	NA
CV (%)		25.0	21.5	29.8	32.4	27.5	18.1	16.7	25.7	27.6	NA

[1]SPVD = sweetpotato virus disease
SPVD and other scored traits, rating scale = 1-5: 1 = no apparent damage; 2 = very little damage
3 = moderate damage; 4 = considerable damage; 5 = severe damage

Table 7. Results of a participatory sweetpotato breeding trial planted in Soroti in September 2007 and harvested 5 months after planting (data was collected from 5 out of 15 planted farms due to severe drought).

Code	Name of clone	Yield (t/ha)			SP VD[1]	Alternaria	Weevil damage	Cracking	Sprouting	Rottting	Drought	Taste pair-wise rank
		Total root	Vine	Biomass								
1	NKA259L	2.7	3.9	6.6	1.2	1.0	3.0	1.0	1.0	1.0	3.0	10
2	NKA103M	3.8	4.0	7.8	1.0	1.0	4.0	1.0	1.0	1.0	3.0	3
3	**NKA1081L**	**3.7**	**3.6**	**7.2**	**1.0**	**1.0**	**4.6**	**1.0**	**1.0**	**1.2**	**3.6**	**1**
4	NKA318 L	2.9	3.7	6.7	1.2	1.2	4.6	1.0	1.0	1.0	2.8	8
5	**NASPOT 1**	**4.0**	**3.5**	**7.5**	**1.0**	**1.0**	**3.6**	**1.0**	**1.0**	**1.0**	**3.0**	**4**
6	**Dimbuka**	**3.2**	**3.8**	**6.9**	**1.0**	**1.0**	**4.0**	**1.0**	**1.0**	**1.0**	**3.4**	**7**
7	BND12K	2.5	4.2	8.3	1.0	1.0	4.0	1.0	1.0	1.2	3.0	5
8	NKA14K	2.5	3.0	5.5	1.0	1.0	4.6	1.0	1.0	1.0	3.8	9
9	BND21K	1.4	3.4	5.0	1.0	1.2	4.4	1.0	1.0	1.4	3.0	2
10	BND18K	2.5	4.4	6.9	1.0	1.0	4.2	1.0	1.4	1.0	3.0	6
Mean		3.1	3.8	6.8	1.1	1.0	4.1	1.0	1.0	1.1	3.2	NA
$LCD_{0.05}$		1.2	1.4	2.4	0.3	0.3	1.1	0.0	0.4	0.4	0.5	NA
CV (%)		29.6	28.2	27.0	22.7	19.5	20.8	0.0	27.2	32.1	13.0	NA

[1]SPVD = sweetpotato virus disease; SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage 2 = very little damage 3 = moderate damage

4 = considerable damage 5 = severe damage

Table 8. Results of a participatory sweetpotato breeding trial planted in Kiboga in September 2007 and harvested 4.5 months after planting (results of four group farms, 20 farmers)

Code	Name of clone	Dry matter %	Yield (t/ha)				SPVD[1]	Alternaria	Weevil damage	Cracking	Sprouting	Rotting	Drought	Taste pair-wise rank
			Total root	Market root	Vine	Biomass								
1	NKA259L	31.2	7.0	5.1	8.9	15.9	2.0	2.0	1.5	1.0	1.0	1.0	2.5	5
2	NKA103M	31.3	11.4	8.9	8.6	20.0	2.0	2.0	1.5	1.0	1.0	1.0	2.0	7
3	**NKA1081L**	**34.1**	**11.8**	**9.9**	**9.9**	**21.7**	**2.0**	**1.8**	**1.5**	**1.3**	**1.0**	**1.3**	**2.0**	**1**
4	NKA318 L	31.8	3.6	2.5	8.9	12.5	2.0	2.0	1.0	1.0	1.0	1.0	2.3	6
5	**NASPOT 1**	**34.1**	**11.7**	**10.1**	**9.3**	**21.1**	**1.8**	**2.0**	**1.8**	**1.0**	**1.0**	**1.3**	**2.0**	**3**
6	**Dimbuka**	**30.2**	**12.6**	**10.2**	**8.9**	**21.6**	**2.3**	**2.0**	**2.3**	**1.0**	**1.5**	**1.0**	**2.0**	**6**
7	BND12K	31.3	9.3	8.3	11.1	20.3	1.8	1.5	1.0	1.0	1.6	1.0	2.0	2
8	NKA14K	30.4	11.9	9.7	15.4	27.3	2.0	2.0	1.5	1.3	1.0	1.0	1.8	4
9	BND21K	30.1	13.9	11.7	13.7	27.7	2.3	2.0	1.5	1.0	1.0	1.0	2.3	8
10	BND18K	31.1	10.2	15.2	17.8	35.9	2.0	1.5	2.5	1.0	2.0	1.0	3.0	7
Mean		31.6	11.1	9.2	11.2	22.4	2.0	1.9	1.6	1.0	1.2	1.1	2.2	NA
$LCD_{0.05}$		NA	4.1	3.5	6.1	8.3	0.5	0.6	0.8	0.3	0.4	0.4	0.5	NA
CV (%)		NA	25.4	26.3	37.5	25.5	16.1	21.7	34.9	21.7	21.5	25.2	14.7	NA

[1]SPVD = sweetpotato virus disease; SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage 2 = very little damage 3 = moderate damage 4 = considerable damage 5 = severe damage

Taste ranking, n = 20 (12 women, 8 men), 1 = first choice (best), 8 = last choice

Table 9. Results of a participatory sweetpotato breeding trial planted in Kabale in November 2008 and harvested 6 months after planting ((results of five group farms, 10 farmers)

Code	Clone name	Yield (t/ha)				SPVD[1]	Alternaria	Weevil
		Root	Marketable	Vine	Biomass			
1	NKA259L	9.2	6.5	19.1	28.3	2.0	2.4	1.0
2	NKA103M	10.3	8.2	13.4	23.7	2.2	2.2	1.0
3	NKA102M	16.6	12.9	25.1	41.7	2.0	2.3	1.0
4	NKA41M	11.2	9.0	12.8	24.0	2.1	3.6	1.0
5	WAG34L	9.8	7.4	15.4	25.2	2.0	2.5	1.0
6	**NKA1081L**	**12.0**	**9.7**	**17.3**	29.3	**2.2**	**1.7**	1.0
7	BND145M	10.1	7.5	21.5	31.6	2.1	2.8	1.0
8	NKA318L	12.0	8.8	21.8	33.8	2.0	1.9	1.0
9	**Dimbuka**	**8.0**	**6.0**	**18.2**	26.2	**2.0**	**2.1**	1.0
10	BND145L	7.3	3.7	10.5	17.8	2.3	2.3	1.0
Mean		10.7	8.0	17.5	28.2	2.1	2.4	1.0
LSD (0.05)		3.1	2.4	3.6	4.6	NS	0.6	NA
CV (%)		32.5	34.1	23.7	28.8	15.0	31.7	0.0

[1]SPVD = sweetpotato virus disease

SPVD and other scored traits, rating scale = 1-5: 1 = no apparent damage; 2 = very little damage
3 = moderate damage; 4 = considerable damage; 5 = severe damage

Table 10. Summary of performance of promising clones in sweetpotato participatory breeding trials 2005-2008.

District/staion/ year	Code	Clone	Yield (t/ha) Root	Biomass	Disase severity SPVD	Alternaria	Taste test rank
Mpigi 2005	1	NKA259L	18.0	37.3	3.0	2.0	5
	2	NKA103M	17.6	60.1	2.3	1.7	2
	3	NKA102M	19.5	54.5	3.0	2.0	8
	4	NKA41M	17.4	58.1	3.0	3.0	1
	5	WAG34L	13.9	63.7	2.3	2.0	7
	6	**NKA1081L**	**27.8**	**77.3**	**2.3**	**2.0**	**3**
	7	BND145M	3.8	13.3	3.0	5.0	4
	8	NKA318L	30.1	53.6	2.3	2.3	3
	9	**Dimbuka**	**4.9**	**46.4**	**3.7**	**2.0**	**7**
	10	BND145L	18.1	45.8	2.3	2.7	6
	11	NKA51M	5.7	17.9	2.7	2.0	4
	Mean		16.0	48.0	2.7	2.4	NA
	LSD (0.05)		13.5	32.5	0.8	0.7	NA
	CV (%)		49.5	39.8	17.4	17.9	NA
Luwero 2005	1	NKA259L	17.2	31.9	1.7	1.3	3
	2	NKA1081L	12.2	30.2	1.3	1.3	6
	3	NKA147M	11.9	21.8	1.3	1.3	7
	4	NKA318L	16.1	28.9	1.7	1.7	2
	5	NKA103M	10.7	24.7	1.3	1.0	5
	6	NKA102M	9.4	28.6	1.3	1.3	1
	7	BND145L	17.6	33.8	1.3	1.3	9
	8	**Dimbuka**	**17.9**	**44.5**	**1.7**	**1.3**	**8**
	9	**NASPOT 1**	**16.7**	**32.2**	**1.3**	**2.0**	**4**
	Mean		14.4	30.7	1.4	1.6	NA
	LSD (0.05)		6.3	10.0	0.8	1.3	NA
	CV (%)		25.4	18.8	33.6	47.3	NA
Luwero 2006	1	NKA259L	8.6	18.8	1.9	1.2	NA
	2	NKA103M	12.5	24.2	1.4	1.1	NA
	3	NKA102M	7.4	23.0	1.6	1.6	NA
	4	**NASPOT 1**	**15.2**	**28.9**	**1.9**	**2.6**	NA
	5	**Dimbuka**	**15.5**	**29.8**	**1.5**	**1.3**	NA
	6	**NKA1081L**	**13.3**	**30.8**	**1.3**	**1.1**	NA
	7	NKA318L	9.1	18.1	1.8	1.2	NA
	Mean		11.7	24.8	1.7	1.4	NA
	LSD (0.05)		4.0	6.0	0.7	0.6	NA
	CV (%)		36.4	25.5	41.6	44.8	NA
Mpigi 2006	1	NKA103M	6.5	12.4	1.0	1.7	NA
	2	BND145L	4.7	12.5	1.3	2.3	NA
	3	WAG34M	4.9	11.9	1.0	2.0	NA
	4	NKA 318L	5.2	10.0	1.3	2.3	NA
	5	**NKA1081L**	**5.1**	**12.2**	**1.7**	**2.0**	NA
	6	NKA 259L	8.5	12.5	1.7	2.0	NA
	7	NKA 102M	4.0	9.6	2.0	2.0	NA
	8	**Local check**	**3.6**	**9.1**	**1.8**	**2.0**	NA
	Mean		5.3	11.3	1.5	2.0	NA
	LSD (0.05)		4.5	6.4	NS	NS	NA
	CV (%)		21.5	32.4	27.5	18.1	NA

District/staion/ year	Code	Clone	Yield (t/ha) Root	Biomass	Disase severity SPVD	Alternaria	Taste test rank
Soroti 2007	1	NKA259L	2.7	6.6	1.2	1.0	10
	2	NKA103M	3.8	7.8	1.0	1.0	3
	3	**NKA1081L**	**3.7**	**7.2**	**1.0**	**1.0**	**1**
	4	NKA318 L	2.9	6.7	1.2	1.2	8
	5	**NASPOT 1**	**4.0**	**7.5**	**1.0**	**1.0**	**4**
	6	**Dimbuka**	**3.2**	**6.9**	**1.0**	**1.0**	**7**
	7	BND12K	2.5	8.3	1.0	1.0	5
	8	NKA14K	2.5	5.5	1.0	1.0	9
	9	BND21K	1.4	5.0	1.0	1.2	2
	10	BND18K	2.5	6.9	1.0	1.0	6
	Mean		3.1	6.8	1.1	1.0	NA
	$LCD_{0.05}$		1.2	2.4	0.3	0.3	NA
	CV (%)		29.6	27.0	22.7	19.5	NA
Kiboga 2007	1	NKA259L	7.0	15.9	2.0	2.0	5
	2	NKA103M	11.4	20.0	2.0	2.0	7
	3	**NKA1081L**	**11.8**	**21.7**	**2.0**	**1.8**	**1**
	4	NKA318 L	3.6	12.5	2.0	2.0	6
	5	NASPOT 1	11.7	21.1	1.8	2.0	3
	6	**Dimbuka**	**12.6**	**21.6**	**2.3**	**2.0**	**6**
	7	BND12K	9.3	20.3	1.8	1.5	2
	8	NKA14K	11.9	27.3	2.0	2.0	4
	9	BND21K	13.9	27.7	2.3	2.0	8
	10	BND18K	10.2	35.9	2.0	1.5	7
	Mean		11.1	22.4	2.0	1.9	NA
	$LCD_{0.05}$		4.1	8.3	0.5	0.6	NA
Kabale 2008	1	NKA259L	9.2	28.3	2.0	2.4	NA
	2	NKA103M	10.3	23.7	2.2	2.2	NA
	3	NKA102M	16.6	41.7	2.0	2.3	NA
	4	NKA41M	11.2	24	2.1	3.6	NA
	5	WAG34L	9.8	25.2	2.0	2.5	NA
	6	**NKA1081L**	**12.0**	**29.3**	**2.2**	**1.7**	**NA**
	7	BND145M	10.1	31.6	2.1	2.8	NA
	8	NKA318L	12.0	33.8	2.0	1.9	NA
	9	**Dimbuka**	**8.0**	**26.2**	**2.0**	**2.1**	**NA**
	10	BND145L	7.3	17.8	2.3	2.3	NA
	Mean		10.7	28.2	2.1	2.4	NA
	LSD (0.05)		3.1	4.6	NS	0.6	NA
	CV (%)		32.5	28.8	15.0	31.7	NA

[1]SPVD = sweetpotato virus disease

SPVD and other scored traits, rating scale = 1-5: 1 = no apparent damage; 2 = very little damage 3 = moderate damage; 4 = considerable damage; 5 = severe damage

Taste ranking, 1 = first choice (best), 9 = last choice

Table 11. Performance of 10 sweetpotato clones in participatory breeding trials, planted at Namulonge Agricultural Research Institute in October 2006, harvested 5 months after planting.

Code	Clone name	Marketable root yield (t/ha)	Total Root yield (t/ha)	Dry matter %	Vine yield (t/ha)	Biomass yield (t/ha)	SPVD[2]	Alternaria	Weevil	Cracking	Rotting
1	NKA259L	66.0	67.6	33.2	28.2	95.8	2.5	2	2.0	1.0	1.3
2	NKA103M	46.0	47.6	33.7	31.4	79.0	1.8	1.5	2.0	1.3	1.5
3	NKA102M	45.0	45.6	32.8	33.2	78.8	2	3	1.8	1.3	1.5
4	**NASPOT 1**	**42.0**	**43.8**	**32.8**	**40.3**	**84.1**	**2**	**2.8**	**2.0**	**1.5**	**1.0**
5	**Araka white**	**21.5**	**19.9**	**33.2**	**60.5**	**80.4**	**2**	**3**	**2.0**	**1.3**	**1.0**
6	**NKA1081L**	**67.0**	**67.6**	**33.0**	**44.9**	**80.4**	**1.5**	**2**	**1.8**	**1.0**	**1.0**
7	NKA318L	39.0	39.5	32.4	26.9	112.5	2	1.6	2.0	1.0	1.0
8	**Dimbuka**	**36.0**	**36.3**	**34.3**	**40.0**	**66.4**	**2.3**	**1.5**	**2.0**	**1.5**	**1.0**
9	BND145L	30.0	31.9	32.0	40.8	76.3	1.5	1.8	2.0	1.0	1.0
10	**New Kawogo**	**42.0**	**42.3**	**30.6**	**67.8**	**72.7**	**2.5**	**1.5**	**2.0**	**1.3**	**2.0**
Mean		43.5	44.2	32.8	41.4	85.6	2.0	2.1	2.0	1.2	1.2
LSD (0.05)		19.3	23.9	NA	18.4	31.2	0.7	0.7	0.3	0.6	0.4
CV (%)		30.6	37.3	NA	30.6	25.1	22.9	22.8	11.7	35.1	28.4

[1]DMC = dry matter content, [2]SPVD (sweetpotato virus disease)
[2]SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage
2 = very little damage
3 = moderate damage
4 = considerable damage
5 = severe damage

Table 12. Performance of 10 sweetpotato clones at Kachwekano selected in participatory breeding trials, planted in June 2006, harvested 5 months after planting.

Code	Clone name	Market root yield (t/ha)	Total root yield (t/ha)	Dry matter %	Vine yield (t/ha)	Biomass yield (t/ha)	SPVD[2]	Alternaria	Weevil	Cracking	Rotting
1	NKA259L	33.9	36.6	34.8	39.4	76.0	1.8	1.5	1.0	1.0	1.0
2	NKA103M	23.9	26.1	28.8	26.4	52.6	2.0	1.3	1.0	1.0	1.0
3	NKA102M	18.7	21.8	29.6	25.8	47.5	2.0	2.3	1.0	1.0	1.0
4	**NASPOT 1**	**27.7**	**29.8**	**29.1**	**23.7**	**53.6**	**2.0**	**2.5**	**1.0**	**1.0**	**1.0**
5	**Magabari**	**21.5**	**26.0**	**33.9**	**55.2**	**81.3**	**2.0**	**1.0**	**1.0**	**1.3**	**1.0**
6	**NKA1081L**	**29.2**	**31.2**	**29.6**	**36.5**	**67.8**	**2.0**	**1.0**	**1.0**	**1.0**	**1.0**
7	NKA318L	24.1	28.8	31.3	33.7	62.5	2.0	1.0	1.0	1.0	1.0
8	**Dimbuka**	**30.1**	**32.7**	**30.4**	**20.4**	**53.1**	**2.3**	**2.0**	**1.0**	**1.0**	**1.0**
9	BND145L	34.5	38.9	31.3	60.6	99.4	2.3	1.5	1.0	2.8	1.0
10	**New Kawogo**	**13.6**	**16.0**	**30.2**	**21.5**	**37.5**	**2.5**	**3.5**	**1.0**	**1.0**	**1.0**
Mean		25.7	28.8	30.9	34.3	63.1	2.1	1.8	1.0	1.2	1.0
LSD (0.05)		10.5	11.4	NA	15.5	22.3	0.6	0.6	NS	1.6	NS
CV (%)		28.1	27.4	NA	31.2	36.6	16.0	25.6	NA	91.7	NS

[1]DMC = dry matter content, [2]SPVD (sweetpotato virus disease)

SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage
2 = very little damage
3 = moderate damage
4 = considerable damage
5 = severe damage

Table 13. Performance of 10 sweetpotato clones at Serere Research Institute selected in participatory breeding trials, planted in October 2006, harvested 5 months after planting.

Code	Clone name	Marketable root yield (t/ha)	Total root yield (t/ha)	Dry matter %	Vine yield (t/ha)	Biomass yield (t/ha)	SPVD[1]	Alternaria	Weevil	Cracking	Rotting
1	NKA259L	33.1	33.8	34.3	13.3	47.1	1.0	1.3	2.5	1.0	2.0
2	NKA103M	50.7	50.9	35.9	18.1	69.0	1.0	1.0	2.5	1.0	1.3
3	NKA102M	48.0	48.7	32.2	21.9	70.6	1.0	1.0	2.3	1.0	1.5
4	**NASPOT 1**	**72.7**	**73.3**	**35.3**	**44.8**	**118.1**	**1.0**	**1.3**	**1.8**	**1.0**	**1.0**
5	**Araka white**	**19.5**	**20.0**	**32.2**	**57.6**	**77.6**	**1.0**	**1.3**	**1.0**	**1.0**	**1.0**
6	**NKA1081L**	**45.5**	**46.0**	**33.4**	**28.0**	**74.0**	**1.0**	**1.0**	**1.8**	**1.0**	**1.0**
7	NKA318L	51.3	52.4	34.3	13.7	66.1	1.0	11.0	2.0	1.0	1.3
8	**Dimbuka**	**35.0**	**36.5**	**31.2**	**26.3**	**62.8**	**1.0**	**1.3**	**1.3**	**1.0**	**1.0**
9	BND145L	41.9	42.7	31.9	21.3	64.0	1.0	1.5	2.0	1.0	1.0
10	**New Kawogo**	**40.6**	**41.3**	**29.0**	**14.0**	**55.3**	**1.0**	**1.3**	**2.3**	**1.3**	**1.0**
Mean		43.8	44.6	32.9	25.9	70.5	1.2	1.2	2.0	1.1	1.1
LSD (0.05)		19.3	16.3	NA	11.4	23.1	NS	0.6	0.6	0.3	0.6
CV (%)		25.7	25.3	NA	30.4	55.6	31.7	33.9	21.4	21.7	27.1

[1]SPVD = sweetpotato virus disease

SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage
2 = very little damage
3 = moderate damage
4 = considerable damage
5 = severe damage

NA = not applicable

NS = not significant

Table 14. Performance of 10 sweetpotato clones at Ngetta ARDC selected in participatory breeding trials, planted in May 2006, harvested 5 months after planting.

Code	Clone name	Marketable root yield (t/ha)	Total Root yield (t/ha)	Dry matter %	Vine yield (t/ha)	Biomass yield (t/ha)	SPVD[2]	Alternaria	Weevil	Cracking	Rotting
1	NKA259L	6.0	7.0	31.9	13.0	20.0	1.0	1.5	3.5	1.0	1.0
2	NKA103M	9.1	7.1	32.9	12.0	19.0	1.0	1.0	3.5	1.3	1.0
3	NKA102M	3.1	4.1	34.4	7.8	11.9	1.0	1.0	4.0	1.0	1.3
4	**NASPOT 1**	**9.5**	**9.8**	**33.8**	**18.1**	**27.9**	**1.0**	**1.5**	**3.5**	**1.8**	**1.0**
5	**Otada**	**1.9**	**2.7**	**33.8**	**13.9**	**16.5**	**1.0**	**1.0**	**3.5**	**1.0**	**1.0**
6	**NKA1081L**	**6.5**	**7.7**	**31.7**	**11.0**	**18.7**	**1.0**	**1.0**	**4.0**	**1.0**	**1.0**
7	NKA318L	2.8	3.7	31.2	5.6	9.3	1.0	1.0	4.0	1.3	1.0
8	**Dimbuka**	**2.3**	**3.6**	**34.6**	**14.0**	**17.5**	**1.0**	**1.0**	**3.8**	**1.0**	**1.0**
9	BND145L	3.2	4.4	34.9	9.6	14.0	1.0	1.0	4.0	1.0	1.0
10	**New Kawogo**	**2.3**	**3.1**	**33.8**	**20.2**	**23.3**	**1.0**	**1.0**	**3.5**	**1.5**	**1.0**
Mean		4.7	5.3	33.3	12.5	17.8	1.0	1.3	3.7	1.2	1.0
LSD (0.05)		1.5	1.9	NA	5.4	6.9	NS	0.7	0.7	0.5	0.2
CV (%)		21.8	25.1	NA	29.6	26.6	NA	40.0	11.6	29.2	15.4

[1]DMC = dry matter content, [2]SPVD (sweetpotato virus disease)

SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage
2 = very little damage
3 = moderate damage
4 = considerable damage
5 = severe damage

NA = not application

Table 15. Performance of 10 sweetpotato clones selected in participatory breeding trials in four locations on station - Namulonge, Kachwekano, Ngetta and Serere, planted between June and October 2006 and harvested 5 – 5.5 months after planting.

Code	Name of clone	Marketable root yield (t/ha)	Total root yield (t/ha)	Dry matter %	Vine yield (t/ha)	Biomass yield (t/ha)	SPVD[1]	Altermaria	Weevil damage
1	NKA259L	34.7	36.2	33.6	23.5	59.7	1.8	1.6	2.3
2	NKA103M	32.4	32.9	32.8	22.0	54.9	1.5	1.2	2.3
3	NKA102M	28.7	30.1	32.3	22.2	52.2	1.6	1.8	2.3
4	**NASPOT 1**	**38.0**	**39.2**	**32.8**	**31.7**	**70.9**	**1.5**	**2.1**	**2.1**
5	**Local check**	**16.1**	**17.1**	**33.3**	**46.8**	**63.9**	**1.5**	**1.6**	**1.9**
6	**NKA1081L**	**37.0**	**38.1**	**31.9**	**30.1**	**68.2**	**1.4**	**1.3**	**2.1**
7	NKA318L	29.3	31.1	32.3	20.0	51.1	1.6	1.2	2.3
8	**Dimbuka**	**25.8**	**27.3**	**32.6**	**25.2**	**52.2**	**1.6**	**1.4**	**2.3**
9	BND145L	27.4	29.5	32.5	33.0	62.5	1.4	1.3	2.3
10	**New Kawogo**	**24.6**	**25.6**	**30.9**	**30.8**	**56.5**	**1.8**	**1.9**	**2.2**
Mean		29.4	30.7	32.5	28.5	59.2	1.6	1.5	2.2
$LSD_{0.05}$		6.8	7.7	NA	8.0	12.5	0.2	0.3	0.2
CV (%)		32.9	30.1	NA	39.9	30.1	21.8	28.9	15.0

[1]SPVD = sweetpotato virus disease

SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage
2 = very little damage
3 = moderate damage
4 = considerable damage
5 = severe damage

NA = not applicable

Table 16. Sweetpotato participatory breeding trial planted at Namulonge in November 2007 and harvested 4.5 months after planting.

Code	Name of clone	Dry matter %	Yield (t/ha) Total root	Market root	Vine	Bio mass	SPVD[1]	Alternaria	Weevil damage	Cracking	Rotting
6	**NKA1081L**	**30.8**	**57.1**	**26.3**	**31.8**	**88.8**	**3.0**	**2.8**	**2.3**	**1.0**	**1.3**
8	**Dimbuka**	**30.4**	**55.8**	**24.6**	**39.8**	**95.7**	**2.5**	**2.8**	**2.0**	**2.3**	**1.0**
4	**NASPOT 1**	**30.3**	**48.5**	**22.5**	**32.6**	**81.1**	**2.8**	**3.3**	**2.0**	**2.3**	**1.5**
1	NKA259L	31.7	44.1	20.3	60.0	104.3	3.0	3.0	1.8	2.0	1.3
2	NKA103M	35.0	40.4	18.9	24.0	64.4	2.3	1.5	1.5	2.0	1.0
9	BND145L	32.4	39.4	18.0	24.2	63.6	2.3	2.8	1.8	1.3	1.3
3	NKA102M	35.8	17.0	7.1	31.7	48.7	2.0	2.0	1.5	1.5	1.0
5	**New Kawogo**	**29.7**	**15.5**	**6.9**	**65.0**	**80.5**	**2.8**	**2.0**	**1.8**	**2.3**	**1.3**
7	NKA318L	35.9	13.3	5.3	32.1	45.4	2.0	2.8	1.5	1.0	1.0
10	**Kyabafuruki**	**29.7**	**6.3**	**3.0**	**58.5**	**65.2**	**2.3**	**3.3**	**1.3**	**1.3**	**1.0**
Mean		NA	33.8	15.3	40.0	73.8	2.5	2.6	1.7	1.7	1.2
$LCD_{0.05}$		NA	11.8	5.6	20.8	27.4	0.6	0.8	0.9	0.6	0.6
CV (%)		NA	24.1	25.3	35.8	25.6	16.4	21.6	34.3	24.8	33.0

[1]SPVD = sweetpotato virus disease; SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage 2 = very little damage 3 = moderate damage

4 = considerable damage 5 = severe damage

Table 17. Sweetpotato participatory breeding trial planted at NaCRRI in April 2008 and harvested in January 2009

Code	Name of clone	Dry matter %	Yield (t/ha)				SPVD[1]	Alter naria	Weevil damage	Cracking	Sprouting	Rotting
			Total root	Market root	Vine	Biomass						
1	NKA259L	34.4	21.8	20.4	17.2	38.9	2.8	2.3	3.3	1.5	1.8	3.0
2	NKA103M	33.2	39.4	36.7	21.9	61.3	2.0	1.5	4.0	1.8	2.0	3.0
3	NKA102M	34.4	35.6	33.4	23.6	59.2	2.0	1.5	2.8	1.5	1.3	2.5
4	**NASPOT 1**	**32.3**	**47.9**	**45.0**	**28.8**	**76.8**	**3.0**	**3.5**	**3.5**	**2.3**	**1.8**	**3.5**
5	**Magabari**	**30.7**	**20.9**	**20.1**	**13.8**	**34.7**	**3.5**	**3.0**	**2.8**	**2.3**	**1.5**	**2.5**
6	**NK1081L**	**30.5**	**48.6**	**46.8**	**29.3**	**77.9**	**2.0**	**1.3**	**3.0**	**1.8**	**2.0**	**2.3**
7	NKA318 L	33.2	24.0	22.9	24.8	48.7	2.0	1.8	3.0	2.0	1.3	2.0
8	**Dimbuka**	**34.1**	**35.9**	**31.5**	**23.6**	**59.5**	**2.8**	**2.0**	**3.5**	**2.5**	**2.3**	**2.8**
9	BND145L	34.4	36.5	33.8	27.6	64.0	2.3	2.0	3.0	1.8	2.0	1.8
10	**New Kawogo**	**33.5**	**24.3**	**23.5**	**75.2**	**99.5**	**2.0**	**2.3**	**2.5**	**1.3**	**1.3**	**2.3**
Mean		29.6	33.5	31.4	28.6	62.0	2.4	2.1	3.1	1.9	1.7	2.6
$LCD_{0.05}$		NA	12.0	11.6	9.7	18.7	0.5	0.8	1.2	1.1	0.8	1.4
CV (%)		NA	24.6	25.4	23.4	20.7	14.1	24.9	27.4	39.2	30.6	38.0

[1]SPVD = sweetpotato virus disease; SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage 2 = very little damage 3 = moderate damage 4 = considerable damage 5 = severe damage

Table 18. Sweetpotato participatory breeding trial planted at Kachwekano in May 2008 and harvested 6.5 months after planting.

Code	Name of clone	Dry matter %	Yield (t/ha)				SPVD[1]	Alter naria	Weevil damage	Cracking	Sprouting	Rotting
			Total root	Market root	Vine	Biomass						
1	NKA259L	32.3	39.7	35.3	33.5	73.1	1.3	1.5	1.0	1.0	1.0	1.0
2	NKA103M	34.6	46.1	40.8	37.0	83.0	1.3	1.8	1.0	1.0	1.0	1.0
3	NKA102M	33.1	36.2	31.4	35.0	71.2	1.8	2.0	1.3	1.0	1.5	1.0
4	**NASPOT 1**	**34.6**	**57.0**	**50.9**	**69.1**	**126.1**	**1.3**	**1.8**	**1.0**	**1.0**	**1.5**	**1.0**
5	**Magabari**	**33.5**	**33.2**	**27.1**	**56.2**	**89.4**	**1.8**	**1.5**	**1.0**	**1.0**	**1.0**	**1.0**
6	**NKA1081L**	**31.0**	**46.4**	**42.1**	**36.9**	**83.3**	**1.5**	**1.5**	**1.5**	**1.0**	**1.0**	**1.0**
7	NKA318 L	30.5	45.5	40.7	48.8	94.2	1.3	1.3	1.0	1.0	1.0	1.0
8	**Dimbuka**	**32.9**	**48.6**	**38.7**	**45.8**	**94.5**	**2.3**	**2.5**	**1.0**	**1.0**	**1.0**	**1.0**
9	BND145L	32.7	29.4	26.2	39.0	68.4	1.0	1.3	1.0	1.0	1.0	1.0
10	**New Kawogo**	**30.6**	**47.5**	**44.3**	**36.6**	**84.1**	**2.0**	**2.8**	**1.5**	**1.0**	**1.3**	**1.0**
Mean		32.6	43.0	37.7	43.8	86.7	1.5	1.8	1.1	1.0	1.1	1.0
$LCD_{0.05}$		NA	17.5	17.1	19.1	24.0	0.6	1.0	0.4	0.0	0.6	0.0
CV (%)		NA	21.4	24.6	26.2	19.1	29.7	37.0	26.9	0.0	35.4	0.0

[1]SPVD = sweetpotato virus disease; SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage 2 = very little damage 3 = moderate damage 4 = considerable damage 5 = severe damage

NA = not application

Table 19. Sweetpotato participatory breeding trial planted at Ngetta in July 2008 and harvested in December 2008.

Code	Name of clone	Dry matter %	Yield (t/ha)				SPVD[1]	Alter naria	Weevil damage	Cracking	Sprouting	Rotting
			Total root	Market root	Vine	Biomass						
1	NK259L	34.4	18.2	17.0	23.3	41.6	1.5	1.0	1.3	1.0	1.0	1.0
2	NK103M	31.9	15.7	15.3	14.0	29.7	1.0	1.0	1.5	2.0	1.0	1.0
3	NK102M	33.4	15.2	14.6	21.3	36.5	1.5	1.0	1.7	1.3	1.0	1.0
4	**NASPOT 1**	**32.7**	**22.0**	**20.9**	**15.9**	**37.9**	**1.3**	**1.0**	**2.0**	**1.3**	**1.0**	**1.0**
5	**Otada**	**34.0**	**8.1**	**7.6**	**16.4**	**24.5**	**1.3**	**1.0**	**2.0**	**1.5**	**1.0**	**1.0**
6	**NK1081L**	**33.1**	**20.8**	**20.2**	**16.8**	**37.6**	**1.8**	**1.0**	**1.5**	**1.0**	**1.0**	**1.0**
7	NK318 L	34.9	5.7	5.3	11.9	17.6	1.5	1.0	1.8	1.0	1.0	1.0
8	**Dimbuka**	**32.6**	**19.0**	**16.9**	**11.5**	**30.5**	**1.8**	**1.0**	**1.8**	**1.3**	**1.3**	**1.0**
9	BND145L	32.6	12.4	11.8	13.5	25.8	1.5	1.0	2.3	1.0	1.0	1.0
10	**New Kawogo**	**33.0**	**1.5**	**1.4**	**33.1**	**34.6**	**1.3**	**1.0**	**1.8**	**1.0**	**1.0**	**1.0**
Mean		29.8	13.8	13.1	17.8	31.6	1.4	1.0	1.8	1.1	1.0	1.0
$LCD_{0.05}$		NA	7.0	6.6	4.8	9.3	0.8	0.0	0.6	0.5	0.2	0.0
CV (%)		NA	34.7	34.7	18.6	20.2	36.9	0.0	23.6	30.5	15.4	0.0

[1]SPVD = sweetpotato virus disease; SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage 2 = very little damage 3 = moderate damage 4 = considerable damage 5 = severe damage

NA = not application

Table 20. Sweetpotato participatory breeding trial planted at Serere in May 2008 and harvested in October 2008.

Code	Name of clone	Yield (t/ha)				SPVD[1]	Alter naria	Weevil damage	Cracking	Sprouting	Rotting
		Total root	Market root	Vine	Biomass						
1	NKA318 L	11.2	8.6	11.3	22.4	1.9	1.4	1.9	1.0	1.0	1.0
2	BND21K	10.9	8.7	10.9	21.7	1.4	1.6	2.0	1.0	1.0	1.0
3	**NKA1081L**	**31.4**	**17.5**	**12.6**	**44.0**	**1.6**	**1.3**	**1.7**	**1.0**	**1.0**	**1.0**
4	BND14K	43.7	10.9	17.3	61.0	1.8	1.4	1.3	1.0	1.0	1.0
5	**Araka**	**20.3**	**13.4**	**10.3**	**30.5**	**1.8**	**1.1**	**1.8**	**1.1**	**1.0**	**1.0**
6	NKA103M	28.5	17.7	13.0	41.6	1.7	1.6	1.9	1.0	1.0	1.0
7	**NASPOT 1**	**26.8**	**17.1**	**20.1**	**46.9**	**1.9**	**3.0**	**2.0**	**1.1**	**1.0**	**1.0**
8	NKA259L	19.8	10.0	23.1	42.9	1.9	1.4	1.9	1.0	1.0	1.0
9	BND18K	26.7	9.0	11.8	38.4	1.7	1.9	1.2	1.3	1.0	1.0
Mean		24.4	12.6	14.5	38.8	1.7	1.5	1.7	1.1	1.0	1.0
$LCD_{0.05}$		9.0	4.7	6.5	14.8	0.3	0.4	0.3	0.2	0.0	0.0
CV (%)		41.5	42.2	50.5	42.8	19.9	31.8	21.9	25.9	0.0	0.0

[1]SPVD = sweetpotato virus disease; SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage 2 = very little damage 3 = moderate damage 4 = considerable damage 5 = severe damage

Table 21. Performance on station in 2008/2009 in four on-station sites of sweetpotato clones previously selected in participatory breeding

Code	Name of clone	Locations				Mean across sites					Root color	
		Namulonge	Kachwekano	Ngetta	Serere	Root yield	Biomass	Dry matter	SP	Alter	Skin	Flesh
		Storage root yield (t/ha)				(t/ha)	(t/ha)	(%)	VD[1]	naria		
1	NKA259L	21.8	39.7	18.2	29.6	27.3	54.3	33.6	1.8	1.6	Purple-red	Cream
2	NKA103M	39.4	46.1	15.7	37.7	34.7	61.1	32.8	1.4	1.3	Purple-red	Cream
3	NKA102M	35.6	36.2	15.2	13.4	25.1	58.1	32.3	1.7	1.4	Cream	Cream
4	**NASPOT 1**	**47.9**	**57.0**	**22.0**	**28.0**	**38.7**	**78.0**	**32.8**	**1.9**	**2.0**	**Cream**	**Cream**
5	**Magabari**	**20.9**	**33.2**	**8.1**	**21.9**	**21.0**	**50.7**	**33.3**	**1.7**	**1.6**	**Cream**	**Cream**
6	**NKA1081L**	**48.6**	**46.4**	**20.8**	**49.5**	**41.3**	**78.5**	**31.9**	**1.6**	**1.1**	**Purple-red**	**Cream**
7	NKA318 L	24.0	45.5	5.7	10.9	21.5	58.1	32.3	1.4	1.3	Purple-red	Cream
8	**Dimbuka**	**35.9**	**48.6**	**19.0**	**44.6**	**37.0**	**70.3**	**32.6**	**2.1**	**1.9**	**Cream**	**Cream**
9	BND145L	36.5	29.4	12.4	28.9	26.8	58.0	32.5	1.4	1.3	Purple-red	Cream
10	New Kawogo	24.3	47.5	1.5	2.6	19.0	76.9	30.9	1.6	1.8	Purple-red	Cream
Mean		33.5	43.0	13.8	26.7	29.3	64.3	32.5	1.7	1.3	NA	NA
$LSD_{0.05}$		12.0	13.3	7.0	10.2	5.2	9.4	NA	0.3	0.3	NA	NA
CV (%)		24.6	21.4	34.7	26.7	25.6	20.8	NA	25.2	29.1	NA	NA

[1]SPVD = sweetpotato virus disease; SPVD and other scored traits, rating scale = 1-5:

1 = no apparent damage 2 = very little damage 3 = moderate damage 4 = considerable damage 5 = severe damage

NA = not application

Table 22. Average storage root yield and estimates of four stability parameters of regression analysis (Eberhart and Russel, 1966) and Tai stability test (Tai, 1971) for the trait of 10 sweetpotato clones for 2 seasons, 4 sites (Namulonge, Kachwekano, Ngetta, and Serere), 2006/7-2008/9.

Code	Clone		Root	Regression analysis[1]				Tai test[2]							
			yield t/ha	b^3	Probability	S^2d^4	Prob.	α^5	Prob.	Sign.	Lower	λ^6	Upper	Sign	Prob.
1	A	NKA259L	31.79	0.72542	<.0001	196.2	<.0001	0.62618	0.96523	ns	0.26193	5.62	3.8178	*	0.00476
2	B	NKA103M	33.8	0.72538	<.0001	172.4	<.0001	0.62614	0.81173	ns	0.26193	3.97	3.8178	*	0.02157
3	C	NKA102M	27.57	0.81296	<.0001	172.4	<.0001	0.71383	0.48613	*	0.26193	1.43	3.8178	ns	0.24474
4	**D**	**NASPOT 1**	**38.96**	**0.92925**	**<.0001**	**135.6**	**<.0001**	**0.83026**	**0.42073**	*****	**0.26193**	**1.07**	**3.8178**	**ns**	**0.34724**
5	E	Magabari	19.09	0.1703	<.0001	130.4	<.0001	0.07039	0.44939	ns	0.26193	1.22	3.8178	ns	0.29967
6	**F**	**NKA1081L**	**39.72**	**0.92939**	**<.0001**	**132.6**	**0.4217**	**0.37075**	**0.44939**	**ns**	**0.26193**	**1.22**	**3.8178**	**ns**	**0.29967**
7	G	NK318 L	26.3	0.72548	<.0001	222.2	<.0001	0.62624	1.10897	ns	0.26193	7.42	3.8178	*	0.00096
8	**H**	**Dimbuka**	**32.14**	**0.77436**	**0.0001**	**151.8**	**0.0001**	**0.67518**	**0.6496**	*****	**0.26193**	**2.55**	**3.8178**	**ns**	**0.08307**
9	I	BND145L	28.11	0.65488	0.0031	140.4	0.0031	0.55556	0.53942	*	0.26193	1.76	3.8178	ns	0.17766
10	J	New Kawogo	22.31	0.92077	<.0001	241.9	<.0001	0.82177	1.20676	ns	0.26193	8.79	3.8178	*	0.00029

Significance at P<0.05 (*); ns is not significant.

[1]Eberhart and Russel stability criteria: b = 1.0 and S^2d = 0, at 5% of probability

[2]Tai's test stability criteria: $\alpha = 0$ and $\lambda = 1.0$, at 5% probability

[3]Regression coefficient of the i-th variety

[4]Deviation from regression of the i-th variety on the environmental indices

[5]Linear response of the i-th variety on the environmental effects

[6]Deviation from the linear response in terms of the magnitude of the error variance

Table 23. Summary of main traits of NKA1081L and the local check, Dibumbuka-Bukulula

Character	Score (description) of character of variety	
	NKA1081L	Dimbuka-Bukulula
Storage root skin color	Purple-red	2 Cream
Flowering habit	3 Sparse	5 Moderate
Stigma exertion	1 Inserted (shorter than longest anther)	1 Inserted (shorter than longest anther)
Seed capsule set	1 Scarce	5 Moderate
Storage root dry mater (%)	33.5 (range 29.6-36)	32.4 (range 26.9-35.9)
Storage root yields (t/ha)	26.5 (3.7-48.2)	23.3 (3.6-34.79)
Sprouting ability in beds	8 Very good	8 Very good
Firmness of boiled root	4 Firm	4 Firm
Mealiness	4 Mealy	3 Moderately mealy
Sweetness of boiled root	3 Moderately sweet	3 Moderately sweet
Pest reaction	Susceptible to sweetpotato weevil (SPW)	Susceptible to SPW
Disease reaction	High resistance to Alternaria blight	Moderately resistant to Alternaria blight
	Moderately resistant to SPVD	Susceptible to SPVD

Figure 1 - 3. Stability Analysis

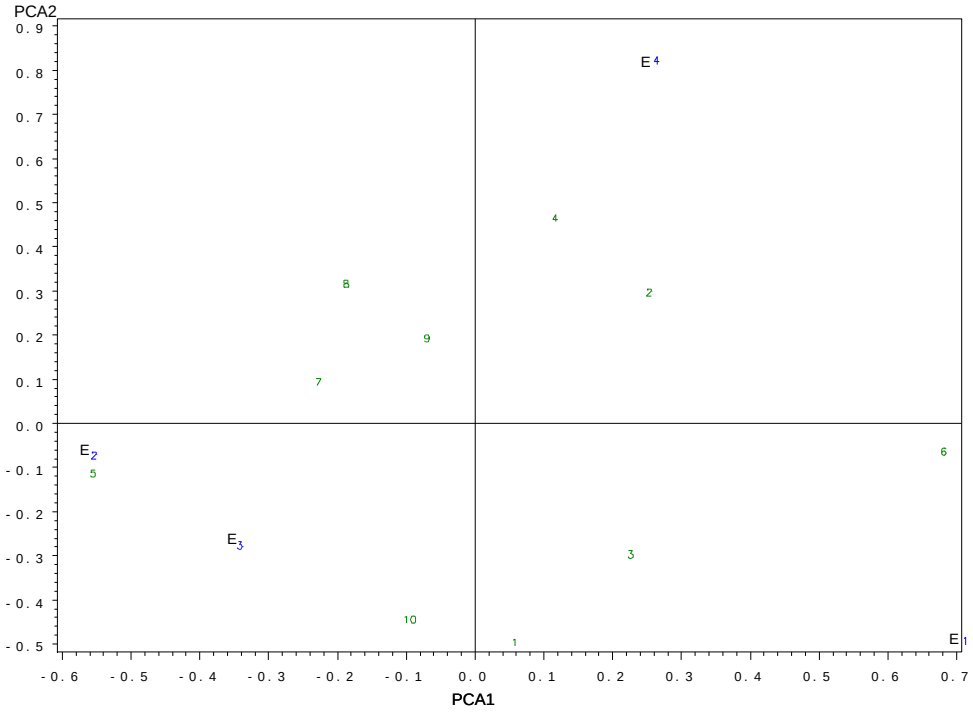

Fig. 1. Biplot of principal components analysis (PCA) axis 2 vs axis 1 for mean root yield (t/ha) for 10 sweetpotato clones grown in two, 2007/2008 and 2008/2009 in four sites [environments (E)]: E1 = Namulonge, E2 = Kachwekano, E3 = Ngetta, and E4 = Serere. Relatively stable clones are clustered close to the center of the biplot. More unstable clones are far away from the center. Proximity of some clones to certain environments indicates positive correlation for this trait. Unstable clones appear distant from all environments indicating lack of correlation with any particular environment, whereas stable ones appear closer to one of the environments. Clones: 1 = NKA259L, 2 = NKA103M, 3 = NKA102M, 4 = NASPOT 1, 5 = Magabari, 6 = NKA1081L, 7 = NKA318 L, 8 = Dimbuka, 9 = BND145L, 10 = New Kawogo.

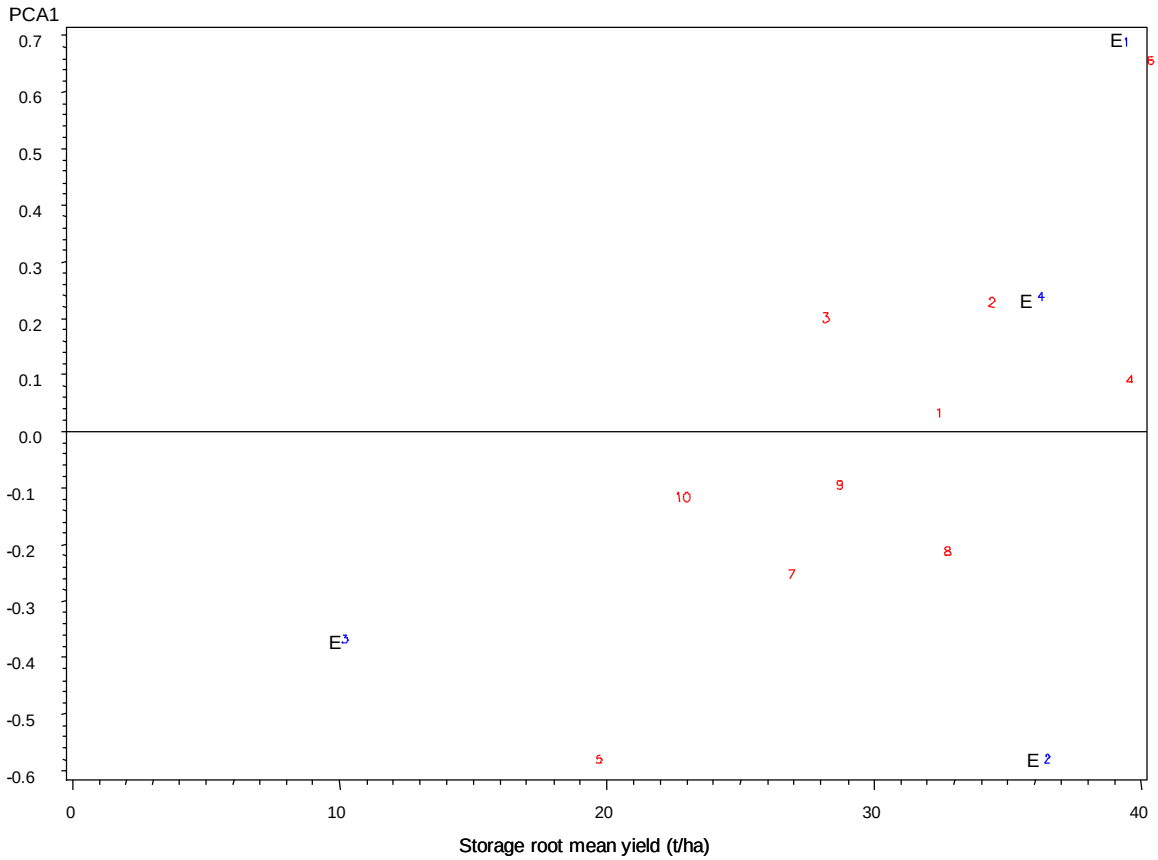

Fig. 2. Biplot of principal components analysis (PCA) axis 1 vs mean root yield (t/ha) for 10 sweetpotato clones grown two seasons during 2007/2008, 2008/2009 in four sites [environments (E)]: E1 = Namulonge, E2 = Kachwekano, E3 = Ngetta, and E4 = Serere. The plot of PC1 axis vs. mean root yield shows one cluster with two outliers. Genotypes with large positive scores yield especially well in environments with the same sign. The converse is also true: genotypes with a large negative score yield best in environments with a large negative score. The scatter of points on the PCA axes is a good indicator of factors contributing to the observed variability. For the genotypes, extreme values of the first PCA axis loadings for root yield indicate that such genotypes were important in the GxE interaction. Clones: Clones: 1 = NKA259L, 2 = NKA103M, 3 = NKA102M, 4 = NASPOT 1, 5 = Magabari, 6 = NKA1081L, 7 = NKA318 L, 8 = Dimbuka, 9 = BND145L, 10 = New Kawogo.

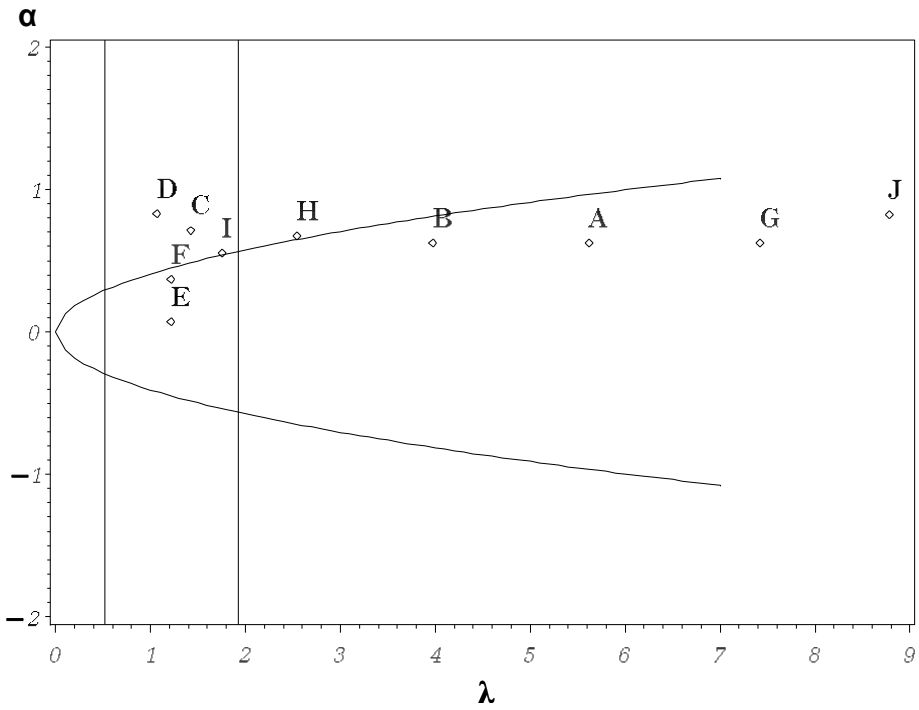

Fig. 3. Distribution of Tai's statistics of root yield (t/ha) for 10 sweetpotato clones grown in 2007/2008 and 2008/2009, in four locations for two seasons. Tai's average stability region is defined by the intersection area of the hyperbola representing a 95% prediction interval for $\alpha = 0$; and the vertical lines that limit a 95% confidence interval for $\lambda = 1$. Genotypes within this intersection area are considered stable. Tai stability analysis produces a plot distribution statistics α and λ that shows a region of average stability ($\alpha = 0$ and $\lambda = 1$). A perfectly stable variety has $(\alpha, \lambda) = (-1, 1)$. Clones showing acceptable values of α, but very high (or very low) values of λ, are regarded as stable but with lower reliability. Other clones that have large PCA scores are well outside the stability region. Clones: A = NKA259L, B = NKA103M, C = NKA102M, D = NASPOT 1, E = Magabari, F = NKA1081L, G = NKA318 L, H = Dimbuka, I = BND145L, J = New Kawogo.

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