

Research Application Summary

Influence of seed bed preparation on morphometric characteristics of *Eragrostis superba*, *Cenchrus ciliaris* and *Enteropogon macrostachyus* in southeastern drylands of Kenya

Omondi, F.E.O.¹, Ekaya, W.N.² & Nyariki, D.M.¹

¹Department of Land Resource Management & Agricultural Technology, P. O. Box 30197, Nairobi, Kenya

²Regional Universities Forum for Capacity Building in Agriculture, Makerere University, P. O. Box 7062, Kampala, Uganda

Corresponding author: w.ekaya@ruforum.org

Abstract

This study compared over a 6-month period effects of tractor-ploughing and hand-clearing seedbed preparation on morphometric characteristics of three arid and semi-arid grass species, namely; *Eragrostis superba* Peyr, *Cenchrus ciliaris* L and *Enteropogon macrostachyus* (Hochst ex A Rich) Monro ex Benth. Seedling mortality was significantly higher under hand-clearing than tractor-ploughing. Tractor - ploughing also gave better growth, and biomass yield.

Key words: *Cenchrus*, *Enteropogon*, *Eragrostis*, Kenya, seed-bed preparation, tillage practice

Résumé

Cette étude a comparé les effets sur une période de 6 mois de labour au tracteur et de préparation de pépinières sur les caractéristiques morphométriques de trois espèces d'herbes arides et semi-arides, à savoir; *Eragrostis superba* Peyr, *Cenchrus ciliaris* L et *Enteropogon macrostachyus* (Hochst ex A Rich) Monro ex Benth. La mortalité des semis était significativement plus élevée en labourant à la main plutôt qu'avec un tracteur. Le labourage à l'aide d'un tracteur a également donné une meilleure croissance et un rendement en biomasse.

Mots clés: *Cenchrus*, *Enteropogon*, *Eragrostis*, le Kenya, la préparation des pépinières, travail du sol

Background

In Kenya, arid and semi-arid lands (ASALs) cover over 88% of the country's landmass. These areas have undergone increasing land use pressure within the last 15 years, largely due to a number of factors that threatened the sustainability of land-based production systems. Encroachment into the grazing areas by cultivation and settlement has led to shrinking of pastoral production resource base, as pastoralists are increasingly

confined to less productive ASALs (Alemu *et al.*, 2000). In Kitui, diminished or total loss of some important forage species, especially *Chloris roxburghiana*, *Eragrostis superba*, *Cenchrus ciliaris* and *Enteropogon macrostachyus* have been noted.

Literature Summary

In Kenya, options for improving pasture cover and quantity where graminoid and non-graminoid plant species have disappeared have been limited to destocking, bush management, and intermittent grazing. However, some early reseeding attempts as a means of rehabilitating degraded natural pasture have been made with encouraging success. Recently, the International Crops Research Institute for the Semi-arid Tropics (ICRISAT) also carried out re-seeding trials in Makueni, Kajiado district.

A review of ecological work undertaken in Kenya's ASALs on the performance of indigenous African rangeland grasses shows that a considerable amount of work has been done. However, little progress has been made on how to improve the establishment success of grasses in ASALs (Chelische and Kitanyi, 2002). Understanding this aspect is essential in improving reseeding success in ASALs, which are characterized by low, erratic and unreliable rainfall.

The objective of this study was to determine the effects of tractor-ploughing and hand-clearing seed bed preparation on morphometric characters of three important ASAL grasses; *Eragrostis superba* Peyr, *Cenchrus ciliaris* L and *Enteropogon macrostachyus* (Hochst ex A Rich) Monro ex Benth.

Study Description

This study was conducted over a six-month period on the Endau hill escarpment of Kitui district in eastern Kenya. The area is characterized by high temperature throughout the year, with the minimum and maximum temperatures ranging from 15°C to 18°C and 25°C to 28°C respectively. The rains in the district are low, erratic and unpredictable in nature, varying between 250 and 900 mm in a year.

The experimental design was a randomized block design (RBD) with land preparation methods and species considered as the main and sub-plot factors respectively. Six sub plots measuring 6 m by 6 m were laid out in each treatment. The two seed bed preparation methods were tractor-ploughing and hand-clearing. The percent germination of the grass seeds as a measure of

seed quality was examined under laboratory conditions (Tarawali *et al.*, 1995).

The following morphometric parameters were monitored weekly: plant height (cm), number of primary plant shoot leaves live tillers, foliage cover and seedling mortality. Aboveground biomass production was estimated leaving a stubble height of less than 2.5 cm. Statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS) packages. Mean separation tests were performed using least significant difference (LSD) at 5% level.

Research Application

Seed germination was significantly ($P < 0.05$) influenced by grass species. Among the three species, seeds of *C. ciliaris* had the highest percent germination of 28.4%, *E. macrostachyus* and *E. superba* had percent germination rates of 20.1 and 8.6%, respectively (Fig. 1). The percent seedling mortality and foliage cover of three grasses in the two seed bed preparations after 12 weeks are presented in Table 1. Seedling mortality varied considerably between seed bed preparation methods. Seedling mortality was significantly higher ($p < 0.05$) in hand-cleared than tractor-ploughed seed beds. The seedling survival of all the three grass species were significantly higher ($p < 0.05$) on tractor-ploughed than on hand cleared seed bed plots. Similarly, mean percent foliage cover was significantly higher ($p < 0.05$) in the tractor-ploughed than in the hand-cleared plots. The mean grass

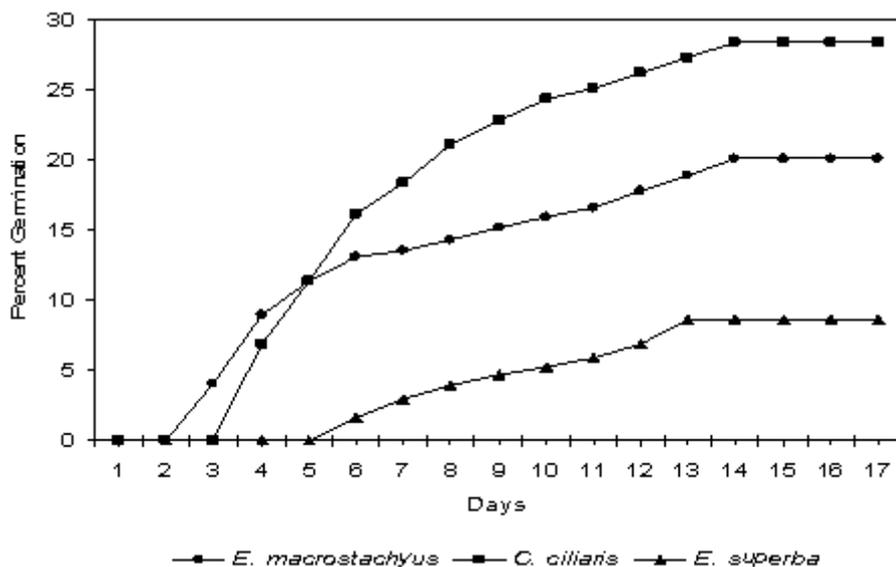


Figure 1. Percent seed germination of *E. macrostachyus*, *C. ciliaris* and *E. superba* under laboratory conditions.

height was significantly higher ($p < 0.05$) in tractor-ploughed than in the hand-cleared seed bed plot. Results also revealed that the grass mean number of tillers was significantly ($p < 0.05$) affected by the seed bed preparation method. Comparing the seed bed preparation methods, the mean number of tillers was significantly higher ($p < 0.05$) in tractor-ploughed than in hand-cleared plots. Grasses in the tractor-ploughed plots had a significantly higher ($p < 0.05$) number of leaves than those in the hand-cleared plots. However, the mean number of leaves were significantly influenced ($p < 0.05$) by grass species. Tractor-ploughed plots had significantly higher ($p < 0.05$) aboveground biomass yield than hand-cleared plots (Table 2). This suggests that tractor-ploughing ameliorated the habitat for the grass species and promoted growth of plants, especially their biomass production.

Table 1. Percent seedling mortality and foliage cover of three grass species in two seed beds within a period of twelve weeks.

Species	(%) seedling mortality		(%) foliage cover	
	Tractor-ploughed	Hand-cleared	Tractor-ploughed	Hand-cleared
<i>E. macrostachyus</i>	15.4 ^a	20.5 ^b	46.2 ^a	20.1 ^b
<i>C. ciliaris</i>	10.5 ^a	18.2 ^b	65.8 ^b	31.4 ^c
<i>E. superba</i>	24.8 ^b	32.4 ^c	20.8 ^c	8.4 ^d

Means followed by different superscripts in the same column, and those with different letter superscripts in the same row are significantly different at $p < 0.05$ as determined by LSD test.

Table 2. Mean number of tillers, leaves per shoot and aboveground biomass production (DM kg ha⁻¹) of three grass species in tractor-ploughed and hand-cleared seed beds.

Species	Tractor-ploughed	Hand-cleared	Tractor-ploughed	Hand-cleared	Tractor-ploughed	Hand-cleared
	Mean no. of tillers per shoot		Mean no. of leaves per shoot		Kg DM ha ⁻¹	
<i>E. macrostachyus</i>	3.3(2.0) ^a	2.3(0.6) ^b	4.6(1.3) ^a	4.1(1.2) ^b	4,908.5 ^a	3,682.5 ^b
<i>C. ciliaris</i>	4.6(1.1) ^b	3.7(1.0) ^c	5.0(1.2) ^b	4.8(1.1) ^{bc}	3,734.0 ^b	2,213.0 ^c
<i>E. superba</i>	2.2(0.8) ^c	1.5(0.7) ^d	3.4(1.2) ^c	2.8(1.2) ^d	2,434.5 ^c	1,899.5 ^d

Means followed by different superscripts in the same column, and those with different letter superscripts in the same row are significantly different at $p < 0.05$ as determined by LSD test.

Recommendation

It was observed that studies such as this require long-term monitoring of the reseeded plots for comprehensive conclusions and recommendations to be made. Thus, it is recommended

that, a study covering more than two seasons be carried out as this would yield more information on the morphometric characteristics of the grass species under different seed bed preparations. Other potential species such as *Digitaria macroblephara*, *Cynodon dactylon*, *Chloris roxburghiana* and *Themeda triandra* should also be studied under different seed bed preparations.

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