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Research Paper

Evaluation of Various Spacings to Enhance Sweet Potato Production in Kenya

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ABSTRACT

Sweet potato cultivation is on the increase in semi-arid lands due to its high adaptability and utilization. In Kenya, it is an important food crop across Counties alongside maize and has gained popularity among many farmers due to its ability to give satisfactory yields under adverse climatic and soil conditions as well as under low or no use of external inputs. However, its yield potential of 20-50 t/ha of tuber weight is yet to be exploited by farmers due to abiotic and biotic constraints. Field trials were conducted in two sites (KALRO- Muguga South and Siaya ATC) during long rains season of 2014, with an aim of evaluating various spacings that would aid in enhancing sweet potato production in Kenya. SPK 004 variety yielded highest when spaced at 75cm x 30cm and 90cm x 30cm, and Kemb 10 at 90cm x 30cm in KALRO- Muguga South, while Bungoma yielded highest when spaced at 75cm x 30cm and Cuny-kibuonjo at 90cm x 60cm in Siaya ATC.

Keywords: Sweet potato, variety, spacing, enhance, production

1.0 INTRODUCTION

Sweet potato (*Ipomoea batatas*) is the third most economically important tuber crop after Irish potato and cassava in Sub-Sahara (Ikeorgu, 2003). It is the only tuber crop with a positive per capita annual rate of production in sub-Sahara Africa due to its high yield potential that may be achieved within a short growing season (Tewe *et al*., 2003). Sweet potato is mainly grown by small-scale resource-poor farmers, with minimal inputs. Its production in African countries falls way below the expected maximum yield potential of 20-50 t/ha since farmers produce an average of less than 10t/ha (Nweke, 2002). The tuber is an important source of carbohydrate and can be consumed without processing by the majority of Kenyans. The succulent vines can also be eaten as vegetables. Usually it is consumed by low-income consumers but is now being embraced by high income consumers nowadays. Its production is constrained by the sweet potato weevil virus complex, mammalian pests like moles and wild pigs, among others. Poor market infrastructure is also not well developed. Nevertheless, use of improper spacing to plant the crop contributes to low yields in Kenya (Karanja, *et al*., 2006). Results of the survey done before conducting this study indicated that the majority of farmers across counties in Kenya planted using various spacings namely; 100cm x 100cm, 120cm x 60cm, 45cm x 30cm, 60cm x 45cm, 60cm x 30cm, 60cm x 60cm, 75cm x 30cm and 75cm x 60cm (Momanyi, *et al*., 2016).

2.0 MATERIALS & METHODS

The trials were planted in August 2014 and harvested in December 2014 at KALRO Muguga South and Siaya

Agricultural Training Centre (ATC). Kemb 10 and SPK 004 varieties were planted at KALRO Muguga South while Cuny-kibuonjo and Bungoma at Siaya ATC. Three spacings/ treatments used at both trial sites for each variety were; 90cm x 30cm, 90cm x 60cm and 75 x 30cm. Treatments were replicated three times and arranged randomly in blocks. Plots measured 4.5m wide by 3 m long. Data on crop growth parameters; crop biomass and ground cover was collected monthly in an area of $0.5m^2$ from inner rows. The sampled crop biomass was transported in polythene papers to the National Agricultural Research Laboratories, air dried on open benches for five days and then dried in an oven at a temperature of 70°C for 48hrs to obtain dry matter. Harvesting was done from two middle rows in an area of $1m^2$ (8 plants) but not from the outer buffer plants and rows (guard plants and rows), and the weight of tubers taken. Analysis of collected data was done using Genstat, 12th edition. Analysis of variance (ANOVA) was done at 5% level of significance to determine the effect of spacing on ground cover, crop biomass, dry matter and tuber weight.

3.0 RESULT AND DISCUSSION

3.1 Ground cover

Treatments (spacing) did not significantly ($p>0.05$) increase the percentage ground cover for varieties planted both at KALRO Muguga South and Siaya ATC. Foliage spread and covered the soil/ ground equally. However, SPK 004 variety planted at Muguga had the highest cumulative mean (82.8%) when spaced at 90 cm x 30cm and Cuny-kibuonjo planted in Siaya had the highest (65%) when spaced at 90cm x 30cm and 90cm x 60cm. However, ground cover positively affected the yield. Increase in the number of leaves translates into greater photosynthetic activity and translocation of assimilates to tubers, which manifests as increased tuber yield (Adubasim *et al*., 2017). Apart from synthesising more food, increased foliage and ground cover conserves soil moisture, stabilizes/ regulates soil temperature which favour growth thereby increasing the yield (Sangakkara, 1994).

3.2 Crop biomass and dry matter

There were no observed significant ($p>0.05$) differences for the crop biomass and dry matter content between potato varieties and spacing at both trial sites (Table 1). However, there were varietal significant ($p<0.05$) differences in crop biomass and dry matter weights between Cuny-kibuonjo and Bungoma varieties planted at Siaya ATC, but no significant differences ($p>0.05$) between varieties Kemb 10 and SPK 004 planted at KALRO Muguga South.

Table 1. Crop biomass and dry matter weights at KALRO- Muguga South and Siaya ATC

Site	Variety	Spacing (cm)	Crop Biomass (kg/m^2)	Crop Dry matter (kg/m^2)	p-value
KALRO-Muguga South	Kemb 10	90x60	4.77	0.82	Crop biomass
		90 x 30	10	1.64	Variety = 0.725
		75 x 30	5.94	0.97	Spacing = 0.173 Variety-Spacing = 0.412
	SPK 004	90 x 60	5.67	0.87	Dry matter
		90 x 30	6.86	1.08	Variety = 0.515
		75 x 30	6.71	1.04	Spacing = 0.143 Variety-Spacing = 0.365
Siaya ATC	Cuny-kibuonja	90 x 60	4.62	0.44	Crop biomass
		90 x 30	5.04	0.75	Variety = 0.02
		75 x 30	2.89	0.64	Spacing = 0.8 Variety-Spacing 0.284
	Bungoma	90 x 60	1.17	0.19	Dry matter
		90 x 30	1.98	0.42	Variety 0.05
		75 x 30	2.76	0.43	Spacing 0.522 Variety-Spacing 0.37

However, Kemb 10 planted at KALRO-Muguga South, and Cuny-kibuonjo at Siaya ATC had the highest crop biomass and dry matter weights when spaced at 90 cm x

30cm (Table 1). Correlations showed that Crop biomass positively increased the tuber weight for all the varieties at both trial sites. This was in agreement with findings of Roy Chowdhury *et al*. (2002) that total biomass and dry matter positively influenced tuber yield of sweet potatoes in the India.

3.3 Tuber weight (Yield)

Spacing did not significantly (P>0.05) increase tuber weight of all sweet potato varieties planted at KALRO-Muguga South and Siaya ATC, which was similar to the findings of Mortleyl *et al.* (1991). However, SPK 004 variety planted at KALRO- Muguga South had the highest yield (40.78 ton/ha) when spaced at 75 cm x 30cm while Cuny-kibuonjo variety planted at Siaya ATC yielded the highest (41.06 ton/ha) when spaced at 90cm x 60cm (Table 2).

Table 2. Tuber weight at KALRO- Muguga South and Siaya ATC. P > 0.05

Site	Variety	Spacing (cm)	Tuber weight (Ton/ha)	p-value
KALRO- Muguga South	Kemb 10	90 x 60	17.04	P>0.05
		90 x 30	30	
		75 x 30	17	
	SPK 004	90 x 60	36.64	P>0.05
		90 x 30	40.38	
		75 x 30	40.78	
Siaya ATC	Cuny-kibuonja	90 x 60	41.06	P>0.05
		90 x 30	27.72	
		75 x 30	21.58	
	Bungoma	90 x 60	14.4	P>0.05
		90 x 30	24.96	
		75 x 30	38.52	

Nevertheless, SPK 004 variety equally yielded well when spaced at 90cm x 30cm and 90 cm x 60cm. These results are similar to the finding of Adubasim *et al.*, 2017. High crop biomass reflected in high ground cover contributed to increased tuber weight in that high foliage synthesized more food, conserved soil moisture and regulated/ stabilized soil temperature which favoured tuber formation (Adubasim *et al*., 2017).

4.0 CONCLUSION

All sweet potato varieties yielded well with all spacings though SPK 004 yielded highest when spaced at 75cm x 30cm and 90cm x 30cm, and Kemb 10 when spaced at 90cm x 30cm. On the other hand, Bungoma variety yielded highest at a spacing of 75cm x 30cm and Cuny-kibuonjo at 90cm x 60cm. However, from results obtained in this study, all spacings could be adopted by farmers.

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