

The performance of advanced sorghum lines under diverse environments

Ebiyau J., Oryokot J., Esele J.P., Amongin B., and Okwi B.
Serere Agricultural and Animal Production Research Institute (SAARI)
P.O.Soroti,Uganda.

Abstract

The objective of this experiment was to evaluate, under three diverse environments, the performance of advanced sorghum lines selected from uniform yield trials in 1995 and select stable high yielding, cultivars for further evaluation. Released sorghum varieties Sekedo (brown seeded type) was included as a check variety. The trial was conducted for two seasons in 1996 and 1997. Observations were made on yield, plant height, days to 50% flowering and disease responses. Yields between four selected entries at Serere T.V.C, Bukedea T.V.C and Ngetta T.V.C and across locations were not significantly different from the check variety sekedo. AN 1/6/1/ produced the highest at SAARI and across locations during 1996–1997 cropping season, however yields were generally lower in Bukedea due to late planting, drought and severe sorghum midge attacks. AN 1/6//1, 3EX 88/1, LDRM 11/1/1 and 4MX/8 were selected based on earliness, yield potential, for further evaluation and they yielded 9–25% over the check variety Sekedo. The paper discusses the performance of only four selected advanced sorghum lines under diverse environments over a period of two cropping seasons 1996 and 1997.

Key words: Performance, sorghum lines, multi-location.

Introduction

Sorghum is the third most important cereal food crop grown in Uganda after maize and finger millet (FAO, 1995). The crop is grown throughout the country with greater concentrations in the drier areas of Eastern, Northern and Western Uganda. Sorghum has the ability to tolerate drought and give acceptable yields under marginal production environments. The main constraints limiting increased sorghum production in Uganda includes low genetic potential of local cultivars grown by farmers, long maturity period and sometimes poor grain quality.

One of the main objectives of Sorghum Improvement Project at SAARI is to develop high yielding, stable and widely adapted varieties through germplasm evaluation and breeding. Adaptation is an important consideration to be met prior to recommendation of a variety for release to farmers. At initial stages of testing, preliminary yield trials are evaluated at Serere Agricultural and Animal Production Research Institute (SAARI) environment, which does not represent all sorghum growing areas of Uganda. At the later stages of testing however, it is important to evaluate promising elite advanced sorghum lines over a wide range of environments to assess their performance and stability.

Objective

To evaluate the performance of 24 advanced sorghum lines under diverse environments in order to identify and select stable high yielding sorghum lines for further evaluation on-farm and subsequent release to farmers.

Materials and methods

Twenty-four elite sorghum lines selected from advanced uniform yield trials at SAARI were evaluated at three locations selected for the different growing conditions that they represent.

This was done over a period of two seasons during first rains in 1996 and 1997 at:-

Experimental sites

- i Serere Agricultural and Animal Production Research Institute (SAARI) Eastern region, Soroti district representing areas of high rainfall with strong bio-model rainfall distribution.
- ii Ngetta District Farm Institute (DFI) Sub-Station of SAARI in Lira district, Northern region representing areas of moderate rainfall with a tendency towards a mono-model distribution.
- iii Bukedea Technology Verification Centre (TVC) in Kumi district, Eastern region representing areas of low rainfall but bimodal distribution.

Experimental design

A Randomized Complete Block Design (RCBD) with three replicates was used. Each plot consisted of five rows of 5-metre length. Plant spacing was 60 x 20 cm thinned to one plant per stand. All plots were weeded twice as recommended. In each plot data was collected from three centre rows.

Data was collected on plant stand, plant heights, days to 50% flowering and grain yield over two seasons and

pooled across locations. The data was subjected to analysis of variance (ANOVA) using GENSTAT statistical package. Least Significant Difference (LSD) was used to compare treatment means.

Amount (mm) and distribution of rainfall at Ngetta (Lira District)

and Serere Agricultural and Animal Production Research Institute (Soroti District) in 1996 and 1997 is presented in Figure 1. Soroti District received more rainfall than Lira District during the cropping season 1996 – 1997. At Bukedea Technology Verification Centre (T.V.C) there

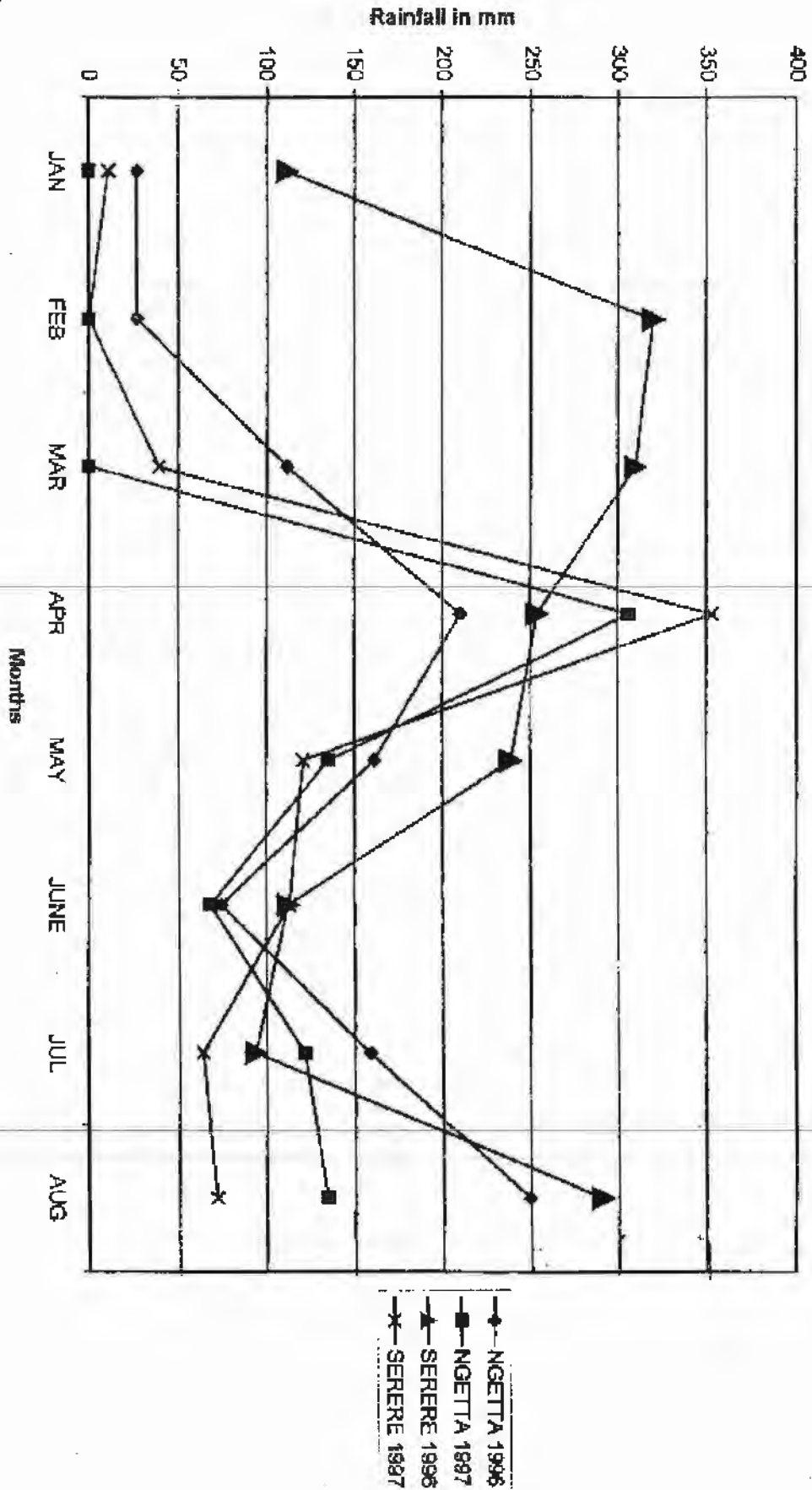


Fig. 1 Amount (mm) and distribution of rainfall at Ngetta (Lira District) and Serere Research Institute (Soroti District), 1996 and 1997

was no weather recording station therefore there was no information obtained.

Results and discussion

The performance of the four best performing entries selected on the basis of earliness, plant height and yield across the three diverse environments is presented in Table 1 and 2. Entry AN1/6/1 showed superiority in yield at SAARI and across location during 1996 and 1997 cropping season and out yielded sekedo the check variety by 25%. However the four selected varieties did not significantly differ from each other in each location and across locations, suggesting that all the four entries tested have attained wider adaptability across the diverse environments. Entry 3EX88/1 out yielded the check variety at Bukedea Technology Verification centre (TVC). However, the low mean grain yield values obtained at Bukedea T.V.C were attributed to several factors including, late planting, low rainfall, shootfly and sorghum midge attack during both

Plant heights and days to flowering ranged from 114 to 179 cm and 63 to 70 days to 50% flowering respectively across locations. The four selected entries were generally mid height in Bukedea T.V.C probably due to the prevalent drought and/or low rainfall in the area (Table 2 and Figure 1). Entries AN1/6/1 and 4MX11/8 in Ngetta and Bukedea Technology verification centres significantly differed from the check variety sekedo in days to 50% flowering.

From these results entries AN1/6/1, LDRM 11/1/1, 3EX88/1 perform better under both marginal harsh conditions of low rainfall and under severe pest (shootfly and midge) attack. It would appear from the results that 3EX88/1 is more suited to low rainfall areas than the other three entries. This advantage disappears under high rainfall. Yields between four selected entries at Serere T.V.C and Ngetta T.V.C were therefore not significantly different from the check variety sekedo. The rainfall received in both places during the two years were not different in spite of this distribution.

years (Table 1).

Table 1. Mean grain yields in Kg/ha of four selected sorghum genotypes at three diverse environments over 1996 and 1997 cropping seasons

Location	Bukedea	Ngetta	SAARI	Means Locations	across % Control Sekedo
Entry					
AN1/6/1	825	2833	3486	2381	25.4
3EX88/1	1181	2728	3021	2310	22.7
LDRM11/1/1	667	2767	3298	2244	19.2
4MX11/8	618	2414	3144	2059	9.3
SEKEDO	1097	2136	2417	1883	
Means	718	1741	2532	1664	
CV(%)	32.4	26.2	22.8	26.4	
LSD (P=0.05)	407	915	1154	803	

Table 2. Mean Plant height and Days to 50% flowering from selected sorghum genotypes at three diverse environments during 1996/1997 cropping seasons.

Locations	Plant Height (in cm)			Means across locations	Days to 50% flowering			Means across locations
	Bukedea	Ngetta	SAARI		Bukedea	Ngetta	SAARI	
Entry								
AN 1/6/1	118	151	166	145	69	70	65	68
3EX 88/1	119	151	161	144	66	68	66	67
LDRM 11/1	124	153	160	146	66	69	63	66
4 MX 11/8	114	156	179	150	69	70	64	68
SEKEDO	119	147	172	146	65	67	66	66
Mean	131	170	179	160	69	72	68	70
CV(%)	4.9	4.0	7.2	5.2	2.6	2.1	3.6	1.6
LSD (p = 0.05)	4.0	14.0	25.7	16.0	3.8	3.2	4.4	2.0

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