NATIONAL LIVESTOCK RESOURCES RESEARCH INSTITUTE (NaLIRRI)

EASTERN AFRICA AGRICULTURAL PRODUCTIVITY PROJECT (EAAPP)

SMALL-SCALE PASTURE SEED PRODUCTION

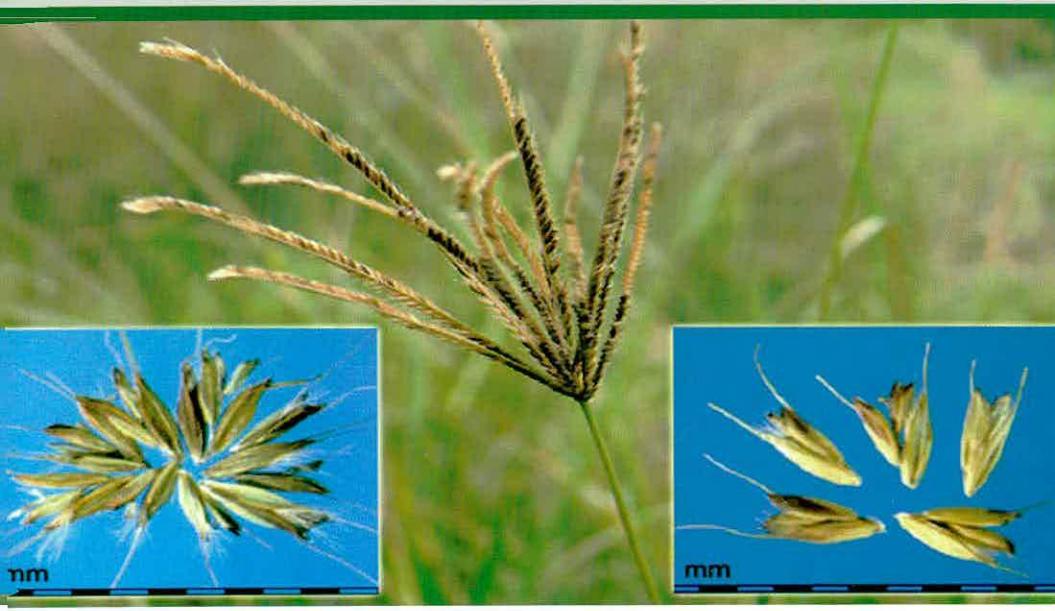
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1.0 Introduction

The demand for high quality forage seed for development of livestock feed resources is increasing rapidly in Uganda. This demand is fuelled by the expanding beef and dairy production occasioned by the increased demand from rising population and improved income particularly in the urban centres. Availability of adequate and good quality forage seed is critical to meet the expanding meat and milk demand in the Country. Further, the need to restore degraded natural pasture (the major source of livestock feed) through reseeding and/or over-sowing interventions emphasize the urgency for concerted efforts to ensure availability of large quantities of good quality seeds. However, production of adequate quantities of good quality seed is greatly constrained by inadequate knowledge on appropriate agronomic practices among livestock farmers. Documentation and dissemination of already synthesized and simplified information on appropriate forage seed production techniques to farmers is thus critical in ensuring availability of adequate quantities of good quality seed.

2.0 Establishing a pasture seed crop

Establishment of an excellent, uniform stand of forage in a short period of time is important. If a sparse stand initially develops, many of the perennial grasses have the ability to cover bare spots and achieve complete ground cover, especially

if planting was done on virgin land. If planting is on old pasture land contaminated with aggressive grass weeds such coach grass, the ability of the planted forage seed crop to provide complete ground cover is lessened. The producer needs to do everything possible to ensure successful establishment

2.1 Land Preparation

Efforts to prepare an appropriate seedbed for production of forage seed should aim at producing a seedbed that ensures the requirements for appropriate seed germination as well as establishment. The seedbed should thus facilitate adequate water infiltration and root development. Seedbed preparation should also be intended at eradicating weeds (especially of graminae family) as much as possible. The initial ploughing should be conducted early enough (usually at end of the previous rain season) to give ample time to the cleared vegetation to decompose and to ensure adequate mineralization of nutrients. Secondary ploughing is also necessary to produce a fairly fine seedbed as well as to remove any weeds that might have emerged after initial ploughing. Once the first and second ploughing are properly done, the seedbed will be reasonably fine and may not necessitate disc-harrowing. In cases where timely ploughing operations fail, first and second ploughing may be conducted at the on-set of rains and then the sites sown to seeds. The problem with this method of seedbed preparation is that weeds will have developed seeds at the time of ploughing and as they are ploughed into the soil, they instead germinate taking advantage of the available rain. A lot of resources shall thus be directed towards weed control.

2.2 Fertilizer requirements

Adequate soil nutrients are required to promote plant growth, tillering, branching and subsequent seed production. Nitrogen (N) is the main nutritional determinant of forage grass seed yield and split applications after one month of sowing and at flowering, each of 50-100 kg/ha N, are commonly used based on the fertility of the soil. This implies that after application of the two split dozes, the total application rate of nitrogen will range between 100-200 kg/ha N. Single dose application of nitrogen is discouraged as the plant will not have adequately developed to effectively utilize all the applied nitrogen. As such, much of the nitrogen is often wasted and is not channelled into vegetative and seed production. At times, the grass seed crop benefits from application of phosphate fertilizers at sowing if phosphorus is limiting however,

the farmer is advised to consult a local extension staff before such a decision is taken.

In case of forage legume seed crops, N is often not limiting because the nitrogen fixing bacteria found in the root nodules of legumes have the capacity to utilize atmospheric nitrogen and fix it into soil. The fixed N is then utilized by the leguminous plants. However, root and nodule development is dependent on the quantity of phosphorus in the soil. Yet, seed production in forage legumes is greatly influenced by the extent of root and nodule development. As such, ensuring adequate availability of phosphorus is crucial if adequate seed yields are to be realized. It should be noted that the rate of application will depend on the Phosphorus (P) content and pH condition of the soils. When the soils are strongly acidic, application of P is merely a waste as most of it is simply fixed and rendered unavailable for plant uptake. Under such conditions, amendment of the soil with lime shall improve the soil pH conditions and hence prevent fixation of applied phosphorus. In Uganda, Mugerwa *et al.* (2011) noted that 30kg $P_20_5ha^{-1}$ is the most economically viable rate for lablab seed production. Fertilizers should not be mixed with lablab seed as this can result in complex chemical reactions between fertilizer and seed components leading into reduced viability. Where area and legume specific studies on appropriate phosphate fertilizer regimes have not been conducted, a bracket application rate of Single Super Phosphate (SSP) (100 Kg/ha) is used for nearly all legumes.

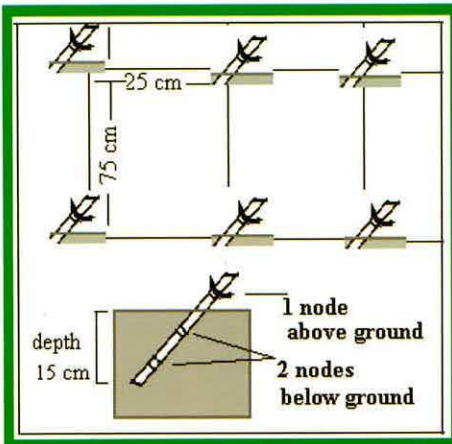
2.3 Time of sowing

Planting should be done at the onset of the rains. In case of late flowering cultivars (e.g Lablab cv. Rongai), planting should be timed to ensure that peak rains of the subsequent season occur during seed/pod development. Once peak rains occur during flowering, most of the flowers are usually lost.

2.4 Planting material

Forage crops can be propagated using vegetative materials or from seed. Vegetative planting materials are often used for forage grasses because: (1) adequate grass seed of good quality is often not available; (2) grass seed is too expensive and often beyond the reach of most farmers; (3) the viability of most grass seed is often too low; (4) some fodder grasses do not produce seeds e.g. Napier grass and *Brachiaria* hybride mulato. Vegetative materials help to offset problems associated with poor quality seeds (non-viable seed) and the high costs of purchasing grass seeds in Uganda. The vegetative

materials can be obtained by breaking up larger clumps into pieces, or using the small tussocks along the stolons that establish readily.



Vegetative (stem cutting) propagation

The vegetative materials may be in form of rhizomes, stolons, stems, splits, cuttings, potted seedlings and rhizomes. In case seed is used, it is desirable that the germination percentage do not go below 75 and 30% for legumes and grasses respectively.

1.5 Sowing

2.5.1 Sowing rates

High sowing rates may depress yields especially in legume seed crops. Recommended sowing seed rates for some of the common forage grasses and legumes used in Uganda are shown in Table 1.

Table 1: Recommended sowing densities for some of the common grasses and legumes

Pasture species	Common name	Seed rate (kg/ha)
Chloris gayana	Rhodes grass	10-14
Panicum maximum	Guinea grass	15-25
Centrosema pubescens	Centro	2-4
Macroptilium atropurpureum	Siratro	2-4
Lablab purpureus	Lablab	12-20

The seed rates will depend on the method used in sowing the seed crop.

2.5.2 Sowing methods

There are two types of sowing methods namely: **row spacing** and **broadcasting**.

(i) Row spacing

Sowing in rows has several advantages

- A lower seeding rates is used
- Weeds can be easily be identified and controlled
- Harvesting is usually a lot easier
- With climbing legumes such as Centro and Siratro, better yields are harvested from row-spaced trellises.

(ii) Sowing in swards (Broadcasting)

Sowing in swards has a disadvantage of using a higher seed rate. However, it has advantages of producing more forage for livestock and of controlling soil erosion.

2.6 Pre-planting seed treatment

Many forage legume seeds have hard seed coats which are impermeable to water. This results in poor germination and establishment. To achieve good seed establishment, rapid and even germination, some pre-planting seed treatment may be undertaken. Pre-planting treatments include mechanical scarification, hot water treatment and inoculation of legume seed with appropriate rhizobia strains to induce nodulation. These pre-planting operations are described in the proceeding sections.

1.1.1 Mechanical scarification or abrasion of the seed coat

This is the most common treatment for small quantities of legume seeds. It involves rubbing gently small quantities of seed between two sheets of sand paper held in the palm of the hand. For larger amounts, a mechanical scarifier (i.e a cement mixer containing some gravel) can be used.

1.1.2 Hot water treatment

i) Boil about one litre of water.
ii) Put 1-2 kg of seeds into a cloth bag and dip it into the boiled water removed from boiling place for 3-5 minutes.
iii) All the seeds must be submerged and in contact with the boiled water.
iv) Soak it in cold water for 12 hours.
v) Dry the seeds for 1-2 hours.
vi) Treated seed should preferably be sown soon after treatment.

1.1.3 Inoculation of legume seed

Inoculation of forage legumes prior to sowing is recommended when introducing new species into new areas. Many legumes are specific in their Rhizobium requirements and special inoculum is required.

If the specific Rhizobium is not available, then the soil from rhizosphere of nodulating plants of the same species should be mixed with the seed. The rhizobium is commercially available mixed in a peat culture, which ensures the survival of the rhizobia until seed germination. Improved survival is obtained by using an adhesive or sticker to attach the inoculum to the seed. The most readily available form of sticker is a 10% sugar solution (i.e. 10 gm sugar in 100 ml water). Seed is wetted with the solution and the peat culture mixed with the seed and allowed to dry in the shade - direct sunlight will kill the rhizobium. The following should be noted when inoculating and handling inoculated seed:

(a) make sure that the seed has not been treated with chemical and that containers used do not contain toxic substances such as oil, petrol, chemical pesticides;
(b) do not mix inoculated seed with acid fertilisers such as superphosphate;
(c) ensure that the peat culture used is within the expiry period;
(d) Store inoculum in a refrigerator - up to 2 months maximum.
(e) Sow into moist soil.
(f) Spraying a peat/inoculum mix onto established legumes during cloudy weather can partially or completely overcome nodulation failure.

2.7 Forage seed crop management

The overall aim of managing a forage seed crop, whether for grasses for legumes is to produce high yield. The local environment sets the broad growing conditions which are then manipulated through management to meet the needs of particular crops. The management of grasses and legumes differ remarkably.

2.7.1 Weed control

The time and frequency of weeding operations entirely depends on method of seedbed preparation and amount of rainfall in the area. With frequent rains, the weeds re-grow within a short period and therefore weeding will be required more frequently. When the first ploughing is done early enough (at the end of the rain season), the cleared vegetation will be incorporated into the soil, dried and decomposed during the dry season. As the rains begin, some weed seeds that had developed and dropped on the soil surface at the time of the first ploughing will germinate. These weeds should be left to establish and then be sprayed before the second ploughing is conducted. These operations will greatly reduce weed infestation in the forage seed crop field. Hand weeding is the commonest method of weed control but the method is very expensive.

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The difficulties encountered in differentiating grass weeds from forage grass crops especially in the early stages of development make manual operations very expensive yet chemical and mechanical weed control in established grass swards is impossible. As a practical rule of thumb, the height of weeds should not surpass that of the forage crop otherwise, the crop will be out competed.



A well weeded lablab field during establishment



Weeding out woody species from a *Chloris gayana* field



Supervision of a weeded *Chloris gayana* field

2.7.2 Pests and disease control

Pests and diseases are generally more severe with legumes than grasses. Insect pests include moth caterpillars, sucking bugs and butter flies that are seen feeding on pods and flowers. A wide range of diseases can affect different legumes. The more important ones are Rhizoctonia, Anthracnose in Stylo, rust on Siratro and viruses on may species. Siratro and Lablab must be regularly sprayed to protect the pods and young leaves from aphids and thrips. A regular application of one litre per hectare every fortnight using appropriate pesticides such as Ambush and Rocket helps to control most of these pests. The most serious pest of forage seed grasses are birds that consume enormous quantities of seeds once they are not controlled. As such, birds should be scared out of forage grass seed crops during seed development and setting stage.

2.7.3 Staking/use of trellises

Staking is the provision of vertical support for creeping and climbing legumes. This can be done using sticks or trellises comprised of timber poles and wires in between as often done for passion fruits. Trellises are more effective and long lasting than the sticks; however, they are more costly. Staking increase seed yields by as much as two times in forage seed crops.



Lablab staked on sticks

2.8 Seed harvesting

The decision to harvest the crop depends on how the head or the pods look like. A number of visual indicators have been proposed for grass seed crops to fix the optimum harvesting time more closely. Crops should generally be harvested when the bulk of seed is not far from shedding. At this stage, ripening seed can be easily removed by gently rubbing or by stroking from the base to the apex of an inflorescence. Samples should be checked to ensure that the florets contain seeds by biting individual seeds, or by rubbing in the palm of the hand to remove seed. In *Chloris gayana* forage seed crop, a golden color appearance of the field is an indicator of seed maturity and hence appropriate time for harvesting.

In grasses the principle tools to be used by small-scale farmers are the knives and sickles. Harvesting may be on the entire plant or, if necessary, selectively remove seed heads. *Panicum maximum* (Guinea grass) seed will produce high yields of high quality seed if the freshly cut seed heads are placed in a stack and then sweated for two to three days before threshing and drying. The main aims of sweating are to detach the seed from the heads and to allow marginally mature seed to mature fully. Mature seed pods of Siratro, Centro and Lablab can be hand-picked every two to three days.

2.9 Post-harvest handling

2.9.1 Sweating

Ripe grass seed heads are cut in the field, tied into loose bundles and



Lablab stacked on elephant grass

taken to a shed. Long stems and leaves should be removed as their high moisture content can spoil the seed during sweating. When the stack is opened after two to three days most of the mature seed has undergone abscission. A light threshing on the floor will loosen more mature seed. Sweated seed should then be dried slowly over several days to the required storage moisture content (8-10%).

2.9.2 Threshing and winnowing

Threshing involves separating the seeds from panicles and straw, and winnowing the chaff from the seeds. Small-scale farmers employing this method often use a sample stick or flair to separate the seed from the inflorescence and straw by beating the crop repeatedly on the floor.

2.9.3 Seed drying and cleaning

Newly harvested seed especially the grasses and at times the legumes is quite moist. Freshly harvested grass seeds must therefore be dried to a safe moisture content to prevent loss due to germination, heating and infestation during storage. The seed is spread on a floor, racks, mats, tarpaulins etc in the sun or shade to dry.

2.9.4 Seed storage

Dry legume seed must be dressed with an insecticide e.g. Actellic to prevent damage by insects. The seed can be stored in jute bags to allow further drying and to reduce the sweating that can lead to rotting. The seed is then stored in well ventilated stores free from rats.

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