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The Somali Journal of Range Science serves as a forum for the presentation of scientific research pertaining to the study, management and use of Somalia's rangeland resources. The papers in this first issue are a summary of some of the B.S. theses that have been previously completed by students of the Botany and Range Science Department, Faculty of Agriculture, Somalia National University.

This journal will be published twice yearly. Articles relating to all aspects of natural resouce research in Somalia are welcomed. Submitted manuscripts should follow the same general format as used in this issue. Papers should clearly and concisely state the purpose of the research. Unsupported hypotheses and rambling discussion should be avoided. The submission deadline for the next issue will be October 1, 1986.

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GERMINATION AND PRODUCTION OF CENCHRUS CILIARIS AND CYNODON DACTYLON

A.M. Ibrahim

Cenchrus ciliaris and Cynodon dactylon have been documented as being highly palatable livestock forage at all stages of phenological development (Dabadgao and Shankaruarayan 1973). Hence, Cenchrus ciliaris and Cynodon dactylon provide excellent pasture for grazing or they can be conserved as a hay or silage. Both species persist well under close grazing. Because of the high palitability of Cenchrus ciliaris and Cynodon dactylon they are potentially important in range re-seeding efforts. Previous germination studies of Cenchrus ciliaris have documented the species has delayed germination and a low germination percentage (Chakravarty 1970). It is therefore important to develop techniques to enhance germination if successful range seeding is to be feasible. It is also important to understand differences in phenological development characteristics associated with the different varieties so that the most suitable seed source can be chosen.

The objective of this study was to document the germination characteristics and phenological development of Cynodon dactylon and native and introduced varieties of Cenchrus ciliaris as affected by soil type. In addition, techniques designed to enhance germination were tested.

METHODS

Research was conducted using three varieties of Cenchrus ciliaris seed (from Somalia (S), Kenya (K), and from the southern United States of America (USA)) and Cynodon dactylon seed (from Kenya). Two different treatments were tested for their ability to reduce seed dormancy. Those treatments (soaking in normal tap water for 28 hours and immersion into 80% concentrated sulfuric acid for 10 minutes followed by rinsing with water) were compared with germination of seed that had received no pre-planting treatment.

In each trail four replications of 25 seeds were used. Each set of twenty five seeds were equally dispersed on filter paper in a petri dish. Germinated seeds were counted daily for a period of two weeks. Seeds were considered germinated when the radical emerged. Germinated seeds were removed daily from the petri dishes. Percent germination for each variety was determined. The trials lasted fourteen days.

To determine relative production, plant growth was monitored over a nine week period. The plants were grown inside a greenhouse to reduce extraneous environmental variables which could confound analysis of the results. A total of thirty two plastic bags were used in the experiment. Half were filled with clay-loam texture soil and half were filled with sand texture soil. Four seeds of a particular variety were planted per plastic bag. Later the seedlings were thinned to prevent competition. Four bags per variety were used as replications. Nine weeks after planting the root system of each of the plants was excavated by cutting the side of the plastic bags and washing away the soil from the root system. The plant was then severed into aerial and root portions which were measured for maximum length. The plant parts were subsequently dried at 60°C for 48 hours and then weighed.

The author is a former student of the Botany and Range Science Department, Faculty of Agriculture, Somali National University. S.A. Young was the research advisor. This paper is a summary of the authors B.S. thesis by T.L. Thurow (ed.).

RESULTS AND DISCUSSION

The percent germination of the Cenchrus ciliaris varieties and Cynodon dactylon was clearly affected by the pre-planting seed treatments (Table 1). The lack of germination of the Cenchrus (S) seed compared with the relatively high germination rate when treated with sulfuric acid indicate the value of pre-treatment techniques. The fact that Cynodon dactylon did not germinate in the sulfuric acid treatment may be due to the acid concentration or duration of immerision. It is necessary to conduct a series of trials of different combinations of acid concentration and immersion duration to determine the optimum benefits for this method.

Table 1. Germination rate (%) of Cynodon dactylon and three varieties of Cenchrus ciliaris.

	Types of Treatments		
Species	None	Water	Sulfuric Acid
Cenchrus ciliaris (S)	No Emergence	10	34
Cenchrus ciliaris (USA)	11	22	7
Cenchrus ciliaris (K)	20	8	14
Cynodon dactylon	4	2	No Emergence

Table 2. Shoot and root length (cm) and biomass (kg) of Cynodon dactylon and three varieties of Cenchrus ciliaris after nine weeks of growth.

	Root				Shoot			
	Clay		Sand		Clay		Sand	
Species	Length (cm)	Biomass (kg)	Length (cm)	Biomass (kg)	Length (cm)	Biomass (kg)	Length (cm)	Biomass (kg)
Cenchrus ciliaris (S)	36.0	1.3	23.7	0.9	32.0	1.3	33.3	1.2
Cenchrus ciliaris (USA)	41.5	1.1	32.0	1.0	30.2	0.5	31.5	0.5
Cenchrus ciliaris (K)	42.5	1.2	28.7	0.7	38.2	0.8	35.2	0.8
Cynodon dactylon	46.5	1.3	34.3	1.1	40.7	0.7	34.0	1.0

Root and shoot length of all grass varieties were generally greater in the clay soil (Table 2). This trend was probably due to the more favorable matric potential of the clay which could store more water for plant use in the four days between watering. The Kenyian variety of Cenchrus generally produced the largest root and shoot growth of the Cenchrus varieties tested however the Somali variety generally produced the greatest amount of biomass. The Somali variety developed faster and reached maturation more quickly than did the other varieties. This faster rate of development would be of clear adaptive advantage in regions of erratic precipitation.

The differences in germination rates and growth patterns of Cenchrus varieties may reflect genetic differences. When choosing a seed source for re-vegetation the characteristics of the varieties and the environment should be used to determine which variety would be best suited to the requirements of the endeavor.

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EFFECTS OF BRUSH REMOVAL ON HERBACEOUS VEGETATION COVER AND PRODUCTION

A.A. Hassan, A.H.A Mohamed, and M.H. Aden

Shrub invasion commonly occurs on grassland sites that have been overgrazed. Brush control can be an effective means for improving herbacious forage production since when shrub cover is reduced there is less competition for available water, nutrients and light. In addition to competing with grass, many woody species are very thorny and restrict animal access to herbacious forage growing under the canopy.

Most of the rangelands of Somalia have a significant shrub component. Many of these species are very important sources of browse for camels and goats. Brush control that results in an increase in herbaceous vegetation would primarily benefit grazing herbivores such as cattle and sheep. Brush control may also be undertaken to control tsetse fly, to reduce cover that harbors predators, or to create fence lines or road access that will ease ranching operations.

Forage production increases resulting from bush clearing have been recorded in several parts of the world. Experiments in Commiphora woodland where bush was reduced by 42% resulted in a 77% increase of grass production (Bunderson, Unpublished data). The objective of this study was to document the effects of brush control on herbaceous vegetation, composition and production.

METHODS

The study site was located 5 km southwest of Afgoi, Somalia on the Artificial Insemination Station rangelands. The site was heavily dominated by brush species. Herbaceous cover and production was very low. Study sites were established on two different soils, one with a sand texture located on a ridge and the other was on the Shabelle River floodplain characterized by soils of clay-loam texture. The sites were characterized by different vegetations, and on all sites there was heavy brush occupation. On the sand soil texture site the dominant brush species was Acacia horrida. On the clay-loam soil texture site, the most frequent species of brush were Acacia nilotica and Dichrostachys cineria.

The study design was structured as a randomized block design. Each site was divided into six blocks, each 10 m by 30 m with a 10 m buffer zone between plots, so the total area of each site was 3300 m. Three blocks were randomly selected and cleared by hand of all brush at each site. A five meter buffer was cleared on the sides of the cleared plots to eliminate a potential border effect. The other three remained undisturbed. The treatment site were cleared at the beginning of the Deyr season. The entire study site was fenced with brush cleared from the plots to prevent domestic livestock grazing.

Only herbaceous understory vegetation was measured because the brush had been removed from the cleared plots and was not therefore comparable to the uncleared plots. The point frame method was used to determine the percent of aerial cover and composition. Cover

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The authors are former Botany and Range Science Department students, Faculty of Agriculture, Somali National University. The advisor for the study was F.E. Kinsinger. This paper is a summary of the authors B.S. thesis by T.L. Thurow (ed.).

data was collected at the end of Deyr (December, 1982) Jillaal (March, 1983) and Gu (June, 1983) seasons. A 20 m long permanent transect was randomly selected in every block and aerial cover was determined at five meter intervals; a total of 30 frames at each site. Dry weight production was determined by clipping quadrats at the end of the two rainy seasons. Production data was collected on a total of 30 randomly located quadrats at each site. Clipped herbage was segregated by species, dried and weighed.

RESULTS AND DISCUSSION

There was a rapid increase in herbaceous aerial cover and species diversity on all cleared plots (Tables 1 and 2). On the sand soil texture site 26 species were recorded on the cleared blocks compared to 21 species on the uncleared blocks. Prevalent species on the sandy site were Leptothrium senegalensis, Commelina forskaalea, Cyperus esculentus, Gisekia pharmaciodes and Ipomea garckana. By the Gu sample period the most pronounced difference for a species between the cleared and uncleared plots was Leptothrium senegalensis which had an aerial cover of 3.5% on the uncleared plots but an aerial cover of 15.9% on the cleared plots; an increase of 440%.

Table 1. Comparison of foliar cover and standing biomass on cleared and undisturbed shrubland located on a soil of sand texture.

RIDGE SITE	DEYR		JIILAAL		GU	
(Soil Texture : Sand)	Cleared	Uncleared	Cleared	Uncleared	Cleared	Uncleared
Grass/sedge Foliar Cover (%)	39.3	15.8	24.7	4.7	29.2	18.1
Forb Foliar Cover (%)	22.8	6.7	4.5	0.8	21.2	3.0
Dwarf Shrub Foliar Cover (%)	5.2	0.8	4.8	2.7	4.7	0.0
Total Foliar Cover (%)	67.3	23.3	34.0	8.2	55.1	21.1
Litter Cover (%)	4.4	17.0	18.4	33.2	8.0	14.3
Bare Ground (%)	38.3	59.7	47.6	58.6	36.9	64.6
Standing Biomass (kg/ha)	1491	605	----	----	1357	635

Table 2. Comparison of foliar cover and standing biomass on cleared and undisturbed shrubland located on a soil of clay-loam texture.

FLOODPLAIN SITE	DEYR		JILLAAL		GU	
(Soil Texture : Clay Loam)	Cleared	Uncleared	Cleared	Uncleared	Cleared	Uncleared
Grass/Sedge Foliar Cover (%)	8.6	5.5	4.8	2.5	3.8	1.1
Forb Foliar Cover (%)	9.0	5.6	1.1	2.4	5.2	1.6
Dwarf Shrub Foliar Cover (%)	10.3	7.9	0.4	0.0	5.2	1.1
Total Foliar Cover (%)	27.9	19.0	6.3	4.9	14.2	3.8
Litter Cover (%)	7.7	11.2	28.4	33.5	13.9	13.4
Bare Ground (%)	64.4	69.8	65.3	61.6	71.9	82.8
Standing Biomass (Kg/ha)	1079	812	----	----	621	126

The same trends of greater herbage cover and production were documented on the clay-loam soil site although the total number of species present was less than that of the sandy site. On the clay-loam site 10 species were recorded on the cleared blocks compared with 8 species on the uncleared blocks. Prevalent species on the clay-loam site were Tephrosia uniflora and Clitoria turnata. This difference between soil types can partially be explained by the more abundant brush species and less frequent herbaceous vegetation during the pre-treatment period.

These data are the first of their kind for Somalia and are part of a long-term effort to monitor the effects of brush control. Clearly herbaceous vegetation can be greatly increased by the removal of brush. How long this effect lasts and the pattern of species succession will determine the viability of brush control as a range management tool in Somalia. This study indicates that if clearing is to be done the best time to begin would be at the beginning of the rainy season, to give the herbaceous species an opportunity to utilize the moisture, light and nutrients which become available after the brush is cleared.

HISTORY AND CURRENT STATUS OF LIVESTOCK DEVELOPMENT IN SOMALIA

A.J. Hussein

The objective of this paper is to provide an overview of the development and current status of the Somali livestock industry.

More than 80 percent of Somalia is uncultivated rangeland. The human population is primarily agrarian and estimated at 5.1 million of which 25 percent live in major cities and towns, 29 percent in rural areas and 46 percent are nomadic (AFI Con, 1985). The annual population growth is estimated to be 3.1 percent. These data show the primary importance of livestock to the livelihood of most residents. The pastoral sector of Somalia has a long history of commercialization. There is evidence that there have have been exports of livestock, hides and skins since the mid-nineteenth century but livestock exportation was probably occurring long before that date (Konczacki 1978). About 33.3% of the world's camel population is located in Somalia (44.9% of Africa's camel population) (FAO, 1983) and also considerable numbers of other livestock.

The last livestock census in Somalia was carried out in early 1975 (Table 1). Since then livestock population figures have been based on estimates of annual growth rates of 1.2 percent for cattle, 1.1 percent for camels, 1.7 percent for sheep and 2.3 percent for goats (Table 2). It is commonly thought that because of the construction of reservoirs and watering points and improved herd control, the number of animals in Somalia substantially increased in the 1960's and 1970's (Ministry of Livestock, Forestry and Range).

Table 1. Livestock Distribution in Somalia in 1975 (Ministry of Livestock, Forestry and Range).

Regions	Cattle (1000 head)	Camels (1000 head)	Sheep (1000 head)	Goats (1000 head)
Northern	290	1526	6291	6383
Central	728	1607	2011	5637
Southern	1178	1053	555	1405
Trans-Juba	1755	1242	595	1572
National Total	3951	5428	9452	14997

The author is a former range science student, Faculty of Agriculture, Somali National University. The advisor for the study was F. Thetford Jr. This paper is a summary of the authors B.S. thesis by T.L. Thurow (ed.).

Table 2. Livestock populations in Somalia (Ministry of Livestock, Forestry and Range). A Tropical Livestock Unit (TLU) is calculated on the basis of 1 TLU = 250 kg of animal weight. The 1986 values are Ministry of Livestock, Forestry and Range extrapolations from the 1975 census data.

Year	Cattle	Camels	Sheep	Goats	TLU
1975	3951	5428	9452	14997	12119
1986	5169	6186	12601	19258	14744

The Livestock Development Agency (LDA) was established in 1966 to coordinate and promote livestock development and exportation (Ghouse, 1983). The LDA was also charged with marketing the livestock. The LDA supervised consturction of livestockholding areas in Berbera and Kismayo. In addition to the existing livestock market in Mogadishu, a second market was created at the Kismayo holding ground (Konczacki, 1978).

The LDA was dissolved in 1981 after in had failed its mission to adequately and consistenly supply sufficient amount of cattle to the meat factories. With the abolition of the LDA, the Somali government opened the market to the private sector. While public export facilities are generaly poor, an intricate private export marketing infrastructure exists. Roughly 200 exporters have formed a Livestock Export Trader Committee to coordinate holding and shipping operations (FAO/IFAD Report, 1984). The current livestock marketing system is a complex pattern of private collection, transportation and distribution industries. Livestock are brought to the markets, through a well established system of buying agent, collectors, intermediaries and indepedent traders.

Livestock are procured by buying agents on grazing areas, rural markets and regional livestock markets. At the markets, intermediaries help the producers transact sales with the various buyers. The intermediaries are hired by the producers and they are paid a fee after the sale. Indepedent livestock traders use their own capital to finance purchases and also rely on credit from livestock producers since the payment for purchased animals might take place several months later (FAO/IFAD, 1984). Traders often purchase many of their animals at low prices during the long dry season and keep them on the range for several months until their condition improves in the subsequent rainy season. The traders then sell the livestock to the exporters and thus obtain a higher price at sale than they would have received if they had sold them immediately after procurement. Exporters rely on their agents and the independent livestock traders for collection of livestock for export. The exporters usually have letters of credit for a certain number of animals to be exported. In some cases the exporter buys directly at the livestock market to complete his export consignment.

Taxes are on livestock sales by the local government. The local markets must therefore be registered with the local government for tax collection purposes. Various fees and taxes are also collected by each local government through which the livestock are transported and still more taxes are collected at the ports such as municipality taxes, port taxes, port charges and export taxes. Currently taxes and and other government fees amount to 47.7% of the total export value of the animal.

In an attempt to control the high prices generated at the competitive local livestock markets the Somali government created a new law in 1985 which obliges the livestock traders to create private livestock trading companies with a minimum membership of 15 persons in each company (IMR, 1985). These companies must establish their own facilities needed for holding live animals prior to export. This law specifies the minimum age of animals eligible for export at 2.5 years for sheep and four years of age for goats, camels, and cattle. Only male animals may be exported.

The trends and importance of livestock exports to the Somali economy are illustrated in Table 3. The Middle East has been the traditional export market for Somali livestock. The demand for Somali livestock in the most important market, Saudi Arabia, fluctuates throughout the year. Demand peaks in the Haj season. Saudi Arabia is single most important market for Somali livestock, purchasing over 90% of Somalia's small ruminant exports (95% in 1983 and 92% in 1984). Countries that purched Somali livestock in 1985 were Saudi Arabia, Egypt, U.A.E., North Yemen, South Yemen, Kuwait and Qatar (AFI Con, 1985). Cattle exports to Saudi Arabia and Gulf countries reached their peak in 1981 and 1982. This was probably a consequence of higher demand for cattle by the importing Arab States. This market was substantially weakened in 1983 when Saudi Arabia banned imports of all live cattle from Somlia for the stated purpose of controlling livestock disease. Subsequently the import ban of sheep and goats was lifted but the ban on cattle continues. The ban on livestock imports from Somalia prompted Saudi Arabia to seek other countries from which to obtain livestock. This has created a new competitive force in markets that had previously been based on traditional trading patterns of the region.

Table 3. Value and proportion of total export income associated with livestock products (1980-1984). Values obtained from the Livestock Marketing and Health Project, the Hides and Skins Agency and the Central Bank of Somalia. SS = Somali Shillins.

Export Class	1980 Export Value (10^6SS)	1980 Portion of Exports (%)	1981 Export Value (10^6SS)	1981 Portion of Exports (%)	1982 Export Value (10^6SS)	1982 Portion of Exports (%)	1983 Export Value (10^6SS)	1983 Portion of Exports (%)	1984 Export Value (10^6SS)	1984 Portion of Exports (%)
Live Animals	639.5	75.7	1001.9	87.8	1511.9	83.8	1129.3	73.4	767.6	65.9
Hides & Skins	39.9	4.7	26.3	2.3	62.8	3.5	49.3	3.2	55.7	4.8
Canned Meat	6.5	0.8	2.6	0.2	0.3	0.0	2.7	0.2	0.0	0.0

In response to importing countries concerns about disease control the government created the Livestock Marketing and Health Project in 1985. This project was designed to implement animal health control before shipment, to inspect, treat and observe export animals within and outside quarantines and to certify healthy animals for shipment. The project is also to explore and expand new livestock markets, thereby diversifying the traditional export markets.

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EVALUATION OF THE CHARACTERISTICS OF SOME SOIL SERIES COMMON IN CENTRAL SOMALIA

J.A. Bahdon, A.A. Takar and A.A. Yasin

In 1968 the FAO/UNDP conducted an investigation and description of main landform soils associations and a classification of the soils as part of an agricultural and water survey of Somalia (FAO,1968). Soil classification was based on the morphological, physical and chemical characteristics, and suitability for cultivation of agricultural crops. Each soil series was given the name of the general locality where it occurred. This classification of Somalia's soils did not include any attempt to measure fertility. The objective of this study was to obtain a general characterization of some aspects of the chemistry of the major soil series of the central rangelands. The fertility characteristics of the various soil series is of great importance in trying to assess the potential productivity of rangeland or cultivated crops. This is especially important in Somalia since a preliminary soil fertility survey by Newton (1967) determined that about 50% of the soils analyzed were deficient in phosphorous.

METHODS

Discription Of Soil Series That Were Analyzed

Burei Soil Series. A fine-textured brown to yellowish-brown solonelzic soil. The soil is deep and moderately alkaline and has developed from erosion products derived from the limestone of crystalline materials of the Bur Region. The Burei soil occurs in areas that have a range in average annual rainfall of 400 mm to 500 mm and at a range in elevation of 30 m to 100 m. The natural vegetation is semi-arid scrub steppe. The Burei soil has been mapped over 312,400 ha. There is some cultivation of this soil but most of the area remains vegetated by its native cover of semi-arid tree and shrub species.

Issur Soil Series. A red, medium-textured latozol. The soil is deep and moderately acidic. It has developed from a deeply weathered mantle of material derived from crystalline rocks. The Issur soil series covers 118,800 ha. The Issur soil occurs in area that have a range in average annual rainfall of 400 mm 500 mm and a range in elevation of 100 m to 150 m. The natural vegetation is semi-arid tree and shrub steppe and is not used for cultivated crops. The soils may form a relatively impermeable surface crust causing rapid runoff and severe erosion during the rainy season.

Dinsor Soil Series. A dark red to red coarse-textured latosol. The soil is moderately deep to deep and medium to slightly acidic. It has developed from a mantle of weathered crystalline materials from their locally derived erosion products. It occurs in areas having a range in average annual rainfall of 400 mm to 600 mm and a range in elevation of 100 m to 250 m. The natural vegetation is a semi-arid tree and shrub steppe. The Dinsor soil series lhas been papped on 1,212,100 ha. This soil type is not used for crop production. The soil is silicious and inherently unfertile.

The authors are former Botany and Range Science students, Faculty of Agriculture, Somali National University. The advisor for the study was O.A. Bailey. This paper is a summary of the authors B.S. thesis by T.L. Thurow (ed.).

Bugta Acable Soil Series. A dark reddish-brown, fine-textured soil provisionally classified as a reddish-brown calcic soil. It is moderately deep and moderately alkaline and has developed in a mantle of gypsic materials derived locally by erosion from the cretaceous limestones. The Bugta Acable Soil series occurs in areas having a mean annual rainfall of 200 mm to 300 mm and a range in elevation of 150 m to 400 m. The natural vegetation is arid shrub steppe. The Bugta Acable soil series has been mapped over 32,900 ha. The land is cultivated on a limited scale for rain-fed sorghum production.

Bulo Burti Soil Series. A fine-textured, dark brown to brown soil developed from alluvium of the Shebelle River. This soil is confined to areas having a range in average annual rainfall of 300 mm to 400 mm and a range in elevation of 100 m to 150 m. The Bulo Burti Soil Series has been mapped over 112,100 ha. It occurs in narrow tracts on either side of the Shebelle River in the upper Shebelle Valley region. The Bulo Burti soils are used to a limited degree for rain-fed cultivation. The presence of salts and gypsum in the profile detracts from its suitabliltiy for irrigation.

Avai Soil Series. A fine-textured, dark brown to greyish-brown Grumosol developed in alluvial deposits associated with the lower course of the Gofca and Shebelle Rivers. It is found in areas having a range in average annual rainfall of 300 mm to 400 mm and a range in elevation of 30 m 50 m. The natural vegetation is semi-arid shrub and grass steppe. The Avai soil has been mapped over 50,400 ha in the Shebelle River flood plain. Salts are comonly found in the subsurface and subsoil horizons. The Avai soil is not utilized to any significant degree for the cultivation of crops but does have some potential for agricultural development.

Goluen Soil Series. A fine-textured dark brown Grumosol. The soil has developed from recent alluvium of the Shebelle River flood plain. It occurs on level to depressional topography and is intermixed with the coarse-textured brown soil which orginates from out wash formations. The Goluen soil occurs in area having a range in average annual rainfall of 400 mm to 500 mm and a range in elevation of 50 m to 80 m. Much of the area is currently being cultivated and little of the natural savanna grassland that previously occurred on this area remains. The Goluen soil series has been mapped over 237,500 ha. It occurs in a large tract extending from Balad through Afgoi and Genale. Calcium carbonate concretions and some solts occur in the subsoil horizons.

Procedures

A 20 kg soil sample was collected from each of the seven different soil series described above. Soils were collected from the surface 20 cm. The sampes were ground and passed through a 2 mm sieve. Texture was determined by the pipette method (Sillanpai 1982). Organic matter was determined by Walkey-Black method (1934). Phosphorous, copper and zinc were determined by the methods described by Sillanpia (1982). Phosphorous and copper uptake by plants was determined by growing maize in 4 kg of soil for 31 days and then analysing the plant tissue for phosphorous and copper according to the methods outlined by Sillanpia (1982).

RESULTS AND DISCUSSION

The results of the analyses are shown in Table 1 and Table 2.

Table 1. Selected measurements characterizing aspects of the soil series that were studied.

Soil Series Series	Soil Texture (%) Clay	Sand	Organic Matter (%)	pH	Electrical Conductivity (mmhos/cm)
Burei	44.9	39.2	0.7	8.6	0.6
Issur	34.9	54.9	0.6	5.6	0.7
Dinsor	14.0	63.2	0.6	6.1	0.9
Bugta Acable	27.6	46.9	1.0	8.0	0.8
Bulo Burti	44.9	39.2	0.7	8.6	0.6
Avai	60.8	9.0	1.6	8.2	3.2
Goluen	50.0	18.5	2.4	8.1	0.8

Table 2. Concentration of selected elements in the soil series that were studied and a relative measure of extractability of the minerals from the soil by maize.

	MINERALS IN SOIL			PLANT UPTAKE	
Soil Series	Phosphorous (ppm)	Zinc (ppm)	Copper (ppm)	Phosphorous (%)	Copper (ppm)
Burei	9.0	0.81	0.54	0.20	5.4
Issur	12.0	1.16	1.02	0.42	6.0
Dinsor	10.5	1.38	0.85	0.16	11.5
Bugta Acable	7.5	0.82	0.87	0.15	10.5
Bulo Burti	10.5	1.30	0.68	0.29	11.5
Avai	19.5	1.45	1.70	0.23	7.2
Gouluen	13.5	1.04	1.41	0.20	8.5

The measured level of phosphorous from the soils is sufficient for the normal growth of most native rangeland plants but the plant uptake of phosphorus for below the critical level of 0.25% needed for economic maize production (Newton 1967). The micronutrients of copper and zinc were also lower than optimum for growth of most agricultural crops. These data are preliminary but they do provide a starting point for beginning to develop a more complete understanding of some of the major soil series found in central Somalia.

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NUTRITION ANALYSIS OF TEN COMMON FORAGE SPECIES OF CENTRAL SOMALIA

A.Y. Derie and M.M. Farah

Range forage is harvested mostly by the grazing animal. A high rate of return from capital investment in land and livestock is dependent upon high production efficiency of the livestock which, in turn, depends upon properly nurished animals and well managed ranges (Cook 1959). For this reason it is of great importance to know the nutrient value of the native forage plants to grazing animals diet. When forage is abundant animals select the species and portions of the plant community which are the most palatable. This selectivity may be influenced by the kind of animal, grazing intensity, and forage species present. Also, differnt forage species have varying nutritional value depending upon the stage of growth. As a result of this selection it is difficult to evaluate the nutritional content of the diet (Cook et al 1954). Very little information is available on the nutrient status of many of Somalia's native forage species. The objective of this research was to establish crude protein content and digestibility of some of Somalia's common forage species.

The chemical analysis of consumed forage is an incomplete measure of nutritive value, since some of the sample may be completely indigestable to animals for reasons such as large amounts of volitale oils, highly lignified cell walls, etc. Nevertheless, chemical analysis of the most recent portions of plant growth can serve as a relative guide for identifying the nutritive value of the species (Cook and Harris 1950) and developing good grazing practices to optimally manage the vegetation and the grazing animal.

METHODS

The study was started at the beginning of the Deyr and continued through the first month of the Jillaal. Samples of forage were collected about once every three weeks. Vegetation was collected on the Artificial Insemination Station rangelands located 5 km southwest of Afgoi, Somalia. The first several centimeters of the newest growth available was clipped. Samples were dried in an oven at 70°C to a constant weight. All samples were ground through mesh screens of 1 mm . Crude protein was determined by using the Kjeldahl procedure. Lignin was determined by the procedures of Christian (1971). The digestibility of the dry matter was estimated from the percentage content of lignin using the following equations of McLead and Minson (1974):

$$Y = 91.7 - 5.44 X + 0.17 X^2 \quad \text{(for legumes)}$$

$$Y = 77.2 - 3.02 X \quad \text{(for grasses).}$$

To estimate in vivo digestion the above two equations have correction coefficients of -0.93 and -0.95 respectively. In both equations, Y represents the digestibility of the dry matter and X stands for lignin content (Christian 1971).

The authors are former students of the Department of Botany and Range Science, Faculty of Agriculture, Somali National University. The advisor for the research was F.E. Kinsinger. This paper is a summary of the authors B.S. thesis by T.L. Thurow (ed.).

RESULTS AND DISCUSSION

Legumes maintained a relatively high protein content in advanced maturation (Table 1). In grasses however, particularly Cencherus, Leptotherium and Cyperus, the nutritive value was higher in the early vegetative stages and rapidly decreased with maturation of the plant. All of the grasses decreased in digestibility during the course of maturation. This trend is attributable to the negative affect that an increase in crude fibre and lignin has on digestability. The digestibility of legumes remained fairly constant. The slight increase in nutritive value of some legume species may be attributable to the pods produced during the growing season. Glycina digestibility could not be calculated using the formulas of McLead and Minson (1974) due to the inapplicability of the quadratic formula for very high lignin contents. In Glycina the lignin content was as high as 28%.

Table 1. Crude protein and digestibility of ten common livestock forage species.

	Crude Protein (%)				In Vivo Dry Matter Digestability (%)			
Species	10/24	11/18	12/4	12/21	10/24	11/18	12/4	12/21
Cenchrus celiaris	17.2	17.4	10.1	7.8	61.6	54.9	50.4	32.4
Aristida funiculata	---	8.7	7.6	6.5	---	52.2	54.8	49.3
Dactyloctenium aegyptium	---	11.0	11.3	8.6	---	54.6	56.9	50.2
Leptothrium senegalenses	16.0	10.7	10.1	9.7	56.0	44.5	46.8	45.8
Digitaria scalarum	15.6	10.9	8.8	8.0	64.6	60.5	55.2	46.8
Clitoria ternata	---	18.5	19.5	20.3	---	56.0	56.0	55.0
Crotolaria commenstiana	24.3	21.9	19.3	20.3	42.7	42.8	56.0	56.0
Glycina juvanica	19.1	18.6	14.4	15.1	***	***	***	***
Cyperus esiculentus	15.2	8.0	8.5	6.9	62.5	48.2	56.5	52.2
Commelina froshalii	---	19.6	19.0	18.7	---	60.4	60.3	64.2

*** = Lignin content too high to use the quadratic formula of McLead and Minson (1974).

Individual plant species differ in chemical composition. When grazed or browzed in combination with various other species the digestibility as well as the nutritive value of a particular plant may be different than when eaten seperately. Since nutritive value changes with maturity it is very important to know when and where the forage quality and quantity is high. It is also necessary to understand the nutritive value of combined species. These data can then be used to manage range vegetation to improve livestock production.

The digestibility of grasses were variable depending on the vegetative stage, therefore best utilization would occur during rainy seasons when growth is occurring. Legumes may be utilized after frutification because of the slight change of their digestibility. These data indicate that livestock diets may need supplementation in the dry season to maintain the high nutritional input needed to maintain optimum production.

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CHARACTERIZATION OF INITIAL STAGES OF SECONDARY SUCCESSION ON A CLEARED PASTURE NEAR AFGOI, SOMALIA

A.M. Abdulle and A.S. Aden

Very little information exists on the dynamics and characteristics of secondary succession and the climax vegetation communities of Somalia's rangelands. Such information is needed to develop a basis for determining vegetation production, range condition and trend. The objectives of this study were to characterize the initial stage of secondary succession of a cleared area.

METHODS

This study was conducted 5 Km southwest of Afgoi on the Artificial Insemination Station rangelands. A 300 ha area dominated by Dichrostachys cineria was cleared of brush by bulldozers in 1977 and again in 1983. This study was begun in November, 1983, about three months after the 1983 clearing operations were finished. Three study plots were established. Each plot was 6 m by 21 m. In addition a 0.5 m buffer was established around each plot to eliminate edge effects. The total area of all plots was 378 m^2. Two belt transects were randomly selected in each plot. Each belt transect was 1 m wide and 20 m long. On each transect five 1 m^2 quadrats were selected. The plots were fenced to prevent differential grazing that would have occurred within the pasture if livestock access was not controlled.

A ten point frame was used to determine cover and composition. Composition and cover data was collected at the end of the rainy seasons (December 1983 and June 1984). Aerial cover was determined every 4 meters along the belt transects, i.e. five frames in each transect and ten frames per plot. Herbage production was determined by clipping 10 randomly located 1 m^2 quadrats in each plot. Production data were collected at the end of the rainy seasons when the vegetation was visibly at the peak of production. The herbage inside the quadrats was clipped, segregated into species and weighed after it was dried. Ten randomly selected 1 m^2 quadrats in each plot were used for density measurements. Density was determined by counting the number of individuals of each plant species in each quadrat.

RESULTS AND DISCUSSION

The amount of precipitation recorded in the plots was 153 mm in the Deyr and 289 mm in the Gu. The partical size distribution of the soil was 38 % clay, 40 % sand and 22 % silt giving a soil texture classification of clay-loam. As expected, species diversity increased with time after the site was cleared (Table 1). However the net addition of three species and the greater plant density, biomass production and total cover from the Deyr to Gu season may also be attributable to the longer, wetter rainy period which

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The authors are former Botany and Range Science Students, Faculty of Agriculture, Somali National University. The advisors for the study were F.E. Kinsinger and S.A. Young. This paper is a summary of the authors B.S. thesis by T.L. Thurow (ed.).

Table 1. Measurements of the species present in the initial stages of secondary succussion on a pasture cleared of brush cover near Afgoi, Somalia.

	Cover (%)		Composition (%)		Density (plant/m)		Biomass (g/m)	
Species	Deyr	Gu	Deyr	Gu	Deyr	Gu	Deyr	Gu
Achyrantus aspera	0.2	0.1	0.5	0.2	2.1	1.6	5.8	5.8
Aristida adscensionis	1.7	0.0	4.4	0.0	0.5	0.0	1.4	0.0
Bothriochine somalensis	0.7	0.0	1.8	0.0	1.5	0.0	1.4	0.0
Brachiaria obtusiflora	4.8	5.4	12.4	7.3	7.5	6.3	7.9	8.7
Cenchrus ciliaris	0.3	0.4	0.8	0.9	1.7	2.4	3.7	5.7
Cynodon dactylon	6.3	9.8	16.3	16.4	8.1	9.6	10.1	12.8
Dactylotenium scindicum	0.6	0.9	1.6	1.8	1.3	2.0	2.4	3.9
Heliotropium cinerscens	0.4	0.9	1.0	1.2	0.8	1.7	2.7	5.8
Latipes senegalensis	0.1	0.2	0.3	0.4	1.2	1.9	4.3	4.9
Panicum spp.	0.2	0.3	0.5	1.2	1.3	2.4	2.5	3.7
Tetrapogon tenelus	0.1	0.3	0.2	0.6	0.8	1.7	2.3	7.5
Urochloa panicoides	0.0	0.5	0.0	1.6	0.0	1.9	0.0	3.4
Lepthoterium senegalensis	0.0	0.2	0.0	0.3	0.0	1.3	0.0	3.2
Entropogon macrostactyus	0.0	0.2	0.0	0.6	0.0	0.8	0.0	2.7
Total Grasses	15.4	19.2	49.3	33.6	26.8	31.9	47.0	68.1
Forbs								
Abutilon spp.	0.2	0.0	0.5	0.0	0.9	0.0	2.5	0.0
Commelina foreskali	0.2	2.7	0.5	14.8	2.3	3.0	3.7	5.3
Corchorus spp.	0.5	1.2	1.3	0.4	1.1	1.2	2.9	4.5
Euphorbia granulata	6.2	8.9	16.1	18.5	7.5	8.5	8.8	9.9
Ipomea spp.	1.5	1.8	3.9	2.9	2.0	2.7	6.2	6.1
Priva adhaensis	11.8	13.5	30.6	24.1	8.7	0.7	12.5	2.3
Boeraria spp.	0.0	0.1	0.0	0.3	0.0	0.7	0.0	2.3
Total Forbs	20.4	28.2	43.2	61.0	22.5	16.8	36.6	30.4
Shrubs								
Dichrostachys cinerea	1.2	1.5	3.1	3.0	0.8	0.7	5.6	7.3
Indigofera spp.	0.6	0.2	1.6	0.5	1.2	1.9	2.6	5.7
Solanum coagulans	0.1	0.1	0.3	0.2	0.7	2.4	1.8	3.3
Phyllantilcus maderaspara	0.0	0.3	0.0	0.5	0.0	1.3	0.0	2.0
Crotolaria saltiana	0.0	0.1	0.0	0.3	0.0	0.9	0.0	3.2
Salvadora persica	0.9	1.2	1.3	1.8	0.6	1.5	6.3	8.2
Shurb Total	2.8	3.4	6.0	6.3	3.3	8.7	16.3	29.7
Grand Total	38.6	50.8	100.0	100.0	52.6	95.0	99.9	122.4

characterized the Gu. Aristida adscensionis and Priva adhaensis, probable early succession pioneer species, showed marked declines between the two sample periods. Commelima foreskali, Cynodon dactylon and Heliotropum cinerscens showed the most noticable increases.

These data provide a characterization of the initial stages of plant sucession on the study site. Research on the same site in the future will provide further information on the dynamics of secondary plant succession.

RESPONSE OF FOUR NATIVE GRASSES TO CLIPPING

Bashir Barre Buuh, Mohamed Jama Gahair and Jerry R. Barker

One major objective of rangeland management is the optimum production of red meat per unit area. To achieve this goal, forage yields must be maximized to provide a nutritional diet for livestock and wildlife. An important Somali forage plant family is Poaceae (grass family) which is represented by about 275 species (Cope 1985). Some of the most economically valuable plants to man belong to this family. Grasses, besides providing forage, are valuable for erosion control and building materials. As a result of their broad use, it is important to understand how removal of photosynthetic tissue by grazing or clipping may influence subsequent forage yield, both quantity and quality. As shown with many grass species, frequent and severe defoliation reduces both shoot and root growth with carbohydrate reserves being depleted within the plant (Younger 1972). The goals of this study were to determine the influence frequent clipping has on shoot and root growth and forage qualilty of four native grasses important to Somalia's rangelands.

METHODS

Cenchrus ciliaris, Dactylactenium aegyptium, Urochloa panicoides, and Leptothrium senegalense were the four species studied in the experiment. Grass clumps of each species were collected from the Artificial Insemination Center, Afgoi. The clumps of grasses were then transplanted into wooden boxes (1.0 x 0.3 x 0.3 m) containing loamy soil. Each grass species was transplanted into four boxes with no replication.

Each species was clipped at a frequency of weekly, biweekly, monthly, and control. At the time of foliage removal, each plant was clipped to a height of 2 cm from the soil surface. The experiment lasted 20 weeks after which the shoot growth of all plants was harvested, oven-dried at $70^{\circ}C$ for 48 hours, and weighed. In addition the roots were carefully removed from the soil by washing, oven-dried at $70^{\circ}C$ for 48 hours, and weighed. To determine forage quality, the herbage samples were analyzed for percent crude protein, ether extract, crude fiber, and ash content (Earley et al. 1965).

RESULTS AND DISCUSSION

During the experiment, each of the four species showed similar responses to the clipping treatments and therefore, will be discussed together. Generally, grass growth was reduced with an increase in clipping frequency as is shown by the values for shoot and root biomass. Herbage and root biomass production was the greatest in the monthly and control clipped plants while the weekly clipped plants produced the least. An interesting note is that D.aegyptium and C. ciliaris monthly clipped plants produced more biomass than the control plants. Perhaps limited defoliation stimulated herbage production of these two species (Haferkamp 1982).

The first two authors are Ecologists, National Range Agency while the last author is a Professor, Faculty of Agriculture, Somali National University, Somalia.

Table 1. Shoot and root biomass (dry weight) production of four native grasses clipped at weekly, biweekly, and monthly intervals. Grasses were grown in wooden boxes and harvested after 20 weeks.

Species	Weekly	Biweekly	Monthly	Control
	Shoot Biomass (g)			
D. aegyptium	30	65	108	100
C. ciliaris	38	49	122	85
U. panicoides	27	38	--	79
L. senegalense	21	59	70	83
mean	29	53	100	87
	Root Biomass (g)			
D. aegyptium	18	32	112	107
C. ciliaris	8	19	82	93
U. panicoides	15	33	--	95
L. senegalense	12	32	58	98
mean	13	29	81	98

Apparently, frequent removal of photosynthetic tissue adversely influences grass productivity (McLean and Wikeem 1985). Regular, frequent removal of herbage, whether by grazing or clipping reduces the plants ability to synthesize carbohydrates needed for growth and reproduction (Younger 1972). This is especially true if severe herbage removal occurs during a critical period of growth such as flower and seed set or the forepart of the normal carbohydrate cycle (McCarty and Price 1942). Therefore, continuous grazing of grasses as pointed out by McLean and Wikeem (1985) may result in a reduction of vigor and eventual death.

Defoliation also affects root growth of grasses by reducing the amount of carbohydrates available for their maintenance and growth (Younger 1972). With continued clipping or grazing without a rest period, the existing roots may die back or be replaced by a new system that is confined to a small volume of soil. After herbage removal, shoots recover and grow faster than the roots because they draw on the available carbohydrates first (Caldwell et al. 1981). Thus, the plants ability to build an extensive root system after severe defoliation does not occur until the photosynthetic tissue is replenished and carbohydrates are again in adequate supply (Younger 1972). The disadvantage of an under-developed root system is that the plant's ability to cope with environmental stresses such as drought and competition is reduced.

The nutritional content also varied among the grasses within the various clipping treatments (Table 2). Percent crude protein, ash and ether extract decreased with a decrease in clipping frequency. On the other hand, percent crude fiber increased with a decrease in clipping frequency. These chemical changes, however, may be result of plant maturation and not due to the clipping treatments per se (Raleigh 1970). As a grass plant matures, crude protein, carbohydrates, and ash decrease while crude fiber, lignin, and cellulose increase. Thus, grass digestibility for animals increases with maturation. Such chemical changes result from increases in the stem-leaf ratios and alterations in physiological process as the plant matures. Haferkamp (1982) has shown that forage quality of big sacaton (Sporobolus wrightii) is improved with moderate defoliation because the plants are maintained in the vegetal growth stage.

Table 2. Nutritional quality of four native grasses clipped weekly, and monthly. Grasses were grown in wooden boxes for 20 weeks.

Species	Chemical Analysis, % dry matter Weekly	Biweekly	Monthly	Control
	Crude Protein			
D. aegyptium	15.20	13.30	12.12	10.60
C. ciliaris	11.80	11.60	13.50	6.70
U. panicoides	14.30	13.03	13.10	8.30
L. senegalense	---	---	15.80	5.80
mean	13.77	12.64	13.63	7.85
	Crude Fiber			
D. aegyptium	23.97	25.06	26.04	25.06
C. ciliaris	24.14	20.03	---	29.07
U. panicoides	23.59	21.59	25.88	26.48
L. senegalense	---	---	37.20	35.68
mean	23.90	22.19	29.71	29.07
	Ash			
D. aegyptium	14.52	11.78	11.70	12.95
C. ciliaris	11.40	10.98	---	11.42
U. panicoides	11.33	11.31	11.37	9.18
L. senegalense	---	---	8.40	9.73
mean	12.42	11.36	10.49	10.82
	Ether Extract			
D. aegyptium	3.84	3.19	2.80	2.43
C. ciliaris	4.39	5.40	---	2.38
U. panicoides	---	---	2.85	2.26
L. senegalense	---	---	2.37	2.18
mean	3.99	3.86	2.67	2.81

As discussed, prolonged herbage removal can have an adverse affect on the vigor and regrowth ability of grasses. However, proper herbage removal at the right time may increase the quantity and quality of forage production. Pratt and Gwynne (1977) reported that for maximum grass production, photosynthetic tissue should be maintained at the optimum by avoiding severe defoliation and by removal of excess herbage by grazing as it accumulates. They also reported that defoliation of grasses as they shift into reproductive development can encourage further vegetal production thus maintaining high carbohydrate and protein levels. Furthermore, according to Heady (1975) the saliva of grazing animals contains a growth stimulant that favors rapid vegetal regrowth after defoliation.

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VEGETAL STRUCTURE AND COMPOSITION OF THE BULO BURTE ECOLOGICAL MONITORING SITE

Abdisalam Sheikh Hassan and Jerry R. Barker

Four ecological monitoring sites were established in 1983 to monitor range condition and trend as part of the Somalia's Central Rangeland Development Project. The four sites are located near Bulo Burte, Ceel Dheere, Nooleye, and Hobyo. Each site is fenced and is approximately 2 ha large. The purpose of these ecological monitoring sites is to measure vegetal changes with the absence of livestock grazing. This paper reports the vegetal structure and composition of the Bulo Burte Ecological Monitoring Site.

STUDY SITE

The ecological study site is located just north of Bulo Burte, Hiran Region. The 2 ha area is enclosed with a fence to prevent livestock grazing and trampling. Mean annual precipitation is 350 mm occurring during the Gu' and Dayr seasons. The elevation is 132 m. The soils are loam to sandy loam and are moderately deep and well drained. The vegetation is thorn shrub with a sparse understory of herbaceous plants and dwarf shrubs. In the past the area has received moderate to heavy livestock grazing pressure.

MATERIALS AND METHODS

Within the exclosure, 10 randomized 100 m transects were established to conduct all vegetal sampling. The circle-plot method was used to assess shrub cover, density, and dominance. Herbaceous plant cover and composition was measured using the point-frame method. All sampling was conducted during June, 1984.

A randomly chosen meter mark along each transect was used as the center-point of a 1256 m^2 (radius = 20 m) circle. Shrub density by species was assessed by counting all shrubs rooted within the circular plots. Shrub cover by species was determined by measuring crown-diameter. Dominance rank was assigned to each species by multiplying shrub density and percent mean cover.

The point-frame method measured cover and composition of the herbaceous understory plants. A metal frame 80 cm tall and 60 cm wide with 10 guide holes spaced 7 cm apart was used. Five randomly chosen points along each 100 m transect were sampled. At each sampling point, the 10 pins were lowered with the initial contact being recorded as foliage cover by species, plant litter, rock, or bare ground. Dominance rank for herbaceous plants was based on percent mean cover.

RESULTS AND DISCUSSION

Total vegetal cover of the exclosure was about 12% with the herbaceous plants providing the majority of cover (Table 1). However, the woody plant component was the visible dominant. Plant litter also provided considerable ground cover at 19%. The remaining 72% of the exclosure was bare ground.

The authors are Instructor, Afgoi Forestry and Wildlife Technical School, Afgoi; and Professor of Range Science, Faculty of Agriculture, Somalia National University, Mogadishu, Somalia. This paper presents part of the senior author's Thesis of Degree at the Faculty of Agriculture.

Table 1. Percent vegetal cover, litter and bare ground of the Bulo Burte Ecological Monitoring Site.

Characteristics	Percent
Woody plant	4.3
Grass	3.4
Forb	4.8
Plant litter	19.4
Bare ground	72.4

Table 2. Shrub cover, density, composition and dominance of the Bulo Burte Ecological Monitoring Site.

Species	Cover (%)	Comp.[1] (%)	Density[2] (plants/Km^2)	Comp.[3] (%)	Dom.[4]
Acacia seyal	1.10	34.6	7.9	23.4	1
Acacia nubica	1.10	34.6	4.5	13.3	2
Cassia longiracemosa	0.10	3.1	4.7	13.9	3
Indigofera articulata	0.10	3.1	3.2	9.5	4
Acacia horrida	0.10	3.1	1.2	3.6	5
Jatropha parvifolia	0.10	3.1	1.0	3.0	6
Balanites sp.	0.10	3.1	0.8	2.4	7
Commiphora sp.	0.10	3.1	0.8	2.4	7
Lawsonia inermis	0.03	0.9	1.4	4.1	8
Acacia benadirensis	0.03	0.9	1.1	3.3	9
Cordia sp.	0.02	0.6	1.4	4.1	10
Cadaba farinosa	0.03	0.9	0.6	1.8	11
Terminalia sp.	0.01	0.3	1.4	4.1	12
Acacia tortilis	0.03	0.9	0.4	1.2	13
Loranthus panganensis	0.01	0.3	1.2	3.6	13
Adenium sp.	0.01	0.3	0.1	0.3	14
Cordyla somalensis	0.10	3.1	0.1	0.3	14
Dichrostachys puccioniana	0.04	1.3	0.2	0.6	15
Dalbergia aurandensis	0.01	0.3	0.6	1.8	16
Zizphus sp.	0.01	0.3	0.4	1.2	17
Glycine javanica	0.01	0.3	0.2	0.6	18
Pedalium sp.	0.01	0.3	0.2	0.6	18
Abutilon fruticosum	0.01	0.3	0.2	0.6	18
Cadaba heterotricha	0.01	0.3	0.1	0.3	19
Euphorbia sp.	0.01	0.3	0.1	0.3	19

[1]percent composition based on plant density
[2]number of plants per Km^2
[3]percent composition based on plant density
[4]dominance rank

Table 3. Herbaceous cover, composition and dominance at the Bulo Burte Ecological Monitoring Site.

Species	% Cover	% Composition	Dominanace
Barleria ciliaris	1.8	21.9	1
Indigofera spiniflora	1.8	21.9	1
Brachiaria sp.	0.8	9.8	2
Cenchrus seticerus	0.8	9.8	2
C. ciliaris	0.4	4.9	3
Dichanthium annulatum	0.4	4.9	3
Sporobolus helvolus	0.4	4.9	3
Neuracanthus polyacanthus	0.4	4.9	3
Aristida funiculata	0.2	2.4	4
Baerhavia erecta	0.2	2.4	4
Tephrosia sp.	0.2	2.4	4
Dactyloctenium annulatum	0.2	2.4	4
Tetropogon sp.	0.2	2.4	4
Leptothrium senegalense	0.2	2.4	4
Digitaria rivae	0.2	2.4	4

Within the monitoring site, 41 plant species were identified with the woody vegetation contributing 26 species (Table 2). The dominant woody plants were Acacia seyal, A. nubica and Cassia longiracemosa. These species were dominant because of their density, cover, and height. The dwarf shrub, Indigofera articulata, was a dominant species in the understory. Only two Acacia species provided the majority of shrub cover while the remaining 24 shrubs provided the rest of the woody plant cover.

The dominant forbs in the understory were Barleria ciliaris and Indigofera spiniflora (Table 3). The dominant grasses were Brachiaria sp. and Cenchrus setigerus. These four species provided the majority of the herbaceous ground cover.

These data characterize the Bulo Burte monitoring site will be useful for future comparative studies. Since livestock grazing will not be allowed in the exclosure, an accurate assessment of its influence on the vegetation may be made. For the ecological monitoring site to be of value, sampling should be conducted yearly during both the dry and rainy seasons. Thus a data base can be developed to use as a management tool. To insure that the data sets from various sampling periods are compariable, similar sampling procedures should be followed. In addition, as an aid to vegetal data interpretation, evapotranspiration and precipitation data should also be obtained.

PATTERN OF ACACIA DISTRIBUTION AT THE ARTIFICIAL INSEMINATION CENTER, AFGOI, SOMALIA

Mohamed Abdisalam Ibrahim and Jerry R. Barker

Acacia species are some of the most important plants on the Somalia rangeland for herbivores and man. Acacia produce abundant, high-quality forage and pods that are palatable to a wide spectrum of domestic and wild herbivores. The nutritional fodder of Acacia is a large component of herbivore diets during the dry season (Rensberg et al. 1948). The forage value of these plants is high in protein because of their leguminous nature (Sherman 1977). Acacia are also used by man for medicines, thorn fences, curved support-poles for Somalia houses, charcoal and fuel-wood. For these reasons Acacia are very useful in Somalia and other parts of Africa (McKell 1980). Being aware of its forage value and other uses, this study was conducted to provide information on Acacia distribution and nutritional quality at the Artifical Insemination Center near Afgoi, Somalia.

METHODS

The study area was the Artificial Insemination Center and Government Dairy Farm located 5.0 km southwest of Afgoi, Somalia . Sampling was conducted from December, 1984 to June, 1985.

The study area was first surveyed to map potential Acacia associations. The association were then sampled using the point center quarter method to measure Acaia plant density. The heights of each Acacia plant sampled were also recorded. Using these data, definite Acacia associations were mapped based on plant dominance and soil texture.

Soil samples of each Acacia association were collected for laboratory analysis. Several bulk samples of the surface 15 cm were collected to determine water-holding capcity, pH, electrical conductivity, organic matter and texture. These analyses were used to help describe the habitat type of each Acacia association. In addition, topographical position and exposure were recorded.

Twigs and leaves of five individuals per species per association were harvested once in the Jillaal season. About 100 g wet weight was measured in the field with spring balances and recorded for water content calculations. Samples were then oven-dried at 70° C to a constant weight. All samples were ground using a 1 mm mesh screen and made ready for crude protein analysis. To assess forage quality percent crude portein and percent dry matter were measured using standard Kjeldahl procedures.

RESULTS AND DISCUSSION

The study are was divided into 6 Acacia associations based on species presence, topographic postion, and soil texture. Species dominance and soil characteristics are given in Tables 1 and 2, respectively.

Authors are former student and a professor of Botany and Range Science Department, Faculty of Agriculture, Somali National University. This paper summarizes the senior author's B.S. thesis.

Association A

Acacia tortilis and A. nubica were the dominant species of this associaiton. Each had a relative density of 50 %, however, A. tortilis was the emergent species. The soils were shallow and sandy and favorable for vegetal growth except for the low water-holding capcity. This associaiton occurred on northeastern facing slopes.

Association B

The dominant species of this association were A. nubica and A. horrida. Their relative densities were 40 % and 35 %, respectively. A. tortilis also occurred within this association. The soils were sandy and shallow with a low water-holding capacity. This association occurred on the southwest facing slopes and ridge tops.

Associaiton C

Acacia horrida and A. tortilis were the dominant shrubs with relative densities of 55 % and 45 %, respectively. The shallow soils were sandy and favorable for plant growth. This association was found on a southwest facing slop along along a water drainage.

Association D

The dominant species were A. senegal and A. horrida with relative densities of 45 % and 30 %, respectively. A. nubica and A. tortilis also were part of this association. The moderately deep soils were sandy. Plant production on this association should be higher than the previous assications because of the high water capacity of the soils. This associaitons occurred on relatively flat terrain.

Association E

The dominant species were A. nubica and A. tortilis with relative dominace of 40 % and 30 %, respectively. A. horrida and A. nilotica were minor components. The soils of this site were a silty-clay-loam and were relatively deep. Plant forage production should be good becauses of the increased water-holding capcity. Topographic position was flat.

Association F

Acacia nilotica and A. nubica with relative densities of 50 % and 45 %, respectively, were the dominant species. A. tortils also was found in this assaociation as the emergent species. The soils were a sandy-clay-loam and favorable for abundant forage production. The topograhic position of this association was flat.

Forage Value

The percent crude protein and dry matter varied among the species (Table 3). Crude protein content was the highest in A.tortilis and A. nubica and lowest in A. horrida. Leaf crude protein, regardless of species was consistantly about 50 percent higher than in the twigs. Percent dry matter was greatest in A. horrida and lowest in A. tortilis. Percent dry matter was the highest in twigs and lowest in leaves. The percent crude protein values presented herein are in the same range as data presented by Le Houerou (1980).

Table 1. Acacia associations, relative densities, and mean plant height at the Artifical Insemination Center.

Association	Species	% Relative Density	Mean Height, m
A	A. nubica	50	2.25
	A. tortilis	50	3.40
B	A. nubica	40	2.60
	A. horrida	35	2.64
	A. tortilis	25	3.50
C	A. horrida	55	2.48
	A. tortilis	45	3.72
D	A. senegal	45	2.30
	A. horrida	30	2.70
	A. tortils	15	4.33
	A. nubica	10	2.50
E	A. nubica	40	2.50
	A. tortilis	30	2.80
	A. horrida	10	2.60
	A. nilotica	20	2.50
F	A. nilotica	50	2.40
	A. nubica	45	2.20
	A. tortils	5	3.50

Table 2. Physical and chemical analysis of the soils associated with each Acacia association.

Association	pH	EC	Organic matter (%)	Water Content (%)	Texture
A	6.4	0.3	1.44	8	sand
B	6.9	0.2	1.68	10	sand
C	6.7	0.2	1.43	11	sand
D	7.6	0.2	1.68	14	sand
E	7.2	0.2	2.12	20	silty-clay loam
F	7.2	0.7	2.23	20	silty-clay loam

Based on the crude protein and dry matter content, A. tortilis produced the highest quality forage while A. horrida produced the lowest. A. tortilis was the most wide spread species at the A.I. Center. Therefore, it is probably the most import Acacia species for forage. One problem is that its forage may grow out of the reach of browsing animals. However, this problem can be rectified by proper prunning of its branches (Everest 1949).

Table 3. Percent crude protein and dry matter of five Acacia species growing at the Artifical Insemination Center.

		Crude Protein		Dry Matter	
Species	Soil Type	Leaf	Twig	Leaf	Twig
A. tortilis	Sand	25.81	13.73	20.45	30.10
A. tortilis	Loam	25.38	13.56	21.60	30.10
A. nubica	Sand	25.37	13.82	25.80	38.80
A. nubica	Loam	25.38	13.82	25.85	39.60
A. senegal	Sand	21.70	13.56	24.20	29.80
A. niltica	Loam	19.60	13.48	20.45	28.60
A. horrida	Sand	17.94	9.19	26.20	31.58

The palatability of these five Acacia species is excellent, except for A. nubica which at times is refused by browsers because of its unpleasnat odor caused by essential oils. Perhaps an artificial selection program could identify varieties that maintain a high protein content and still be low in essential oils.

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