

Sustainable Agricultural Livelihood Restoration, Rehabilitation and Resilience in Kenya Training Manual

2.5.1 SUB-MODULE 1: RANGE RESEEDING AND PASTURE SEED PRODUCTION

Range reseeding is the introduction of grass, legume or other selected seeds to replenish depleted soil seed banks while providing forage for livestock. With changing land uses, reduction in grazing areas, frequent droughts and overgrazing, opportunities for self-seeding of the natural vegetation are reduced. This leads to the depletion of the soil seed banks in the land. Reseeding with appropriate species, particularly perennial and self-sustaining species has been promoted as an option for range rehabilitation with different goals. Some of these include to increase plant diversity, improved forage quantity or quality for livestock, tall grass for structural diversity, plants producing large or abundant seed for wildlife, native legumes and forbs and deep-rooting species for soil stabilisation in disturbed areas. Various successes have been reported especially where native species have been used.

A decision to reseed depends heavily on individual judgement. For areas where more than 10% of vegetation is native, natural succession alone can suffice. Understanding the causes of the degradation in an area guides on decision making on reseeding or approach to use for rehabilitation. Reseeding alone may not be adequate, Degraded lands may never return to their historical state because of soil loss and/or other conditions.

Steps to successful reseeding and pasture seed production

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- Understanding the site
- Consider the weather/climate and site conditions
- Weather conditions include rainfall amount and distribution per annum and temperature ranges
- Site conditions include soil condition, drainage and salinity, the slope (affect land preparation e.g. need for terracing), factors which affect establishment
- It is important for species selection-each species has different tolerance limits for the above characteristics including soil types and soil moisture among others

Species selection

Perennials (plants that live for more than two years) are preferred to short lived annuals in range restoration where conditions allow. Some factors to be considered during species selection for range rehabilitation

- Adaptation to local soil and climatic conditions such as drought tolerance/moisture tolerance
- Species' compatibility; - e.g. complementarity with available vegetation, shade tolerance in relatively wooded/bushy areas or silvo-pastoral system
- Intended utilisation method of the restored area e.g. grazing or machine (hay) harvesting, seed production, soil conservation etc
- Potential higher biomass yield, high seed production, species persistence and tolerance to grazing for sustainable use
- Community preference with regards to utilisation type
- Species mixtures are preferable to a single species because each species has different strengths and weaknesses and a combination of species has much greater biological resilience to grazing, fire, insects, drought, prolonged cold, excess moisture, etc., than a monoculture. Legumes can also be incorporated in grass mixtures

Examples of grasses and legume species in Kenya include

For rain-fed reseeding: Foxtail grass (*Cenchrus ciliaris*), Bushrye (*Enteropogon macrostachyus*), Maasai lovegrass (*Eragrostis superba*), Horsetail grass (*Chloris roxburghiana*), Guinea grass (*Panicum*

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maximum), Red oats (*Themeda triandra*), (*Bothriochloa insculpta*), Finger grass (*Digitaria species*), Coloured guinea grass (*Panicum coloratum*) amongst others.



Cenchrus ciliaris (left) and *Eragrostis superba* (right)

For irrigated reseeded and pasture establishment: Sudan grass, Brachiaria varieties, *Chloris gayana* varieties (Boma Rhodes),

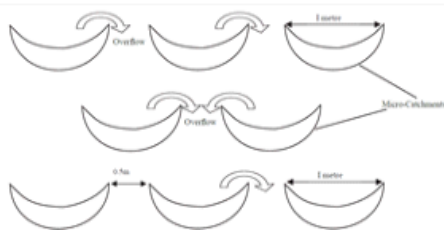
For Range restoration (Legumes and Woody species)

- Herbaceous legume species eg. *Indigofera cliffordiana*, *I. spinosa*, *Neonotonia wightii* and *clitoria ternatea*.
- Woody legume species including *Tinospora caffra*, *Melia volkensii* and *Leucaena leucocephala*

Land preparation

Land preparation, involves the preparation of a site for establishment of appropriate vegetation. This helps in loosening the soil surface for ease of penetration of roots and prevents grass seed from being blown away by wind. It also enables better infiltration of rainwater by creating microsites for water hence enhances soil moisture availability and conservation. Land preparation also aids in removal of weeds to reduce plant competition and give the target plants a head start after planting. Steps of land preparation include:

- Removal of bush or other invasive species if present in the farm can be done mechanically or manually using handheld tools.
- During land preparation, plough using a tractor or ox-plough then harrow the land. Sometimes the level of preparation depends on the target planting method e.g. ox-ploughing commonly used in planting in furrows; over sowing requires minimal tillage if any e.g. ox-ploughing, harrowing or manual digging.
- Hand tools like hoes can be used for small-scale structures like micro catchments and range pits
- Other examples of land preparation involve construction of water harvesting structures such as Kiboko range pits (half-moons), zai pits, tied ridges, etc) and planting vegetation along the structures. Use of water harvesting structures does not require ploughing.



Range pits for water harvesting at Kiboko (Photo J. Ayemba)

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Site description information is necessary during land preparation. This includes information about the slope, terrain or erosion potential which inform what the ploughing method and erosion control measures e.g. terracing, leaving unploughed strips to break water flow, among others.

Planting

Proper timing of the seasons during planting is important for successful establishment. Normally it is advisable to plant just before the rains for rain fed reseedling. Seeding should take place when the soil contains enough moisture for seeds to germinate and plants to become established. Two methods of planting are commonly used for fodder and forages. These include:

Drilling into furrows/direct seeding. There are recommended depths for different species depending on the seed size and soil texture that are important in determining sowing depth - the smaller seed and the heavier the soil, the shallower the planting depth. Generally, planting depths range from 0-2 cm for grasses. While there are some large-seeded forage species with 5,000-50,000 seeds/kg, most forages have small to minute seeds (100,000 to >10 million seeds/kg). Thus, seeds should not be buried deeply since initial vigour is not sufficient to push through a heavy cap of soil.

Broadcasting: Seeds are spread in the field while considering the direction of the wind for even distribution. It should be considered that about 50% of plants fail to germinate hence the need to double the seed rate.

Other planting methods includes include:

- Over sowing (reseedling into natural existing grassland and commonly non-ploughable area)
- Under sowing (establishment of a pasture under a cover crop).
- Planting using vegetative material/splits (common for species without seeds) – transplanting from one area to another.
- Use of animal/grazing management to seed the area (e.g holistic management). In this case, animals ingest grass seeds and deposit in other areas in the form of dung containing viable seeds.

Consider the recommended seed rate per species/variety. Commonly 5kg/ha for range grasses and is adjusted for percent viability. Other grasses and species have recommended rates and spacing

Weed management

It is natural for weeds to germinate together with planted grasses and legumes hence the need for weed management. This is recommended for good crop establishment. Different types of weeds affect pastures including annual and perennial weeds. Eventually, these affect established pastures necessitating management interventions. There are different methods of weed control and management in rehabilitated lands.

Methods of weed control include:

- Chemical control (pre-planting, pre-emergence and post-emergence chemicals available in recommended stockists and agrovet)
- Manual weed control using hand tools by digging out unwanted plants
- Crop rotations and crop competition – utilization of different crops on same farm
- Biological control – use of biological control agents i.e. the natural enemies of the target crop.

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- Use of fire (good for large scale grazing areas and for control of bush encroachment in grazing lands).
- Integrated approaches - combination of two or more of these methods.

Soil fertility management

Fertiliser or manure use during planting is to correct nutrient deficiencies and enhance crop production. Phosphate based fertilisers or farmyard manure is used at planting to promote strong root development. The recommended fertiliser and manure rates are dependent on the crop and soil conditions and mostly after a soil nutrient test.

Top dressing is recommended during plant growth, particularly in the subsequent seasons after the establishment period. Nitrogen is one of the most important nutrients for grass seed and biomass production. However, consider the age of the crop, time of the year and climatic conditions at the time of fertilizer N application.

Manure being readily available in the dryland regions is normally highly recommended because it does less harm to the environment.

Management and utilisation of rehabilitated lands

- Once rehabilitated, the area could be used by direct grazing or by harvesting the forages for utilisation outside the area. Controlled grazing is practised where animals are grazed.
- Consider principles of grazing management including proper timing of grazing and rest intervals to allow for plant regrowth between grazing events and prevent overgrazing.
- If the plants can be pulled out easily by hand, then it is recommended not to graze but to give it an extra season of establishment.
- Grazing frequency and intensity - how frequent and much forage stubble or leaf area is left on the plant at the end of the grazing activity should be taken into account.
- Shorter grazing periods ensure controlled grazing intensity with higher benefits both to the animals and the plants. Longer grazing results in grazing on new plant re-growth and reduced harvesting efficiency by the animal hence lower animal performance.
- Adjust stocking rate (How much is utilised) to match with the carrying capacity (the amount of feed available).
- Monitoring of the pastures: The principle of monitoring is important in ensuring other principles of grazing management are adhered to. Monitoring is done for regrowth, trends for species composition including checking for invasive species and other weeds.

Harvesting of seed for reseed

Once mature, seeds can be harvested and taken for storage and future reseed elsewhere. Key points in seed harvesting that needs consideration include

Timing: Timing to identify mature seed heads (the colour of seed heads varies with species). A golden-brown colour or appearance of the seed heads is the major indicator of the time when the seed is ready to harvest. Additionally, if seeds are easily dislodged from the plant, they are ready for harvesting. Harvesting should be done when most (over 60%) of the seed heads have attained this colour.

Timing is also important to avoid delays and loss of seed through shedding that is common especially with forage grasses and legumes.

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Seed weight, hardness and moisture content are other indicators of seed readiness for harvesting. Hardness is checked by pressing the seed with the fingers or between teeth.

Harvesting method. For grasses, there are **two main methods of harvesting** seed namely

- Stripping - Stripping involves removing only the seeds from the seed head or inflorescence
- Cutting with stalk - cutting with stalk involves cutting the seed head together with its stalk and the last leaf. This will ensure continued maturing of the seeds post-harvest.



Seed harvesting: Stripping method (left) and Cutting with stalk (right)

Pasture seed processing

Seed processing involves threshing, cleaning and sorting to remove foreign materials undesirable seed, drying, packaging and labelling. Additional steps like sorting/grading to improve quality of the seed and protecting the seed from damage by pests and fungal infections is done for the seed of some grass and legume species.

Threshing is the process of separating seeds from panicles and straw. It is done by beating with sticks to dislodge the florets/seeds, particularly for the seed harvested through cutting with stalk.



Threshing of grass seed

- Different types of seeds will dry at different rates depending on the prevailing weather conditions such as temperature, relative humidity and wind.
- Harvested seeds in the tropics usually have a high moisture content of up to 40-70%. Therefore, they must be dried to safe moisture levels (8-12%) to reduce physiological activity. Fungi easily

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damages both grass and legume seeds that have high moisture content.

- Sun drying or drying under a shade is recommended depending on initial seed moisture content. The seed should be turned regularly for proper aeration.

Packaging and storage

Packaging is important because it protects the seed from physical, climate and biological damage. Ensure seeds are well dried. Airtight containers are the best for long term storage. Examples of packaging and storage containers include:

- Tailor-made white woollen /cotton bags
- Woven or synthetic sacks
- Prefabricated aluminium tins/containers
- Brown paper bags
- High-density polythene paper bags
- Metallic containers and plastic containers

Once the above steps have been taken into account, the harvested seed and plant materials can be taken to other areas for restoration and expansion of other rehabilitated areas.