

<b>COURSE CODE:</b>	PRM 504
<b>COURSE TITLE:</b>	MANAGEMENT OF GRASSLANDS
<b>NUMBER OF UNITS:</b>	3 UNITS
<b>COURSE DURATION:</b>	Two hours of lecture and three hours of practical per week

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### COURSE DETAILS:

<b>Course Coordinator:</b>	<b>Prof. Olufemi Sunday, ONIFADE ( Ph.D )</b>
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<b>Office Location:</b>	Department of PRM, COLANIM
<b>Other Lecturers:</b>	Prof. A O Jolaosho and Mrs V O A Ojo

### COURSE CONTENT:

Factors causing low level of animal production, Stocking rate and animal production, Management techniques to increase production : improvement of soil fertility, bush control, direct reseeding, provision of water, provision of dry season feeds, fencing, Noxious plants, Plant related diseases.

### COURSE REQUIREMENTS:

This course is essential for all 500 level students in Department of PRM and other interested Agricultural students. A minimum of 75 % attendance ( lecture and practical) is required to write the final examination.

## READING LIST:

Crowder, L.V. And Chheda, H.R. 1982. Tropical Grassland Husbandry. Tropical Agriculture Series. Longman London.

Heady, H F 1975. Range Management. Mc Graw - Hill Books Co. New York.

Langer, R H M 1990. Pasture – their ecology and management. Oxford University Press, New York.

Pamo, E T and Pieper, R D 2000. Introduction to Range Management in free and open access environments of sub – Saharan Africa. CTA Books. The Netherlands .

## LECTURE NOTES

### INTRODUCTION

Definition: Land used principally for extensive grazing by domestic and wild animals. Vegetation zones – shrub land, grasslands & open forests land. Usually unsuitable for arable farming. Too dry, steep, shallow, rocky, sandy, saline, high evaporation...

Aim of management – manage land to produce forage that will be used by livestock (domestic and wild) and to promote/maintain efficient production of animal products. This will involve:

- i. maintenance of vegetation at the best stage in the succession for the animals ie. Preventing the destruction of natural ecosystem.
- ii. ensuring continuous vigor of palatable and nutritious forage spp.
- iii. preventing soil erosion through out the year.

### FACTORS CAUSING LOW LEVEL OF ANIMAL PRODUCTION FROM GRASSLAND.

1. Limitation imposed by the environment.
  - a. Climate -rainfall usually low and seasonally distributed. – long period of drought and limited water supply.
  - b. Soil – generally low in fertility – N,P, Ca...
  - c. Unstable grassland community – tendency for ingress of trees and shrubs.

d. Incidence of diseases and insects – under utilization of grazing land as a result of tsetse fly infestation. Production and quality of grass are low & unevenly distributed within the year leading to seasonal variation in carrying capacity.

## 2. Sociological causes.

a. Nomadism – Attention is devoted to the stock than to the management of the grazing resources. Consequently, this leads to deterioration of the grassland.

b. Attitude of pastoralists: Their desire is to own as many cattle as possible results in overstocking, overgrazing and ultimately deterioration of the range. With increase in number of animals so the tendency to increase their spouses.

c. Dry season feed. :Some attempts are made to provide this especially for producing animals.

d. Burning. : Indiscriminate burning by cattle owners, hunters and farmers. This can exhaust the grass plants and destroy useful standing hay.

## 3. Economic causes

The marketing system is inadequate, abattoirs are lacking and storage facility are inefficient.

## REMOVING LIMITATIONS TO INCREASED LIVESTOCK PRODUCTION

### Sociological:

It has not been easy to settle the Fulani and restrict animal numbers. Reducing stock numbers to carrying capacity prevents overgrazing and erosion. This will require continuous education and change in attitude. Surplus stock can be sold and poor bulls castrated. Settling will reduce weight loss through endless trekking, increase grazing time and reduce erosion along trails. The challenge of remoteness of grazing areas to the market for animal products (beef, milk and butter) will have to be solved. Availability of water and dry season feed will also be essential.

### Environmental:

The aim is to increase yield and quality of herbage available through out the year. This can be done by proper or controlled stocking and pasture management but in degraded areas more direct and special methods may be needed. This is aimed at sustaining

livestock production and maintenance of plant vigor / desirable spp within the limits of rainfall.

The two systems employed in grazing land are continuous and rotational deferred grazing. Rotational deferred grazing allows for resting periods from grazing, reseeded, provision of dry season feed (fodder) and combustible material to accumulate for burning.

Application of phosphorous and incorporation of legumes into grassland enhance the quantity and quality of forage spp.

### RELATIONSHIP BETWEEN STOCKING RATE AND ANIMAL PRODUCTION

This applies to the grazing management of sown and natural pastures. This relationship was established ( Mott, 1961 ) based on a number of grazing experiments.

- Production/animal decreases from a very lenient rate to the optimum rate and then decreases very rapidly as the optimum grazing pressure (OGP) is exceeded.
- Production/ha rises very rapidly as SR is increased from the under grazed condition to the OGP. Maximum output/ha occurred at a SR in excess of optimum SR. Beyond this point a very rapid fall in production/ha occurs.
- Grazing pressure:- the number of animals per unit of available forage.
- Stocking rate:- number of animal per unit area e.g. 20 bulls/ha

Carrying capacity – the area of rangeland required to carry one mature animal (maintenance and some production) through out the year. Area should be managed to prevent any adverse effect of the grazing land. Eg: 1 ha/ mature beast in forest zone, 3-5 ha / mature beast in sub humid savannah. The capacity will be higher on cleared than in uncleared land.

Purposes of proper stocking:

1. To maintain efficient green leaves and shoots for photosynthesis
2. Provide and preserve the food reserves stored by the plant for use in making quick regrowth
3. Permit seed production for the maintenance of plant stand
4. To protect young seedlings till they can tolerate some grazing
5. To increase the better plants which keep out weeds and poor annual grasses
6. To protect the soil from wind and water erosion
7. To leave a vegetative cover which acts as a mulch and results in increased water absorption and storage in the soil.
8. To prevent extremes in soil temperatures by acting as an insulator.

## MANAGEMENT TECHNIQUES ON GRASSLANDS

- BUSH CONTROL
- DIRECT RESEEDING
- RANGE USE AND PROVISION OF WATER
- FENCING
- PROVISION OF DRY SEASON FEED

### 1. BUSH CONTROL

Definition : reduction in density of undesirable plants by manual, mechanical, chemical , biological or other means.

Classes Of Undesirable Plants :

#### i. Weedy:

Competes for space and nutrients with forage spp thus reducing yield and utilization. eg *Isobertinia doka*, *Cassia tora*.

#### ii. Mechanically injurious:

Plants with projecting appendages ( spines, stipules, burrs) that can puncture skin of animal thereby exposing animals to attack by insects and diseases. eg. *Acacia* spp, *Cenchrus biflorus*

#### iii. Poisonous plants:

Containing toxic chemical compounds within plant tissues. When plant parts are ingested and digested releases toxic by- products which interferes with physiological processes in animal. eg. *Crotalaria retusa*, *Ricinus communis*.

Objectives Of Bush Control

1. removal of undesirable plants in order to reduce competition for nutrients and water to forage spp.
2. reduction of shrubs in order to provide large surface area for seeding and facilitate seedling establishment

3. removal of obstructive shrubs to provide pasture access and facilitate easy handling of livestock.
4. removal of shrubs to facilitate water drainage and control erosion..



**Figure 1: Cassia tora**

5. removal of shrubs to reduce fuel material for range fire.
6. elimination of poisonous plants with direct effect on grazing animals.

### **Bush Control Methods**

Biological, mechanical, chemical and burning.

The best method or combination of methods suited to a particular situation depend on :

Kind of plant to be controlled, the damage to existing desirable spp, character of the topography and soil, the need for seedbed preparation, the effectiveness and speed of the

treatment, availability of equipment & materials (herbicides) and the herbivore components other than livestock and their dietary habits.

a. Biological

Introduction of natural enemies of the undesirable plants.

Manipulating grazing eg mixed grazing taking advantage of different food preferences of herbivores.

b. Mechanical

Hand grubbing, hand chopping and sawing.

Bulldozing

Chaining or cabling

Surface tillage (ploughing, discing, harrowing).

Mowing and shredding.

c. Herbicidal

Synthetic : chemical that kills grass, herbs trees or shrubs.

Contact herbicide : one that kill only plant parts directly exposed to the chemical

Systemic herbicide, when applied to one part of the plant is transported to other parts where the effect is produced.

Arboricides, herbicides used on trees and shrubs. The most effective treatment to control I doka was a 2.5 % solution of 2,4,5-T and 2,4 D in diesel oil to the slashed regrowth.

d. Burning

A cheap method of preventing further encroachment or preventing bush from getting thicker. The area to be burnt should be protected from grazing in the second half of the growing season so as to provide sufficient combustible material necessary for a successful burn. A rest period is also desirable after burning to allow the grass to recover. When the bush is thick and the grass is sparse, as in the dry sub humid, it is difficult to obtain a successful burn of sufficient intensity for trees and bush control.

Use of fire in managing pastures:

- Burn off unpalatable growth from previous season.
- stimulate growth during season of little green materials
- Destroy parasites.
- control ingress of undesirable plants.
- prepare a seedbed for pasture.
- promote uniform distribution of useful herbage & better distribution of animals in pastures.
- Stimulate grasses to produce seeds.
- encourage growth of natural legumes for soil improvement.

Harmful effects:

May lead to depletion of root reserves of palatable spp and progressive reduction in vigor and competitive ability. Invasion of undesirable spp and increased erosion hazards.

## 2. DIRECT RESEEDING

- Introduction of more desirable herbage spp into existing rangeland vegetation
- Adoption of suitable management to enable them compete successfully

Techniques:

(1) broadcasting – by hand or aurally. The legume seed and phosphorus fertilizer are mixed before broadcasting. Best at the end of dry season burning to broadcast stylo and P.

(2) ploughing widely spaced furrows – seed sown into such strips germinate, grow and produce seeds which spread into the range through wind, animals etc

(3) over drilling (sod seeding) – planting seed directly into existing sward, no ploughing, use of discs, planters (partial disturbance)

(4) use of grazing animals. Stylo seed + sorghum meal are fed to cattle. The seeds in faeces germinate and eventually spread into the rangeland.



### 3. RANGE USE AND PROVISION OF WATER

- Sources of water – perennial streams, dams, surface ponds, wells and boreholes.
- Liver fluke infestation and tsetse fly habitat (except borehole)  
With borehole:
  - The pasture is grazed uniformly over the range and disease transmission is low
  - Concentration at water point is reduced
  - High cost of maintenance and wastage of water
- Daily watering gives higher liveweight gains than every 2<sup>nd</sup> and 3<sup>rd</sup> day.
- 300 kg animal require 8-10 l/day during the rainy season and 16 – 20 l/day during the dry season.
- Zones of pasture use are clearly defined around water points – in concentric circles
- Grazing distances from water supply should not to exceed 5 km (sheep), 10-16 km for (cattle).
- The longer the distance to water source, the lower the animal productivity
- Use of troughs (concrete) for large herd is advised
- Provision of shade and mineral licks (NaCl, CaCO<sub>3</sub>, Sulfur and P compounds) for better range use.
- The addition of soluble minerals to drinking water appears more practical than through herbage (fertilizer)

### 4. FENCING

Importance of Proper Fencing.

- Confines livestock to desired property area
- Promotes better distribution and uniformity of grazing
- Provides the guide to livestock movement
- Permits easier handling of livestock
- Protects overgrazed area till they recover
- Protects new seedlings till they are firmly established

- Useful in separation of differently treated paddocks
- Makes controlled grazing possible
- Protects animal from grazing hazards such as poisonous plants
- Used to segregate different kinds and classes of animals
- To protect crop land from being grazed
- Supports greater livestock production

### **Kinds of fences**

1. Barbed wire – Wooden or iron posts at intervals of 4-6 m.
  - At least 4 strands of wire
  - Effective for cattle than sheep/goats
2. Pole fences – long poles used to replace barbed wire.  
They are usually welded to iron posts or tied to wooden posts. Its very expensive.
3. Electric fence – a single wire supported by widely spaced posts.
  - Usually battery operated
  - Effective for control of cattle and horses
  - Cheap to construct and can be moved to different locations
4. Woven (Net) Wire – Usually permanent
  - Effective for controlling sheep and goats
  - Very expensive
5. Live fences – Use of shrubby plants
  - Planted closely around the plot
  - Takes time to be effective
6. Use of thorns – For small enclosures of herd/flocks
  - Used mainly by agro pastoralists
  - Labour is required in cutting shrubs and arranging the thorn bush
  - Can be destroyed by wildfire.

### **5. PROVISION OF DRY SEASON FEEDS**

It is not easy keeping livestock well fed in the dry season. To minimize/prevent loss of weight some methods are available by which this can be achieved.

**a. Pasture legumes (fodder bank)**

- Growing of sole pasture legumes in fields/strips for ration grazing
- Adjacent to the rangeland (supplement)
- *S.guianensis*, *S. hamata* with about 9-10 % CP were grazed by cattle at night to supplement range grazing during the day. Losses in weights were not recorded during the dry season.
- Higher yields of forage was recorded in the second year
- Protection from dry season fire is essential.





Figure 2. Maize residue with Sorghum+cowpea



**Figure 3. Maize residue in situ**

## b. Legume hay

- Provision of hay made from groundnut, mucuna, cowpea, lablab, soybean etc from suitable sites.
- Hay from this method are more costly than using pasture legumes
- Used mainly for growing animals/fattening.

## c. Use of arable by-products

### i. Crop residues

Sorghum, millet, corn and rice straw ( stovers ). Need to add protein rich supplements:- groundnut haulms, stylo, etc for weight gains in animals during the dry season (table 1).

- Treatment with urea to increase intake.
- The residues should be protected in semi arid zones from being burnt by bush fire.

### ii. Use of cotton seed and ground nut cakes

- Animals on natural range grazing when supplemented with these cakes gained weight during the dry season.
- Amount/head varies with animal production expected

Table 1. Animal performance on different feeding systems

<b>Roughage</b>	<b>Concentrate (Kg/day)</b>	<b>LWG (Kg/day)</b>	
Sorghum residue	0.90 (every 2 days)	+0.12	+0.42
Grass hay – savanna	0.90 (every 2 days)	+0.06	+0.09
Maize silage	0.45	-0.09	+0.03
Elephant grass silage	0.45	-0.07	-
stylo	0.45	-	+0.43

(98- day trial with ground nut cake.)

**d. Use of browse plants**

- Rich in protein and minerals when grasses are deficient in these attributes
- Pods, twigs and leaves are very important
- *C. cajan*, *L.leucocephala*, *G. sepium* (sown)
- *Acacia* spp, *Piliostigma* spp, *Khaya senegalensis* ( in natural pastures)
- When clearing land, some of these spp should be retained in the field.

**e. Stimulating growth and utilization of regrowth.**

- Controlled burning during late dry season removes dry and unpalatable old vegetation and stimulates regrowth of herbage with 1<sup>st</sup> rains
- Is it worth sacrificing standing hay for smaller quantity of better quality feed?

**f. Fadama grazing**

- Available in dry season when flood plains are exposed due to low levels of river/streams
- Yield and quantity of feed can be improved through introduction of more productive spp.
- Small areas can also be set aside for irrigating forage crops.

**g. Irrigation**

- Found in Lake Chad, Tiga dam, Kadawa
- Inclusion of forage spp in cropping schemes will enhance finishing of animals from the range to the market.



## **NOXIOUS PLANTS IN PASTURES**

Noxious – Plants that are hurtful ie hazardous to production and utilization of pasture.

They are either poisonous or mechanically injurious ie (with sharp leaf margin, sharp spines burs (bristles), awns and seed coats

These cause skin damages which allows for bacterial and fungal entries. Damages are also done to the tongue, gum and eyes.

The only way to protect livestock from grazing hazard is to prevent the invasion of noxious plants is by removing them.

There are some rules which have to be followed:-

1. Removal of poisonous plants either just emerging,- young or matured
2. Avoid areas with abundant poisonous plants with respect to grazing
3. Care must be taken at the beginning of the rains to ensure that emerging green vegetation is eaten to a moderate extend.
4. Don't misuse the range ie don't retain the animals on dry feed excessively at the expense of forage. Prevent escape to grazing green plant which include poisons plant
5. Use plenty of salt.

Examples of plants with high contents of HCN:- *Cynodon dactylon*, *C. plectostachyus*, *Sorghum alnum*, *Cymbopogon gigatenum*. The effects of high HCN in animals are loss of condition, emaciation and death.

Examples of noxious plants

*Crotalaria retusa* - rattle box , *Chromolina odorata*, *Pteridium aquilinum* – bracken fern

*Cassia occidentalis* - (Raidore or sanga sanga, *Ricinus communis* - (castor oil).

*Indigofera spicata*, *Lasiosiphon kraussianus* (Tururubi), *Erythrophleum africanun* (Samberu).

*Tribulis terrestris* (Tsaidau).

*Crotalaria retusa*

Annual or semi annual shrubby legume whose pods explode when dry and seeds spreads.

It grows up to 1.3 m height and common in abandoned farmland especially in guinea savanna. It is palatable and continues to remain green when others are dry. When seeds are consumed by fowl, death occurs. When the herbaceous portion (leaves) is consumed in large quantity by large animal it causes walking about disease)

Symptoms: irritability, yawning, muscular spasm leading to mad and aimless galloping and staggering which is incurable.

*Cassia occidentalis*

It is used locally to procure abortion. An annual legume which is herbaceous. Commonly found in overgrazed pasture - close to the villages. The plant is unpalatable to stock and its toxic effects are invariably not related to stock poisoning. All parts of the plant are able to cause stomach disorder- related to purging

*Ricinus communis*

A shrub. very easily destroyed by strong winds. The poison is in the seed and leaves.

Symptoms – latent period between ingestion of castor bean and onset of responses varies from several hours in horses to 2-3 days in other animals. When taken in large quantity general weakness and collapse results. In horses, it causes profuse swelling and watery diarrhea. Among pigs it causes vomiting, diarrhea, weakness, lack of coordination and sign of abdominal pains.

In cattle, diarrhea is bloody while in poultry, dullness, drooping of wings, ruffled feathers, wattle and combs grayish in color.

*Indigofera spicata*

A prostrate spreading herb. A cultivated fodder legume though poisonous to livestock. The seeds when taken by poultry causes reduction in growth rate. The herbage causes bloat in cattle. Especially when grazed in the early or late part of the day when there is dew. The animal loses appetite, delayed obstruct and sometimes abortion.

*Lasiosiphon kraussianus*

Plant is irritant to the mouth and often grow under highly palatable herbs resulting in a camouflage. It is very difficult to make animals eat it whether fresh, dried, ground or mixed with other feeds. Because of its extensive root system, the plant remains green and produces flower during the dry season. Its tempting to livestock just after the first rain when it become quite lush before the grass starts growing. The plant is said to be most toxic at this period. When consumed (100 g or less) causes collapse and death in cattle and horses, goats and sheep. The toxic principle may involve a cyanide.

Symptoms: hemorrhagic gastro-enteritis, no cure of toxicity is known, eradication of plant in pasture can only control it.

*Erythrophleum africanum*

Important and in connection with nomadism. During cattle movement in search of food, poisonous plants that are unrecognized by the herdsmen may be distributed along cattle route especially on the way to the south.

The leaves contain an alkaloid which acts similarly to Digitalis, a drug that's administer in the treatment of heart failure. If consumed in toxic amount, both the alkaloid and digitalis cause irregular heart beats. The heart fibrillate and can no longer pump blood causing the animal to die suddenly. There is no cure other than to eradicate the plant.

*Tribulis terrestris* ( Tsaidau)

A small creeping plant distributed around lake side, sea shores, open grassland or woodland where there had been overgrazing. It is also a weed on cultivated land and found on roadside. All the plant parts are palatable. Plant emerges with the first rain and completes its life cycle in a short period. It forms an important early season grazing stuff for livestock. The wilted leaves, stem and roots are the most dangerous. Goats are usually unaffected. When consumed it causes bloat in cattle and in sheep, death may occur if consumed in large quantity .

Symptoms : staggering and head held rigid. Animal later become paralyzed and die. The middle age animals are most susceptible to the symptoms.

## PASTURE RELATED DISEASES

1. Internal parasites
  2. Minor element deficiencies
  3. Bloat
- 
1. Internal parasites – mostly worms
    - a. General stomach and intestinal worms. *Haemonchus contortus* in sheep and cattle. Causes anemia and acute death. The infestation of the worms can be controlled through pasture rotation, strip grazing, creep grazing, use of anthelmintics to remove stomach, liver and lung worms.
    - b. Nematodirus worms – They produce resistant eggs with effective larva inside them. Control method: do not raise lambs on same field for 2 years consecutively. Chemical control through the use of Bephenium.
    - c. Liver fluke – mostly occurring at the end of the dry season. *Fasciola gigantica*, causing unthriftiness, anemic and hard faces and jaundice. Control:- drain the water source or apply  $\text{CuSO}_4$  in order to suppress activity of snails. Restrict fadama grazing and dose animals with  $\text{CCl}_4$  (carbon tetrachloride).
    - d. Lung worms. Causing parasitic bronchitis, they have effective larva in eggs. Pastures recently stocked with yearlings or treated with cattle manure are sources of infection for young calves. It can be controlled through vaccination.
  2. Minor Element Deficiencies
    - a. Cobalt. Component of Vit.  $\text{B}_{12}$  synthesis. Deficiency is due to absence in soil or inability of animal to absorb it. Symptoms include subnormal milk yield, low weight gains, low feed utilization and abortion. Treatment involve drenching animal with soluble cobalt salt (sulphate or chloride) in licks or as bullets into the animals mouth – into the reticulum. The pasture could also be fertilized with soluble cobalt salt.

- b. Copper – low content in herbage may be due to zinc or higher content of molybdenum if pH of the soil is high. Excess of Mo obstructs Cu assimilation by animals.

Symptoms: failure of cow and calf to thrive, rough and dull coats and grey hair around the eyes. When you feed 3 – 4 months calf on Cu deficient herbage, the gait of the animal is tilted in lambs and it causes progressive paralysis. Control involves application of  $\text{CuSO}_4$  e.g thro drenching in mineral licks or by injection.

- c. Iodine: obtainable either from herbage, from the soil or from water.

Apply in form of licks or pellets.

- d. Selenium: apply 15gm of Se to cure Vit. E deficiency. Symptoms: abnormal changes in the muscle and reduced weight.