Proceedings of the 13th ISTRC Symposium, 2007
pp. 355 - 358

Evaluation of orange-fleshed sweetpotatoes varieties for resistance to sweetpotato virus disease

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Abstract. Use of orange-fleshed sweet potatoes (OFSP) rich in ß-carotene, a precursor for vitamin A in the body, is being promoted as a food based approach to combat vitamin A deficiency in diets among vulnerable communities in Uganda. A number of OFSP varieties have been identified and tested. However, sweetpotato virus disease (SPVD) is a major production constraint in Uganda and most of the introduced OFSP materials have succumbed to the viral damage. It is important that before the OFSP are passed to the farmers they are evaluated for desired attributes. Thus experiments were conducted to evaluate different promising OFSP varieties in Uganda. These included SPK004, Zapallo, Naspot5, Ejumula, and Kala. New kawogo served as a SPVD-resistant, the control. The trial was laid out in a randomized complete block design with varieties as treatments replicated four times. Mean number of plants with SPVD symptoms varied among varieties with New Kawogo being least affected. Total fresh weight, marketable weight and mean number of storage roots per plant varied significantly among varieties. The local cultivar Ejumula had a high yield but also had a high incidence of SPVD. Kala and SPK004 suffered the highest weevil damage in the first rains. There was non-significant negative correlation ($r = -0.23$, $P = 0.65$; $r = -0.16$, $P = 0.17$) between yield and cumulative SPVD incidence in both seasons. Susceptible varieties still yielded highest and are capable of yielding higher if SPVD is checked using cultural control methods such as roguing, planting clean vines and planting new fields at a distance (at least 100m).

Introduction

Sweetpotato is one of the major starchy staples for the majority of rural settings and the urban poor. Sweetpotato is the most widely cultivated and widespread food crop in Uganda and is grown as a major staple or as a supplement to banana, finger millet and cassava (Mwanga and Wanyera, 1988, Bashaasha *et al*., 1995). The importance of sweetpotato as a food security and ready source of income to Ugandan farmers is increasing particularly in banana and cassava-based farming system due to increased pests and diseases (banana bacterial wilt, black Sigatoka, banana weevils and nematodes; and cassava mosaic disease). Even in areas where cereals are predominant (northern and eastern Uganda), sweetpotato serves as a buffer crop against famine and helps to supplement food supplies in the months preceding grain harvest. One of the major limiting biotic factor to increased sweetpotato productivity is sweetpotato virus disease (SPVD) (Carey *et al*., 1999). SPVD has been ranked as the single most important disease constraint to sweetpotato production in the East African region and is the most important disease throughout Africa (Geddes, 1990). SPVD results from co-infection of sweetpotato plants with the aphid-borne *sweet potato feathery mottle virus* (SPFMV) (Family *Potyviridae*: Genus *Potyvirus*) and the

Bemisia tabaci-borne *sweetpotato chlorotic stunt virus* (SPCSV) (Family *Closteroviridae*: Genus *Crinivirus*) (Schaefers and Terry, 1976; Gibson *et al.*, 1998).

SPVD is reported to occur whenever sweetpotato is grown in the world, however, in Uganda, it is rare in eastern districts of Soroti, Tororo, and Busia but reaches damaging levels in central Uganda and in the southern districts of Masaka and Rakai (Aritua *at al.*, 1999). The prevalence of SPVD in these areas, coupled with farmers' limited knowledge about its cause and spread has exacerbated the problem.

Of recent there are efforts to combat vitamin A deficiency in children below 6 years by use of orange fleshed sweetpotato varieties. Use of orange-fleshed sweet potatoes (OFSP) rich in ß-carotene, a precursor for vitamin A in the body, is being promoted as a food based approach to combat vitamin A deficiency in diets among vulnerable communities in Sub-Saharan Africa (Low *et al.*, 2001). A number of OFSP varieties have been identified and tested. However, sweetpotato virus disease (SPVD) is a major production constraint in Uganda and most of the introduced OFSP materials have succumbed to the viral damage. It is important that before the OFSP are passed to the farmers they are evaluated for desired attributes. This paper reports on experiments conducted to evaluate different promising OFSP varieties in Uganda.

Materials and Methods

The trial was done twice during the first and second seasons of 2002 at Namulonge Agricultural and Animal production Research Institute (NAARI). The clones included SPK004, Zapallo, Naspot5, Ejumula, and Kala. New Kawogo was included as a SPVD-resistant control. The trial was laid out in a randomized complete block design with six treatments replicated four times. Twelve vines were planted on a ridge of 5 m x 1 m with five ridges in a plot. At 1 month after planting (MAP) plants with SPVD symptoms were rogued out since these would be cutting infections rather than vector introduced. SPVD data was collected on a monthly basis for a period of four months. Infected plants were counted per plot and recorded. Cumulative SPVD incidence was used in establishing correlation between SPVD and yield. At harvest (5 MAP), number of marketable roots, weight of marketable storage roots and total fresh weight was recorded. The total yield area harvested was computed from the 5x2 m (one ridge covering a meter). The weevil score was also recorded using a scale of 1-5 where 1= clean and 5= > 80% of surface area bored. Data analysis was done using SAS package to test for the difference in yield and resistance to SPVD.

Results and Discussion

Total fresh weight and marketable weight varied significantly among varieties (Table 1). The cultivar Ejumula had highest yield (17.8 t/ha) followed by Kala in the first season. In the second season the same varieties yielded highest. Zapallo and Naspot 5 were the least yielding. Kala and Zapallo suffered the highest weevil damage in first rains while Kala and SPK004 were the most damaged by weevils in the second season. New Kawogo had the least damage in both seasons. Cumulative numbers of infected plants with SPVD were highest in Naspot 5 and Ejumula in the first season while Zapallo and SPK004 had the highest SPVD incidence in the second season (Figure 1). However, the control New Kawogo registered lowest amount of disease in both seasons. There was generally less disease in second season compared with the first season. The difference in SPVD incidences in the two seasons could have been due to low rainfall in the first season (Table 2) which may have favoured whitefly population build up and hence more disease spread. This agrees with findings of Butler *et al.* (1983) that whiteflies are more active during warm temperatures and Fishpool *et al.* (1995) who showed rainfall to be negatively

Table 1: Marketable yield, weevil damage and fresh tuber weight of seven sweetpotato varieties grown at Namulonge, Uganda.

Entry	Marketable yield (t/ha)	Weevilscore	Fresh weight(t/ha)	Ranking for yield
First season				
Ejumula	13.3b	2.5ab	17.6bc	1
Kala	13.1b	3.0a	15.4bc	2
SPK004	11.6b	1.8ab	13.9c	3
Zapallo	4.2c	2.8a	6.0d	4
New Kawogo	1.6c	0.8cd	2.4d	5
Naspot 5	0.68c	1.0cd	1.9d	6
CV %	40.6	32.6	36.3	
Second season 2002				
Ejumula	11.7ab	1.3b	17.8a	1
Kala	8.7abc	2.5a	12.1abc	2
SPKOO4	8.9abc	2.0ab	11.1abcd	3
Naspot 5	1.3cde	1.5ab	1.8dc	4
Zapallo	0.5e	1.3b	1.6dc	5
New Kawogo	0.7de	1.0b	0.9d	6
CV %	83.7	51.1	83.5	

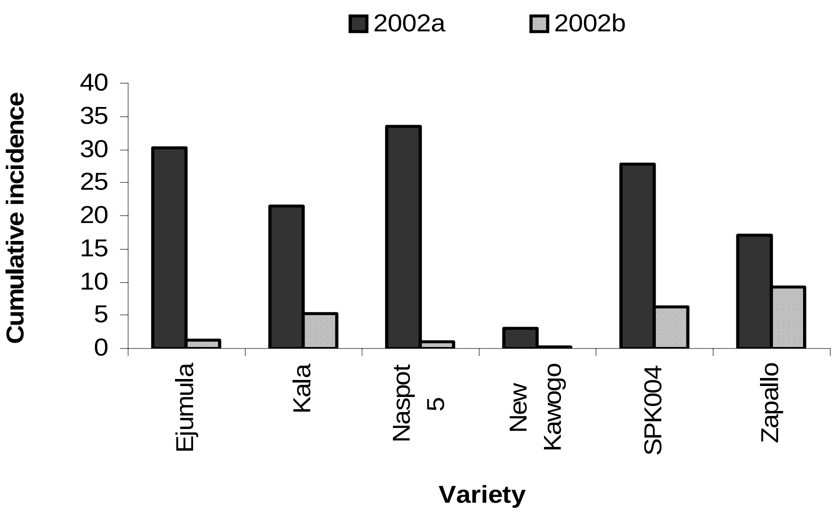

Figure 1: Cumulative number of plants with sweetpotato virus disease symptoms in the two seasons (2002a&b).

correlated with population size, possibly due to a reduction in oviposition.

There was a negative but non-significant correlation between cumulative SPVD incidence and yield (r = -0.23, P = 0.65; r = -0.16, P = 0.17) for the two seasons respectively. The non significant correlation between SPVD and yield indicates that yield depended more on genetic potential of the clones considering that the resistant varieties still yielded less compared to susceptible ones. The yield potential of some of the

Table 2: Rainfall (mm) during the two seasons 2002a&b.

Month	Rainfall (mm)
May	2.80
June	2.58
July	0.58
August	2.05
September	5.65
October	7.87
November	7.36
December	6.39
January	2.60
February	2.60

varieties was low. Previous research by Aritua *et al.*, 2000 showed that varieties inoculated with SPVD yielded less compared to non-inoculated ones. This means that the susceptible varieties have the potential of yielding more if SPVD is checked. Therefore practising simple cultural control methods such as roguing, planting clean material may improve the yield of such clones.

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