HOW TO PRODUCE GOOD QUALITY RANGE GRASS SEED

MANUAL

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# Table of Content

1. Introduction  
2. Production systems  
3. Principles of range pasture seed production  
   3.1 Site selection  
   3.2 Forage species selection  
   3.3 Land Preparation  
      3.3.1 Importance of land Preparation  
      3.3.2 Resources required  
      3.3.3 How to prepare the land  
      3.3.4 Planting  
   3.4 Pasture management  
      3.4.1 Weed management  
      3.4.2 Fertilizer management  
   3.5 Forage seed harvesting  
      3.5.1 Timing of seed harvesting  
      3.5.2 Seed harvesting methods  
   3.6 Forage seed processing  
      3.6.1 Seed drying  
      3.6.2 Cleaning  
      3.6.3 Protection  
      3.6.4 Seed storage  
   3.7 Seed quality  

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction</td>
<td>1</td>
</tr>
<tr>
<td>2. Production systems</td>
<td>2</td>
</tr>
<tr>
<td>3. Principles of range pasture seed production</td>
<td>3</td>
</tr>
<tr>
<td>3.1 Site selection</td>
<td>3</td>
</tr>
<tr>
<td>3.2 Forage species selection</td>
<td>3</td>
</tr>
<tr>
<td>3.3 Land Preparation</td>
<td>4</td>
</tr>
<tr>
<td>3.3.1 Importance of land Preparation</td>
<td>4</td>
</tr>
<tr>
<td>3.3.2 Resources required</td>
<td>4</td>
</tr>
<tr>
<td>3.3.3 How to prepare the land</td>
<td>4</td>
</tr>
<tr>
<td>3.3.4 Planting</td>
<td>4</td>
</tr>
<tr>
<td>3.4 Pasture management</td>
<td>5</td>
</tr>
<tr>
<td>3.4.1 Weed management</td>
<td>5</td>
</tr>
<tr>
<td>3.4.2 Fertilizer management</td>
<td>5</td>
</tr>
<tr>
<td>3.5 Forage seed harvesting</td>
<td>5</td>
</tr>
<tr>
<td>3.5.1 Timing of seed harvesting</td>
<td>6</td>
</tr>
<tr>
<td>3.5.2 Seed harvesting methods</td>
<td>6</td>
</tr>
<tr>
<td>3.6 Forage seed processing</td>
<td>7</td>
</tr>
<tr>
<td>3.6.1 Seed drying</td>
<td>7</td>
</tr>
<tr>
<td>3.6.2 Cleaning</td>
<td>8</td>
</tr>
<tr>
<td>3.6.3 Protection</td>
<td>8</td>
</tr>
<tr>
<td>3.6.4 Seed storage</td>
<td>9</td>
</tr>
<tr>
<td>3.7 Seed quality</td>
<td>10</td>
</tr>
<tr>
<td>Figure 1: Ox-plough furrows</td>
<td>4</td>
</tr>
<tr>
<td>Figure 2: Micro-catchments (Kiboko Range Pits)</td>
<td>5</td>
</tr>
<tr>
<td>Figure 3: Harvesting pasture seeds through (a) cutting with stalks and (b) stripping</td>
<td>6</td>
</tr>
<tr>
<td>Figure 4: A group of farmers harvesting Eragrostis superba seeds</td>
<td>6</td>
</tr>
<tr>
<td>Figure 5: Seed threshing</td>
<td>7</td>
</tr>
<tr>
<td>Figure 6: Seeds drying on a polythene surface</td>
<td>8</td>
</tr>
<tr>
<td>Figure 7: Cleaning of grass seeds to remove impurities</td>
<td>8</td>
</tr>
<tr>
<td>Figure 8: Metal containers with tightly fitting lids</td>
<td>9</td>
</tr>
<tr>
<td>Figure 9: A traditional seed store commonly made from locally available materials</td>
<td>9</td>
</tr>
<tr>
<td>Figure 10: Pasture seeds stored in raised shelves in a well ventilated store at KALRO Kiboko</td>
<td>10</td>
</tr>
<tr>
<td>Figure 11: Seeds arranged in petri dishes</td>
<td>10</td>
</tr>
</tbody>
</table>
Livestock productivity in extensive and semi-intensive production systems is limited by two major constraints, namely feed shortages and poor quality of the little available feed. Although sowing a new pasture or improving an existing natural pasture are viable options to alleviate the feed constraints, this requires a reliable source of seeds of appropriate species. Appropriateness refers to farmers’ needs for livestock production which are usually influenced by:

1. The environment (rainfall, soil type, terrain)
2. Type and class of the grazing animal (cattle (steers, cows, calves), sheep, goats)
3. The animal product (meat, milk, coat)
4. Other potential and desired uses for the forage species are construction (thatching), erosion management, lawn, seed production among others.
5. Forms of forage use (*in situ* grazing, cut and carry, silage, hay)
There are various social, economic and environmental situations associated with extensive livestock production. This makes it difficult to identify seed bulking strategies for extensive livestock production system. It is all the more difficult because forage seed production is not a well developed enterprise with associated standards of quality. Therefore, commercial large-scale forage seed production is negligible and for a number of species, it is non-existent.

However, going by experiences elsewhere in the world, two major seed production systems are recognized - opportunistic and specialized. The two systems could be either mechanized or labour intensive.

The opportunistic labour intensive system is found where seed is harvested by hand from existing stands, mostly natural ones. Specialized system is the other extreme whereby plantations are established for the express purpose of forage seed production and the process is mechanized. In between the two systems are different possibilities. One example in the opportunistic-mechanized system is the practice by large-scale livestock producers, who can use rested paddocks to harvest seed for sale.
It is necessary to understand the different factors involved in seed multiplication. These factors include but are not limited to production systems, site selection, species selection, seed harvesting, seed processing and seed quality testing.

3.1 Site selection

Variation among forage species is so large that it is not easy to prescribe criteria for establishment and management that would apply to all of them. Species adaptation to a particular area, however, must be an overriding consideration. It is essential to match a forage species to the target site to obtain good seed production. Major site characteristics that affect forage species selection are:

1. Rainfall, a range of 600-1500 mm annually is suitable for grasses but legumes require a minimum of 800mm.
2. A frost-free situation is best for most tropical forage species.
3. The soils should:
   a. Be well drained
   b. Be fertile (any mineral deficiency should be corrected, especially nitrogen and phosphorus)
   c. Have good moisture holding capacity

Where soils are saline or have capped surfaces, seed establishment is rather difficult. In addition, choice of site on steep slopes is not advisable. Under such circumstances, terracing should be used to provide a flat bed.

3.2 Forage species selection

Forage species differ in how long they can persist in an area once they have been established. The controlling factor is their natural life cycles which fall under four categories: annuals, biennials, short-lived perennials and perennials.

Annual plants die after seeds are produced. The biennials, as the name suggests, live for two seasons. Short-lived perennials live for 3-5 years and can regenerate vegetatively. Perennials survive for 5-20 years or even longer through maintenance of the original plant. However, for all the categories, there must be a favourable environment.

For the Arid and Semi-Arid Lands (ASALs) good grass species must have the following characteristics:
- Tolerance to heavy grazing
- Resistance to drought
- High palatability
- High biomass production
- High seed production
- Ease of seed harvesting

Examples of the most common species used for reseeding and forage seed production in the ASALs include:-
- Maasai love grass (*Eragrostis superba*)
- Foxtail grass (*Chloris roxburghiana*)
- African foxtail grass (*Cenchrus ciliaris*)
- Bush rye (*Enteropogon macrostachyus*)
3.3 Land Preparation

The timing of land preparation is an important key to the success or failure of pasture establishment. Land preparation should be done just before the onset of rains. This is done at the beginning of October or before the start of the short rains which are more reliable in the case with the Southern rangelands of Kenya. Preparation should be completed by mid-October in readiness for sowing. For areas where the long rains are more reliable preparation of the land should start in late February and end by mid March.

3.3.1 Importance of land Preparation

- Loosens the soil surface
- Reduces the rate of runoff hence controls soil erosion
- Enables better infiltration of rain water into the soil
- Eases the penetration of roots of the crop into the soil
- Prevents grass seed from being blown away by wind
- Removes all weeds to give the target crop a head start after planting

3.3.2 Resources required

These include finance, machinery/equipment i.e. tractor, ox plough, jembes, pangas, axes and labour

3.3.3 How to prepare the land

- Clear bush or other invasive species if present in the farm
- For faster land preparation, use a tractor. First, plough the land then follow-up with harrowing
- An ox-plough can also be used to make the furrows (Figure 1)
- Hand tools like jembes may also be used for small scale grass seed production to make micro catchments (Figure 2)
- These will be important in reducing runoff and aid in faster establishment due to water retention in the pits.

Seed is placed on the soil heap which is firmed to prevent it being washed away when the pits are full of water. To prevent water loss, have an overflow that goes into the next pit as shown in Figure 2.

**Figure 1: Ox-plough furrows**

3.3.4 Planting

- Grass seeds are very small and should be covered with a thin layer of soil or none.
- A seed rate equivalent to 5 kg/ha is used but can be adjusted depending on seed viability (% germination)
- There are two main planting methods:
  - **Broadcasting:** The seeds are spread in the field while considering the direction of the wind for even distribution.
  - **Furrow planting:** The seeds are hand drilled into furrows of about 2 cm depth or ox plough furrows.
3.4 Pasture management

3.4.1. Weed management

Mechanical, biological and chemical methods of weed control can be used. Chemical control is the most common method. Time of chemical control can be either pre-plant, pre-emergence or post-emergence. Pre-plant refers to applications made before the crop is planted while pre-emergence treatments are made after the crop is planted but before it emerges. Pre-emergence applications are usually applied to the soil surface and require rainfall or irrigation to move the herbicide into the soil. Post-emergence treatments are applied following emergence of the crop and/or weeds. Chemical application may involve broadcast, band, directed, or spot application. Broadcast applications cover the entire area while band applications usually refer to treating a narrow strip directly over the row. Directed applications are applied to a particular area or part of the plant.

Other than chemical control, other ways of weed management include weeding with hand hoes or other implements around the grasses or pulling weeds manually especially before they are able to set seed.

3.4.2. Fertilizer management

During planting, it is important to use a phosphate based fertilizer to enhance rooting of the plants. Use of 50-100 kg/ha of Diammonium phosphate (DAP) or of Triple Superphosphate (TSSP) fertilizer. If farmyard manure is used, 5 - 10 tons/ha should be broadcasted and possibly harrowed before planting. For optimum production, top dressing with inorganic fertilizer or farmyard manure is necessary particularly after harvesting. Top dress with 50-100 kg/ha N during the rainy season or use of 5-10 tons/ha of manure if necessary. This may not be necessary during the establishment year.

3.5 Forage seed harvesting

Yields of pasture seeds depend on:

a) Weather conditions
b) Species or cultivars involved
c) Correct timing
d) Harvesting method
e) Management objectives
3.5.1. Timing of seed harvesting

Timing is crucial in achieving high quantity and quality of forage seed. Fortunately, there is one important indicator that can be used – the colour / appearance of the seed heads. For nearly all forage species, there is a characteristic colour that seed heads attain at maturity, which is golden brown. Harvesting should be done when most (over 60%) of the seed heads have attained this colour. Late harvesting may lead to wastage of seeds because they are continuously shed.

Other indicators of seed readiness for harvesting are seed weight, seed hardness and seed moisture content. Hardness can easily be checked by pressing the seed with the fingers or between teeth.

Further, harvesting for grasses should begin when florets can easily be dislodged by striking from the base to the apex of the seed head. The dislodged florets should be rubbed between the palms of the hands to check for presence of seeds.

Weather conditions dictate the harvesting time, since dry conditions are a pre-requisite. Harvesting wet seed during the rains or with a lot of dew may result in mould and rotting.

3.5.2. Seed harvesting methods

Harvesting in smallholder forage seed production systems can be achieved manually using hands with or without such tools as knives and sickles. The approaches to use are:

1. Harvest the entire plant above ground.
2. Harvest only the seed head and its stalk plus the last leaf (Figure 3a).
3. Stripping only the seeds from the seed head (Figure 3b).

Advantages of manual forage seed harvesting:

- The tools used are simple, cheap, easy to maintain and are familiar to most farmers.
- Allows selective harvesting thereby achieving high quality seed.
- Since it is labour intensive, it is a source of employment.

Figure 3: Harvesting pasture seeds through (a) cutting with stalks and (b) stripping

Figure 4: A group of farmers harvesting Eragrostis superba seeds
When entire plants are harvested, they should be stalked for two weeks in the field after binding the seed heads. This allows the seeds time to mature and thus attain a higher quality and free the land for subsequent activities. Heads may be threshed by beating with sticks to dislodge the florets/seeds. Threshing is the process of separating seeds from panicles and straw.

Alternatively, the cut material can be sweated. Sweating is a process of wrapping bundles of seed heads in a gunny bag especially those harvested through stalk cutting and entire plant harvesting. Sweating should be done for seeds of the same species to avoid seed mixing. The bundle is left under shade (a tree shade works fine if there is no threat of rain) for a couple of days. When it is opened, florets/seeds dislodges easily with minimal beating. Sweating has several advantages:

1. A high seed recovery, implying high seed yield.
2. Seed of high quality because maturation can be completed in the moist condition inside the stack
3. Only light threshing is necessary because florets/seeds detach easily.
4. Seeds recovered from sweating tend to store well.

### 3.6 Forage seed processing

Seed cleaning should be done because they may contain inert material, weed seed and seeds of other varieties. Occasionaly, seed may have diseases or get damaged in the process of harvesting. Also, at harvest time, most seed have a high moisture content, which leads to spoilage while in the store.

When seed with any or several of these problems is offered for sale, it will fetch a low price or be rejected. If it is planted, germination will be low, seedlings will be weak and overall establishment will be poor. Therefore, processing is absolutely necessary after harvesting to improve the quality of seed.

Seed processing is thus an important step in seed production that ensures quality seed. Proper procedure of seed processing involves:

a) Threshing  
b) Cleaning to remove foreign materials  
c) Removal of undesirable seed  
d) Drying  
e) Cleaning to improve quality of the seed  
f) Protecting the seed from damage by pests and fungal infections  
g) Bagging and packaging  
h) Labeling

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**Figure 5: Seed threshing**

### 3.6.1 Seed drying

Harvested seed in the tropics usually has 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 damages both grass and legume seed that have high moisture content.

The speed of drying seed depends on the moisture level in the surrounding air (relative humidity), temperature and the speed at which moisture moves from the centre of the seed to surface. That means different types of seeds will dry at different rates depending on the prevailing weather conditions. However, spreading the seed in a thin even layer on mats or tarpaulin sheets, that do not allow ground moisture to reach the seed under shade for 3-5 days (depending on the initial seed moisture content) is adequate (Figure 6). The seed should be turned regularly for proper aeration.

3.6.2. Cleaning

Generally, freshly harvested seed is likely to have many kinds of foreign materials. They range from leaves to insects and stones depending on methods of harvesting and threshing used. Weed seed may also be carried with the desirable seed especially if weeding was not done properly or the source of the seed is wild stands as is frequently the case with range forages. Because seed differ in colour, shape, size and density it is possible to identify and remove the unwanted material from seed.

In range improvement, it is recommended that not one but a mixture of forage species be sown together. However, it is desirable that each seed species is harvested, processed and stored separately. Mixtures should then be made from the pure seed lots when needed. Seed of a desirable species may be present in another lot but it may not have been harvested at the right stage and thus be of inferior quality. Further, maintaining pure seed lot is advantageous when selling to allow the buyers to choose what they need.

Much of the cleaning can be accomplished without machinery. Hand pick impurities from seed spread on canvass or tarpaulin sheets in a wind protected area. For larger seed like Siratro and Glycine, winnowing is possible, similar to what is done with food crops like green gram. Thereafter, more dense matter such as stones, stems, and broken or shriveled and diseased seed must be removed.

3.6.3. Protection

Fungicides and insecticides can be applied to clean seed to stop disease and pest infestation. The chemicals are useful
in two ways:
- They kill germs both on and in the seed.
- Provide protection to emerging seedlings against soil borne disease and insects pests.

Most seed treatment chemicals are marketed in powder form and available in the rural Agro-Vet shops. These chemicals are both suitable for crops and forages. However, care should be taken in handling these chemicals by ensuring that the manufacturer’s instructions are strictly followed.

3.6.4. Seed storage

Post-harvest seed losses can occur even after all the necessary processing has been done. This is especially so where seed is stored for later use. Losses can be avoided or at least minimized if the correct storage conditions are observed and maintained. Three major threats should be addressed in a store:

1. High temperature
2. High humidity
3. Pests (insects and rodents) and fungal growth (moulds)

Seeds, especially for grasses tend to absorb moisture from the surrounding air. Due to a strong seed coat, which is impermeable to water, legume seed can survive longer in a given set of relative humidity than grass seed.

In order to store grass seed for long in good condition, they should be dried to 8-12 % moisture content and then packed in non-porous containers such as aluminum tin with a tight-fitting lid (Figure 8). Polyvinyl chloride (PVC) or high-density polyethylene paper bags can also be used. Basic storage containers such as nylon sacks can be used to store seeds for shorter periods.

Cold storage is the best for long-term seed storage. Otherwise a cool, dry and well-ventilated store is ideal for seed storage. At farm level, the traditional grain store constructed on stilts with woven cane walls and grass-thatched roof (Figure 9) is also satisfactory for up to 3 years under the Kiboko environment.
3.7 Seed quality

During storage, regular checks should be made to ensure that pests and mould do not infest seed. In addition, it is advisable to regularly test seed samples for viability. Further, moisture content of seed has to be monitored. The latter is checked by heating a known weight of seed to constant weight in an oven set at 60°C. The loss in weight is the amount of seed moisture that can then be converted into a percentage, thus:

\[
\text{% Soil moisture} = \frac{\text{Initial seed weight minus dry weight}}{\text{Initial seed weight}} \times 100
\]

This procedure can be carried out by the Kenya Plant Health Inspectorate Service (KEPHIS) laboratories and KALRO Centres countrywide. Many secondary schools with a laboratory usually have an oven and can be requested to do this test. It is advisable that viability tests of stored seeds be done regularly preferably every 6 months. Naked seed (caryopses) can be extracted from grass florets using an appropriate grade of sand paper and placed in a petri dish lined with moist filter paper. Wetting is done using water by a hand sprayer pump that delivers a fine spray so as not to disturb the seeds from their lodged positions.

Observations of number of seed germinating is done daily for 14 days. A percent is then calculated of the total germination out of the number of seed tested.

However, this method does not indicate what proportion of the seed will emerge under field conditions. This is because some seeds may be hard (do not absorb water readily) to germinate but still viable. Some seeds may also germinate but result in abnormal seedlings.
Seed hardness may be overcome by:

1. Pre-soaking
2. Rubbing with abrasives like sand or sand paper
3. Heat treatments
   - Sun drying for 2-3 days before planting.
   - Heating in pre-boiled water (for legume seeds)

KEPHIS has a mandate to undertake inspection, testing, certification, quarantine control, variety testing and description of seeds and planting materials according to specified guidelines for commercial seed production.
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