

Research Application Summary

Constraints of rehabilitating degraded semi-arid lands of Kenya using indigenous perennial grasses

Mganga, K.Z.¹, Musimba, N.K.R.¹, Nyangito, M.M.¹, Nyariki, D.M.¹, Mwang'ombe, A.W.², Ekaya, W.N.³ & Muiru, W.M.²

¹Department of Land Resource Management & Agricultural Technology

²Department of Plant Science and Crop Protection, University of Nairobi, Nairobi, Kenya

³Regional Universities Forum for Capacity Building in Agriculture, Makerere University, P. O. Box 7062, Kampala, Uganda

Corresponding author: mwangombe@kenyaweb.com

Abstract

Land degradation which among others include loss of vegetation is rampant in Kenya, destroying both the fragile arid and semi-arid lands and the non-arid areas. Efforts to rehabilitate semi-arid areas by re-vegetation has often failed. This study was carried out to determine factors responsible for these failures. The study was conducted in the semi-arid district of Kibwezi. Three (3) grass species *Cenchrus ciliaris*, *Enteropogon macrostachyus* and *Eragrostis superba* were used for re-vegetating the land, while agro-pastoralists in the area were interviewed through questionnaires to get their perceptions on the failures of reseeding. Low rainfall, poor seed quality, lack of enough seed, flush floods, destruction by grazing animals were found to be factors limiting the success of reseeding.

Key words: *Cenchrus ciliaris*, *Enteropogon macrostachyus*, *Eragrostis superba*, land degradation, re-vegetation, seed quality

Résumé

La dégradation des terres, qui comprend entre autres la perte de la végétation, est galopante au Kenya, entraînant la destruction des zones fragiles arides et semi-arides et les zones non-arides. Les efforts visant à réhabiliter les zones semi-arides par la ré-végétation a souvent échoué. Cette étude a été réalisée pour déterminer les facteurs responsables de ces échecs. L'étude a été menée dans le district semi-aride de Kibwezi. Trois (3) espèces d'herbes *Cenchrus ciliaris*, *Enteropogon macrostachyus* and *Eragrostis superba* ont été utilisés pour la revégétalisation des terres, tandis que les agro-éleveurs de la région ont été interviewés à partir de questionnaires pour obtenir leurs perceptions sur les échecs de l'ensemencement. La faible pluviométrie, la qualité pauvre des semences, le manque d'assez de semences, les inondations de même niveau,

la destruction causée par les animaux de pâturage ont été qualifiés des facteurs limitant le succès de l'ensemencement.

Mots clés: *Cenchrus ciliaris*, *Enteropogon macrostachyus*, *Eragrostis superba*, dégradation des terres, ré-végétation, qualité des semences

Background

Land degradation is a global problem facing us today. However, the problem of land degradation is difficult to grasp in its totality. The United Nations Convention to Combat Desertification (UNCCD, 2003) defines desertification as a process of land degradation in the arid, semi-arid and dry sub-humid areas, resulting from various factors including both climatic variation and change in human activities. The drylands of the world, comprising the hyper-arid, arid, and semi-arid regions with annual moisture deficits greater than 50% are considered the most threatened by land degradation. These drylands are estimated to cover 47% of the earth's surface. Africa is particularly threatened because the land degradation process affects about 46% of the land surface area of the continent (WMO, 2005). In Kenya, a lot of land has been degraded, and efforts to rehabilitate it through re-vegetation have often been unsuccessful. The aim of this study was to determine the main factors which contributing to rehabilitation failures using grass reseeding technology in a semi-arid environment in south eastern Kenya.

Literature Summary

It has been estimated that approximately 30-40% of Kenya's arid and semi-arid lands are quickly degrading and that another 2% has completely been lost through this process. In Kenya, high rates of soil loss of up to 50 tonnes per hectare per year from degraded grazing lands in semi arid areas are common (Nyangito *et al.*, 2009). Grazing contributes about 34.5% of the total soil degradation. High rates of degradation can partly be attributed to the nature of the soils in the arid and semi-arid lands of Kenya. The main problems associated with these soils are high levels of salinity and sodicity, poor drainage, soil erosion, soil compaction, soil crusting and low fertility. The use of indicators of degradation is more appropriate in trying to understand the land degradation problem. These indicators of land degradation can be grouped into three broad categories; biophysical indicators (degradation of soil, water and vegetation cover), socio-economic indicators (poverty and food insecurity) and institutional indicators (failures in the public/government, private/market, civil/community sectors and civil strife).

Study Description

This study was carried out in the semi-arid district of Kibwezi in Kenya. Seed viability of perennial grasses commonly used for reseeding was estimated as described by Tarawali *et al.* (1995). The three grass species tested were *Cenchrus ciliaris*, *Enteropogon macrostachyus* and *Eragrostis superba*. Land preparation involved the creation of micro-catchments using an ox-driven plough in rows across the slope. Experiment plots were arranged in a Complete Block Design (CBD). Three (3) blocks measuring 15 x 10m were demarcated in the site. Each block was further divided into six (6) plots each 5 x 5m. Seed of each fifty (50) agro-pastoralist households were interviewed using questionnaires. This was aimed at getting their perceptions on the constraints of reseeding. Rainfall data for the study area during the study period was also collected using a rain gauge set up at the experimental site. Disturbed soil samples were taken from the top soil of 0-20cm to determine soil moisture. Soil moisture content was determined by the gravimetric method. Statistical analyses were done using Statistical Package for Social Sciences (SPSS). Descriptive statistics were used to analyze data on the problems of rehabilitating denuded patches in the semi-arid environment.

Research Application

Seed viability tests showed that there was a difference in seed germination between the three grass species tested. Seeds of *Enteropogon macrostachyus* had the highest germination percentage (53%). Percent germination for *Cenchrus ciliaris* and *Eragrostis superba* was 12 and 10%, respectively. Trends in germination percentage of the tested grasses are illustrated in Figure 1. Total rainfall in the study area for the year 2008 was 324 mm.

Results from the household survey showed that insufficient amount of rainfall is the main constraint to rehabilitation. Low amounts of rainfall and high rates of evapotranspiration result into soil moisture deficits, which subjects the grass seedlings to water stress leading to seedling mortality. Other factors, notably destruction by grazing animals, pests and rodents, flush floods, poor sowing time, poor seed quality, lack of enough seed and weeds also contribute to rehabilitation failures in semi-arid lands of Kenya.

Recommendation

Factors that influence seed germination of the candidate grass species be studied further with an aim of improving their germination.

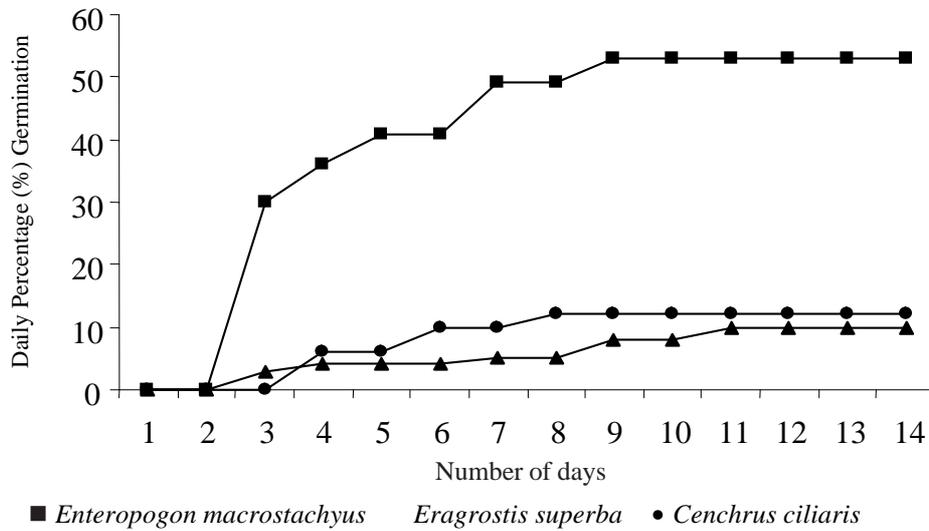


Figure 1. Daily percentage seed germination of *Enteropogon macrostachyus*, *Eragrostis superba* and *Cenchrus ciliaris*, under room conditions (30° C) in the study area (Set of two year old seeds).

References

- Nyangito, M.M, Musimba, N.K.R. and Nyariki, D.M. 2009. Hydrological properties of grazed perennial swards in semi-arid southeastern Kenya. *African Journal of Environmental Science and Technology* 3:26-33.
- UNCCD, 2003. An introduction to United Nations Convention to Combat Desertification. United Nations. www.unccd.int/publicinfo
- WMO, 2005. Climate and Land Degradation. World Meteorological Department (WMO), Geneva, Switzerland.