

Theme 2: Pasture and Rangeland Management

SEED BULKING



A publication sponsored by the ICSIAPL project



Learning objectives

- What is seed bulking?
- Identify factors to consider and steps for successful quality seed production.
- Methods of seed harvesting.
- How to harvest seeds?
- Identify best post harvest management practices to secure reliable storage of quality seeds.

What is seed bulking?

Seed bulking is also known as seed multiplication.

It involves collecting seeds from a target (wild) population of plants and growing these seeds in a controlled "nursery" setting.

Seed bulking is one of the ways that farmers, seed companies and other stakeholders use to conserve rare plant populations and also produce and keep seeds for future use.

Seed bulking is a model to improve and increase the amount of good quality seeds for farming communities.



Photo credits: <https://www.oecd-ilibrary.org/sites/68bcd659-en/index.html?itemId=/content/component/68bcd659-en>

Women cleaning and selecting seeds for storage



Photo credits:
Mercy Cheptoo

Objectives of bulking seeds

- Provide clean true seeds (or vegetatively propagated seed).
- Develop capacity among farmers to improve seed production.
- Promotes the production of improved quality seed varieties as well as enabling maintenance of these seed varieties by farmers, research institutes, commercial seed producers and other stakeholders.
- Increases the availability and affordability of improved seed varieties (of forage crops) for the farming community.
- Helps to increase and improve forage crop production through selection of good quality forage seed varieties from seed producers.

Benefits of bulking farmer retained seeds

Enables farmers to retain and store seeds of good quality produced from his/her own farm for use during the next planting season.

If planting a dual purpose crop one can benefit when harvesting the grain or pulses for household use first and using the crop residue as an animal feed. For example: millet, sorghum, beans, pea etc.

Reduces cost of buying seeds for next planting season.

Source of income for household or community undertaking seed bulking for purposes of sharing and exchange with other farmers.

Reduces the gap between demand and supply.



Photo credits:
Mercy Cheptoo



Factors to consider for a successful seed bulking program

Importance of the forage crop and the different varieties within the crop is to ensure feed security.

Social and economic factors related to the community and locality of the seed bulking activities.

Farmers ability (financial, labour, knowledge etc.) to manage seed bulking activities.

Know the policy guidelines on seed bulking.

Technical factors to consider for a successful seed bulking program

Demand and preference of the forage crop varieties.

Technical knowledge of seed producer (farmer, farm advisors, extension staff etc.)

Suitable weather condition during the period of seed bulking, harvesting and drying.

Availability of irrigation for supplementation especially during the dry period for best yield. This is especially important in arid and semi arid (ASAL) regions.

Farmer mixing DAP fertilizer with seeds before planting



Photo credits: Mercy Cheptoo



Photo credits:

<https://www.standardmedia.co.ke/article/2001303035/mobile-phones-help-detect-counterfeit-seeds-in-kenya>

Weeding



Tips for producing good quality seeds

Use good quality seed of varieties that are adapted to the region.

Follow best agronomic practices and implement them at the right time for best results. (For example; take soil samples for soil testing, apply fertilizer to correct soil fertility if needed, plant at the right time, weeding, disease & pest control).

Use the right equipment for land, seedbed preparation and planting.

Organize to irrigate crops to supply water during drought periods to avoid plant stress that interferes with yield.

Plan ahead for harvesting, drying, handling, transportation and storage.

For more guideline check module 1.35 on planting guide for fodder crops



Chisel plough



Characteristics of good quality seeds

Physical quality of the seeds in the field.

Physiological qualities.

Genetic quality of the seeds.

Seed health.

Image of buffel grass '*Cenchrus ciliaris*' seed



Photo credits: <http://www.iucngisd.org/gisd/speciesname/Cenchrus+ciliaris>

Physical quality of seeds

Farmers need to observe physical characteristics of seeds by observing and touching the seeds to confirm if these are of good quality. Farmers can do this by checking:

- Size of the seeds – (check the length and width of seeds).
- Weight of seeds – (light seeds are considered to be attacked by pests and tend not to be able to germinate).
- Shape of seeds – (compare shape with how it should normally be).



mould on rotten seed



- Surface texture of the seed coat – (For example; is it cracked, wrinkled or smooth as compared to the normal texture).
- Colour of seeds – (For example; is it the seed discolored?)
- Moisture content – (Feel or test if the moisture content of the seed is above the recommended levels).
- Smell the seed – (If the smell is mouldy the moisture content is too high, the moisture content is above recommended levels).
- Based on quality declared seed standards (QDS) of FAO, good quality cereal seeds have less than 13-15% moisture content and pulses have less than 10% moisture after drying.

Physiological quality of seeds

Physiological characteristics looks at how the seeds perform in the field.

This refers to how the seeds perform when sown. This is established by looking at two factors being; germination rate and plant vigour.

Note that a good germination percentage does not necessarily mean good plant vigour.

Germination percentage can be tested by counting the seeds sown versus the seeds that eventually germinate.

Plant vigour looks at the annual production of vegetative biomass of the forage crop, this is commonly calculated on a yield (tons or Kgs per acre/hectare) basis.



Seed germination percentage tests

Seed germination percentage using the water bowl test

Using a bowl filled of water place seeds into the bowl and wait for about 15 minutes and check how seeds behave.

This method uses seed weight and density to determine viability of seeds by observing seeds that sink to the bottom and ones that float on top of the water.

Floating seeds are unfit for planting since they are too light or infested by weevils and will probably not sprout.

Germination percentage calculation using the sowing test

Cenchrus ciliaris "African foxtail"

$$\% \text{ germination} = \frac{\text{Number of seeds germinated}}{\text{Number of seeds sown}}$$



Photo credits: Cookswell jikos and seedballs Kenya

Plant vigour calculation

Steps for calculating crop yield

Select a representative area of the forage/pasture land and using a measuring tape or meter square rod measure a meter square.

Count the number of plants within a meter square and record this, repeat this process 5 times in different spots in the field and average this to "A".

Count the number or heads, pods, cobs per plant within the same meter square and record this. Average this to "B"

Count the total number of seeds/kernels per head (or per pod or cob) in at least 20 heads and average this to your previous count "C".

Determine the seed/kernel weight for the crop concerned "D".

Calculate estimated crop yield as below show;

$$\text{Crop yield (Tons or kg per acre)} = A \times B \times C \times D$$



Photo credits:

<https://farmerstrend.co.ke/trending/how-to-get-optimum-maize-production-in-challenging-times/>

Genetic quality of seeds

Farmers should check the genetic characteristics of the forage seed variety and whether it matches with agroecological conditions of the region.

The forage seed variety selected needs to be suitable for the region for best results when grown as a forage crop.

For example; Does the seed have the genetic potential to tolerate or resist particular pests and diseases.

Another example is if the seed has a hard seed coat which would help preserve the seed quality.

Despite enhancement of seed genetics maintenance, seed quality remains an important activity.



Photo credits:

<https://www.facebook.com/kseed/posts/pokot-rhodes-is-a-very-popular-type-of-pasture-grown-in-medium-altitude-areasver/1428527144014993/>



Seed health

Seed purity: how pure are the seeds? (is there any contamination with, for example other seeds, soil, dust, pests and diseases in a seed lot).

Presence of mould on stored seeds is also a sign of impure seeds. This is sometimes not visible but smelling the seeds and touching them can help determine whether they are still in good condition.

Pest and disease infestation affect the health of the seed. This reduces the usage of the seeds for planting, because they will not germinate or pass the disease to the new crop when it is germinated.

Insect attack during storage



Identifying seed harvesting stage

Regularly check seed heads to identify whether seed heads are ready for harvesting.

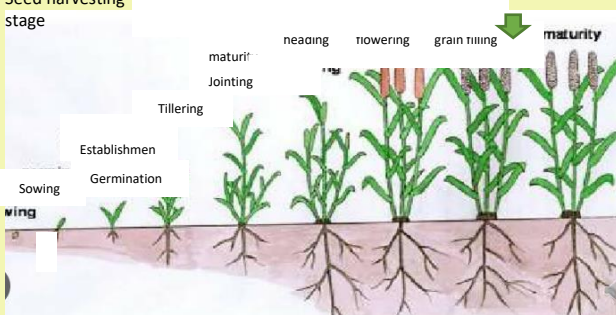
Harvest when the plants are at seeding stage, this is after seed (grain, pulses) filling, the plant is now mature and starts to become brownish.

For forage crops with large seeds such as; cereal crops, you can test the seeds by pressing between two fingernails or biting. When the teeth leaves a mark on the seed it not ready for harvesting.

The seeds should be hard to bite into and when split it is dry in the centre just like flour for example; maize or sorghum seeds.

For tropical grasses also the seeds need to be left to "ripen" when the first seeds start to drop the seed heads need to be harvested.

Seed harvesting stage



Growth and development of pearl millet

Tools and materials needed when harvesting seeds

1. Sickle
2. Gunny bag or sack or container
3. Canvas to put on the floor or a raised structure for drying, for example; a raised floor or roof



Methods of seed harvesting

Harvesting is done either manually or mechanically using these two common methods;

1. Cutting off the stalk

Desirable for crops that grow tall like sorghum & millet and when scale of harvesting is large this method is efficient.

Enables harvesting of the seed head and its stalk plus the last leaf

2. Stripping

Harvesting of only the seed head without the stalk.

Farmer cutting off stalks



Stripping of seeds from grasses

Steps of harvesting seeds by cutting the stalk

Cut off the entire stem containing the entire pod or spent flower head containing the seed.

Spent flower – refers to flowers that have finished flowering and are dying off.

Pick the seed head and stem and place it in a gunny bag or sack and continue with other plants until the bag is full.

Transfer the harvested stalks plus seed head and dry them under the sun on the ground to ensure the right moisture content is attained, ensure to cover the ground to avoid loss of seeds to the ground.

Either on the same or the next day separate the seeds from the stalks at the same time clean the seeds by removing any unnecessary contamination, for example; seeds of a different crop that were harvested in the process.

For easy separation of seeds from the stalks use sticks to lightly thresh the sacks of harvested seed heads so that seeds can drop to the bottom of the bag, this is known as threshing.

Since the seed heads are dried, the majority of seeds will be separated with the first beating.

Separate the remaining seeds from the stalk through picking and/or sieving.



Photo Credits: John Charles Aru



Photo credits:
<https://justdigg.it/org/what-we-do/landscape-restoration/grass-seed-banks/>

Collect the separated seeds and thresh lightly to further loosen chaff coating on the seeds.

Clean seeds by winnowing against the wind to remove chaff from seeds.

Sort and grade grains by sieving. Broken seeds and grains which are small compared to the average size will be graded separately.

Store in a dry gunny bag or sack.

Store in a cool, dark and dry place, even better store in an airtight sack, bag or container.



Farmer threshing her sorghum seeds for easy seed removal and cleaning

Photo credits: Mercy Cheptoo

Steps of seed harvesting by stripping

Strip harvesting is the act of pulling the stalk with slight effort run your hand upwards from the stem to the tip of a flower by squeezing the plant in one's hand/palms so as to pull out seeds into the palms.

Enables harvesting of the seed head only.

For effortless harvesting it is recommended that harvesting is done when some seeds starts to fall off from the seed head of the crop.

Dry the seeds harvested and sieve if necessary before storing the seeds in a gunny bag.

Advantage of harvesting by stripping seeds

Harvesting is done when seeds start to shed at the tip of the seed head.



Labour needed for stripping is not as intensive compared to cutting the stalk

Seeds recovered require less processing since some processes are done away with as compared to cutting the stalk.

Seed purity can be high if person stripping is able to identify the flowers and seed heads without mistake.



Common seed processing practices

1. Seed sweating
2. Drying
3. Threshing
4. Cleaning by winnowing
5. Grading and sorting seeds
6. Pest management
7. Bagging and packaging
8. Labelling



Photo credits: Marco Pautasso

Seed sweating

Sweating is a process of tying freshly cut seed heads in heaps especially for seeds harvested by cutting the seed head plus its stalk.

Heaped seed heads are stored for about three days under a shade before it is separated and dried.

Heaped seed heads should be of the same variety.

When seed head are later unwrapped the seed easily dislodges with minimal beating.

Advantage of seed sweating

Seeds are of higher quality because maturation is completed in the moist condition inside the sack.

Seed recovery is high since it is stored in sacks hence high seed production.

Light threshing is required to detach seeds.

Seeds recovered from sweating tend to store better.



Seed drying

Harvested seeds should be spread thinly under a shade.

When stalks and seeds are heaped in thick stacks heating up in the stack takes place.

Seeds should be turned on regular basis at least for 2-3 days to enable even and uniform drying of the seeds.

Turning seeds when drying also helps to aerate the seeds heaped on one another and prevents moulding and rotting.



Importance of drying seeds

It prevents germination until the time when it is induced (the moment the seed gets in touch with moisture in the warm soil).

Reduces moisture in seed to protect against pest and disease infestation.

Reduces damage of stored seeds due to pest and diseases.

Allows seeds to tolerate extreme temperatures.

Prolongs/increases shelf life of seeds for future use.



Farmer threshing her sorghum seeds for easy seed removal and cleaning

Photo credits: Mercy Cheptoo

Threshing

After drying take sticks and beat the seeds in the bag lightly.

Beat lightly to avoid damaging the seeds and later, you may use a sieve to separate the seeds from the seed head.

Repeat this for the remaining seed heads to ensure collection of all seeds.

Threshing makes it easy to separate the seeds from the stalk as well as loosening chaff from the seeds to enable easy seed cleaning.

Youths winnowing and picking seeds before packaging

Seed cleaning by winnowing and or picking

This refers to a separation techniques used to separate two things using the wind where the lighter particle is separated by blowing wind from the heavier particle.

This method is used to separate dried grains from chaff.

Pick out large and heavy materials that cannot be separated with wind like stones or other heavy seeds that are collected during harvesting.



Photo credits: Mercy Cheptoo

Grading and sorting seeds

Farmers should at least use 2 sieves places below each other.

The first sieve will hold seeds of a large size while the last sieve will allow anything smaller than the desired seed quality to pass through.

Using a sieve a farmer can also further clean the seeds.



Pest management techniques

Physical control - by manipulating the temperatures, moisture content and humidity in the storage room the farmer is able to control pest and disease damage.

Fumigation - use gaseous or pesticides in powder form to suffocate and poison pests within the storage room.

Note: This is only advisable if the person has personal protective gear and equipment.

Microbial control - microbial insecticides are valuable because their toxicity to non-target animals and human is extremely low compared to other commonly used insecticides.

Bagging and packaging

Identifying the right bagging and packaging material is important because it influences seed storage life.

For small scale seed production one can store seeds in sealed containers.

Use of hermetic bags for storage are an effective way to store seeds.

Hermetic bags are sealed with layers of polythene material inside so as to kill fungi and pest once oxygen is used up in the sealed bags.

Note: for longer shelf life store seeds in airtight and climate controlled conditions.

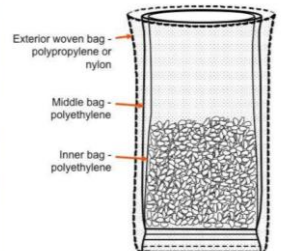


Photo credits: bellindustrieskenya.com

Labelling

Farmers should clearly label the bags or containers with seeds. This will help the farmer identify one variety of seed from the other.

Especially when the seeds of different forage crops are harvested, seeds should be clearly labelled with extra information such as; date of harvest, quantity and moisture content.

Clearly indicate the storage date and expected expiry date.



Photo credits: <https://www.flickr.com/photos/cimmyt/5979294226>

Seed storage

Seeds especially grass seed absorb moisture from their environment and therefore need good storage, ideally climate controlled, to keep seeds in good condition.

Store the bags with seeds away from the ground by placing them on old tires or wood to elevate the bags from the ground to avoid losses.

Alternatively the store can be constructed such that its floor is elevated from the ground.

(See image on the right bottom)

When storing seeds avoid the following factors that affect the seed quality;

- High humidity
- High temperature
- Pests (insects and rodents) and diseases

Storage area should be cool, dry and well-ventilated and for long-term storage cold storage is recommended

Legume seeds (for example; beans, peas, desmodium etc.) can survive longer compared to grass seed in a given relative humidity due to their strong seed coat which does not allow water to get inside the seed.

Before storing seeds eliminate rodents in the store.

Know common pests for selected forage crop seeds and how to manage them for example; sorghum is affected by the large grain borer so prepare for an infestation with best pest management control.

Apart from gunny bags seeds can be stored in airtight, aluminium and non-porous container with a fitting lid.



Photo credits: bellindustrieskenya.com

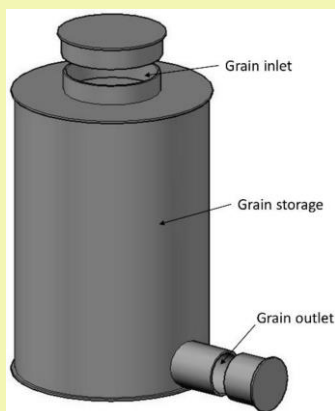


Photo credits:

<https://www.mdpi.com/2077-0472/8/4/57>

Factors to consider for on-farm seed bulking

1. Identification and selection of target areas.
2. Assessment of availability of improved varieties.
3. Identification of crop/varieties grown.
4. Site selection.
5. Educate yourself in seed production.
6. Procurement of basic seeds.
7. Procurement of other farm inputs like fertilizer etc.
8. Establishment of bulking sites.
9. Monitoring, inspection and quality assurance.
10. Seed processing and conditioning.
11. Seed storage facilities.





Ministry of Foreign Affairs of the
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About the ICSIAPL Project

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