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AVAILING NATIVE GRASS SEEDS FOR RESEEDING OF DEGRADED RANGELANDS ACROSS LESOTHO

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ABSTRACT

Most of the rangeland reseeding programmes in Lesotho have been carried out using African love grass (*Eragrostis curvula)* purchased from the neighbouring country of South Africa. This has been due to an insufficient supply of native grass seeds to meet the rangeland reseeding needs of Lesotho. A literature-based research was therefore conducted to find easily affordable seed production, harvesting, processing and packaging techniques that could easily be adopted by the Basotho (people of Lesotho) farmers to meet their country's demand. Red grass (*Themeda triandra)*, African caterpillar grass *(Harpochloa falx)* and thatching grass (*Hyparrhenia hirta)* are some of the most dominant and important grasses providing a livelihood for the Basotho, and therefore this research focused on them. The results indicate that little research has been done in the field of native grass seed production except some localised research in the United States, Canada and Australia. There was no adequate literature found on propagation of the selected species. This study will therefore serve as a foundation for localised research on multiplication of native grass seeds in Lesotho.

Key words: native, grass, seeds

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1. INTRODUCTION

According to the Lesotho Department of Range Resources Management (DRRM 2014), approximately 60% of Lesotho's total land area of 30,355 km^2 is estimated to be rangelands. These rangelands have been deteriorating over the years due to several factors including unsustainable management and frequent unplanned fires (ORASECOM 2014). The plant diversity and forage yields in these rangelands are believed to have declined drastically resulting in a decrease in their overall plant and animal diversity. The rangeland is now mostly covered in woody shrubs and the percentage of exposed bedrock and bare soil has also increased (DRRM 2014).

The Ministry of Forestry, Range and Soil Conservation (MFRSC) through the Department of Range Resources Management (DRRM) embarked on supporting and promoting manual uprooting of shrubs, construction of silt trapping structures and reseeding across most rangelands as a way of rehabilitating these rangelands (DRRM 2014). However, the Department has always been met with the challenge of native grass seed availability.

There is no reliable source of native grass seeds as the propagation and harvesting of such seeds is often overlooked and there are no local grass seed harvesters or producers that can sell seeds to the government (ORASECOM 2014). The DRRM has then resorted to buying grass seeds from the neighbouring countries, especially African love grass (*Eragrostis curvula)* from South Africa; however this practice poses the threat of ecosystem alterations as the grasses are not native and the effects of their introduction to Lesotho's rangeland ecosystems has never really been studied (ORASECOM 2011).

African love grass does occur naturally in the rangelands of Lesotho; however, the seeds that DRRM buys from South Africa have been collected from several places in South Africa and bred for particular qualities that make it only suitable for use in commercial pastures. This implies that the imported seeds are not likely to be similar to the local varieties in traits including adaptability to the local environment (ORASECOM 2014).

It is therefore important to identify different methods for increasing the availability of good quality native grass seeds for reseeding of degraded rangelands across Lesotho. Production of certified seeds is always a long tedious process that involves 10 or more steps and legal processes (USDA Agriculture Marketing Service n.d.; Noble Research Institute 2001); however, in the United States, release of native grass seeds that are not certified is authorised in cases where commercial certified seeds are not available (Waters & Shaw 2003).

This study was aimed at finding simpler budget-friendly production methods that will cater to the DRRM's need for seed as well as the farmers' low production budget. There are many native grasses in Lesotho. Due to time constraints, the study only focused on three grasses that historically dominated most of the rangelands in Lesotho, are mostly effective in soil stabilization, and contribute significantly to the livelihood of the Basotho. The study was carried out through undertaking of practical studies on grass seed production processes within the Soil Conservation Service of Iceland as well as conducting a literature review to:

- Identify suitable seed production techniques for red grass or rooi grass (*Themeda triandra),* African caterpillar grass *Harpochloa falx)* and thatching grass or coolatai grass (*Hyparrhenia hirta),*
- Identify suitable methods and times for harvesting seeds for the grass species mentioned above.
- Identify methods for effective, efficient and safe processing of these grass seeds.
- Identify safe storage techniques for these grass species.

2. BACKGROUND

2.1 Rangeland ecosystems and ecological restoration

Rangelands, like all other ecosystems, provide numerous important goods and services for the functioning of the environment. They also provide the foundation for the delivery of environmental benefits to people (Fischlin et al. 2007). The Millennium Ecosystem Assessment (MEA 2005) group what they refer to as the most important services to human well-being into supporting, provisioning, regulating and cultural services. It has become increasingly obvious that the functionality of the ecosystems is highly dependent on biological diversity. The management of ecosystems can therefore no longer concentrate on separate objectives, but needs to be holistic, taking into consideration both socio-economic and environmental issues (ORASECOM 2014).

Generally, ecological restoration is an attempt to return disturbed ecosystems to their presumed historic functionalities; thus a restored ecosystem should, among other attributes, be dominated by indigenous species (van Rheed van Oudshoorn 2007; van Andel & Aronson 2006). The management of rangelands requires selection of techniques for maximising production of goods and services with no net damage to the rangeland resources. Rangeland revegetation technique has proved to be greatly successful in restoring rangelands and enhancing their capacity for both livestock and wildlife production (Mureithi et al. 2015). Though in Lesotho emphasis is often placed on the effects of grazing systems, the main goal is rangeland resource restoration, together with protection and management for several objectives including biological diversity (species and genetic diversity), conservation and sustainable development for people (Lesotho Ministry of Forestry and Land Reclamation 2014).

2.2 Native grass seeds

A growing awareness and appreciation of the value of native plants from an aesthetic, agronomic, environmental and cultural view has created a huge demand for their seeds (Native Prairie Stewardship 2002; Miller 2013). Native seed is very important and often barely available (Mganga et al. 2010). However, as illustrated in Figure 1 below, for many native species, affordable seed multiplication can be attained through establishment of wild collections in seed increase fields, in nurseries or in agronomic environments where plants can be properly managed for high seed quantity production (USDA Forest Service 2018).

Appropriate seed technologies are necessary at harvesting, processing and storage of seeds because poor methods, skills and facilities to store harvested seeds lead to use of poor quality seeds which in turn leads to poor seedling establishment and therefore restoration failure (Mganga et al. 2010).

Figure 1. Seed production cycle: Native grass seeds are collected from wild grass stands and sown in fields/nurseries/agronomic environments where they are nurtured until they mature and produce seeds. Seeds are then harvested, processed and packed for future seed production for rangeland restoration works. If the grasses can be cross pollinated, seed increase facilities should be isolated from similar species to avoid contamination. (Source: USDA Forest Service 2018).

Different countries across the world have specific laws affecting the production of grass seeds, and such laws govern different seed production processes such as labelling and marketing of the seeds (Sumner & Milton 1949; Noble Research Institute 2001). According to these laws then, grass seeds can be classified as certified or uncertified. However, there are certain standards that should be met for both classifications, for example, crop fields that are used to produce certified seeds must be isolated (Canadian Seed Growers Association n.d.) and sown with foundation seeds (generation 1) (Noble Research Institute 2001) or registered (generation 2) seeds (Cornforth et al. 2001), i.e. seeds that can be directly traced to breeder seeds.

For reclamation and restoration purposes seeds harvested from local wild grass stands are sometimes preferred as opposed to cultivated seeds (McKay et al. 2005). Any person with proper plant identification skills and harvesting abilities can harvest native grass seeds; however, it is important to avoid contamination with the seeds of toxic weeds and non-native grasses and to ensure safe storage of seeds for preservation of seed quality. Wild seed collection is especially suitable for rural communities, offering them an opportunity to make extra revenue where such opportunities are limited (Native Prairie Stewardship 2002).

The equipment required depends on the type and quantities of seeds being harvested. It ranges from simple and low-cost plastic buckets and cloth bags to more expensive motorized seed strippers capable of covering 1-2 acres per hour for large scale grass seed harvesting. Portable hand-held seed strippers are also available for use in rough terrain (Native Prairie Stewardship 2002).

2.3 Thatching grass

Grasses in the class *Hyparrhenia* are often referred to as thatching grass because of the common use of their tough dry stalks for roof thatch, especially in Africa (Australian Weed Management 2007). It is a wiry, tufted, self-pollinated perennial grass that grows up to 1.5 m tall (South African National Biodiversity Institute 2009). It spreads by seeds and regrows quickly from its crown after defoliation, fire or seasonal dormancy. Its main growth period is in late spring to summer but may remain green all year in cases of mild winters. It has deep roots (up to 3 m) and therefore is drought-resistant. It responds quickly to summer rainfall (Australian Weed Management 2007) and therefore works well for soil stabilization and as a pioneer for revegetation of degraded lands (Kativu 2011).

Thatching grass grows in a wide range of soils, light regimes and climates, but it prefers well-drained, lighter textured granites to heavy black, stony soils and, once established, fire may promote its growth and enhance new growth as it removes old dead herbage and decreases competition for light, and the dense tuft base protects emerging sprouts from fire. It is mainly used for thatched roofing of houses but also for weaving baskets, hats, and mats, as well as for animal grazing, especially during its early growth stages (South African National Biodiversity Institute 2009).

Thatching grass may yield seeds during its first growth term and the seeds are produced over an extended period and shed as they mature, making harvesting timing difficult (Australian Weed Management 2007). It has also been noted that seed yield can be increased by annual burning of the grass as the fires have been shown to increase growth, flowering and seed production of this grass species (Ligavha-Mbelengwa & Bhat 2013).

2.4 African caterpillar grass

African caterpillar grass is a wind-pollinated perennial tussock grass that can grow up to 80 cm (Johnson 2003; Clayton et al. 2016). It is found only in southern Africa and most often occurs on leached, rocky, shallow soils that are characteristic of moist, cool, and steep mountain slopes. It commonly occurs with several other tussock grasses and many other plants and remains green throughout the year in frost-free conditions (Johnson 2003). It withstands intensive herbivory and trampling better than other equilibrium species such as red grass (Johnson 2003; O'Connor et al. 2011).

Highly palatable to wild animals and livestock, African caterpillar grass is one of the important species for both Lesotho's diversity of endangered wild animals and livestock dependent livelihoods. Its inflorescence is also used in flower arrangements. Seeds that are harvested in summer can be successfully grown in trays or seedbeds in nurseries and the young plants can be transplanted in spring (Johnson 2003).

2.5 Red grass

Red grass is a wind-pollinated (Saunders 2017) perennial tussock grass native to Africa, Australia and Asia and can grow up to 1.5 m tall (Liles 2004). It varies widely in terms of appearance and forms and the basal parts of its tufts are usually compressed. It forms hanging clusters of large red-brown awned flowers (spikelets) surrounded by leaf-like bracts. The bracts are often in the range of 4-7 cm long and remain attached to the seed when they fall off the plant (Fish 2004; Liles 2004).

Snyman et al. (2013) indicate that red grass grows well in a wide range of climates, geological substrates and ecosystems. They further emphasise that it is of high economic and environmental value, as it is a relatively palatable species for both native and introduced herbivores, and is therefore vital to wildlife and livestock production, and subsequently rural livelihoods. It is also used for thatching and basketry in Lesotho and the border with South Africa and as an ornamental and landscape plant in other countries (Fish 2004).

It is well adapted to fire but not to a heavy continuous, selective grazing regime. A decrease in abundance of *Themeda* in a grassland is usually accompanied by or indicative of a decline in the overall grazing value, species richness, cover and ecosystem function (Snyman et al. 2013).

Seed may be sown immediately after harvesting but generally it remains dormant for up to 12 months depending on its origin. Both gaseous and aqueous plant-derived smoke, fire or temperatures of 40-45 °C may be used to break the dormancy (Baxter & van Staden 1994; Liles 2004). Sowing depth should be to a maximum of 1.5 cm and if seed is still attached to the whole inflorescence, it should be spread onto the soil surface. Direct sowing is recommended as there is little success transplanting red grass, and extreme nurturing of the plant, such as with water crystals and slow release fertilizers, is needed after transplantation (Liles 2004).

Approximately 2/3 of the seed per inflorescence is infertile and it is often difficult to identify which seeds are fertile and which infertile as they all turn brown and hold on to their awns. Fertile seeds, however, are usually larger. If the seeds are harvested by hand, care should be taken to avoid injuries from the sharp callus at the base of the seed (Liles 2004).

3. METHODS OF STUDY

An internet search was conducted and several websites, books, journal articles, reports dissertations, conference papers and blogs as well as hard copies of other documents were reviewed to find the methods for planting, harvesting, processing, packaging and storage of red grass, African caterpillar grass and thatching grass seeds that Lesotho can adopt.

A tour was taken around the Soil Conservation Service of Iceland seed production premises to learn about the processes they undertake and the equipment they use in seed production from seedbed preparation through harvesting to storage.

4. PRODUCTION TECHNIQUES

Characteristically, most native grass seeds are difficult to germinate and as such there have been numerous studies of the physiological and ecological perspectives of seed dormancy and germination resulting in several techniques to aid the processes. In grasses where seed dormancy is due to seed permeability problems or resistance to embryo expansion and radicle emergence, saprophytic fungi action, fire or chemical and physical actions can be used to break the dormancy (Baskin & Baskin 1998).

However, in most grasses seed dormancy is inherent in the embryo itself and in such cases alterations in chemical and environmental regimes, for example, soil nutrients, pH, temperatures, light regimes, etc. may be needed. Treatment of grass seeds with chemicals such as nitrogen compounds are also successful in breaking embryo inherent dormancy. However, combinations of environmental conditions needed to break both cover and embryo inherent seed dormancy are species specific and some grass species tolerate certain environmental stresses that others don’t (Baskin & Baskin 1998).

Sumner & Milton (1949) advise that perennial grasses be seeded in early autumn to get high yields during the first crop year. They highlight that for seedlings to survive heavy frost, it is important that seeds are sown early enough in the autumn. This will ensure that the seedlings are well established before the first frost. Late winter or early spring seeding also securely establishes grass seed stands; however, they result in lower yields in the first year when compared to early autumn seeding.

The best technique for sowing indigenous perennial grasses is to ensure firm contact between seeds and the soil, preferably, just below the soil surface, and if the seed is broadcast on the surface it should be covered (van Rheed van Oudshoorn 2007). If the seed is sown in cultivated fields, compaction of the soil has been observed to yield successful establishment (Sumner & Milton 1949). Seeds should be sown in rows approximately one meter apart as smaller row spacing lowers crop yields. Several machines have been developed for sowing different types of grass seeds and some machines enable simultaneous sowing of different types of grass seeds (van Rheed van Oudshoorn 2007).

Fertiliser addition to grass fields has proven to increase and stabilise yields; however, farmyard manure is not an ideal option as it often contains a lot of weed seeds. Combinations of phosphorus and nitrogen have also been proven to be more successful than fertilising with nitrogen only, though use of too much nitrogen results in lodging (Sumner & Milton 1949).

Cultivated grass stands reach their peak productivity in the second and third year and the productivity is highly likely to decline steadily in the subsequent years. However, there are records of grass stands that remain productive up to seven and eight years owing to good management practices (Sumner & Milton 1949).

5. SEED HARVESTING AND PROCESSING

5.1 Harvesting timing

Najda et al. (2002) indicate that it is important for every seed grower or wild seed harvester to know when to harvest grass seeds as the time varies from species to species, plant to plant, head to head, and even seed to seed in one head. They further state that flowering and seed development processes differ among and within grasses, affected by numerous factors including weather and management practices such as fertilisation and irrigation. However, these processes often last for only approximately two weeks and seeds are often ripe in twenty to thirty days after flowering.

Most grasses tend to hold their seeds for ten to fifteen days after ripening but seed shattering may occur at any point within this time. It is therefore important that seed harvesters inspect the grass stands frequently to ensure timely harvesting and prevent loss of seeds due to shattering (Najda et al. 2002). Maturing seeds go through several stages before they are ready to harvest, namely: milky, soft dough, medium dough and hard dough stages sequentially (Sumner & Milton 1949). The common ways of checking seeds for maturity as stated in Najda et al. (2002) and Sumner & Milton (1949) are:

- Applying moderate to hard pressure on the seed with a thumbnail - seeds are ready for harvesting when they are at medium to hard dough stage.
- Checking the tips of grass heads - seeds are ready to harvest when the tips begin to shatter.
- Gently striking the seed heads against the palm - seeds are ready for harvest if they shatter easily during the process.

It is of utmost importance that harvesting is properly timed as harvesting of immature seeds is likely to result in light weight, low quality seeds (Sumner & Milton 1949).

5.2 Harvesting methods

Conventional grain combine harvesters are ideal for harvesting most grasses in large cultivated fields. However, careful adjustments must be made to prevent or reduce loss of seeds during harvest (Sumner & Milton 1949). For example, air intake should be adjusted in accordance with seed weight and the forward speed should be lowered to prevent grass seeds from moving out with straw or chaff. These harvesters can be used to harvest seeds from both standing and swathed grasses and should be thoroughly cleaned between harvests to avoid seed contamination (Najda et al. 2002).

On small fields or wild grass stands grass seeds can be harvested manually using simple tools, thus allowing for selective harvesting which often yields good quality seeds (Ogillo et al. n.d.).

5.2.1 Swathing and combining

This is the most common grass seed harvesting method in which the grass is cut and left in the field to dry before seeds can be harvested. Grasses that shatter easily should be swathed when air humidity is high, and the heads should be laid into the centre of the swath so that if they shatter, the seeds will be collected onto the swath and not into the ground. This method helps in reducing seed loss due to shattering, makes harvesting earlier, and increases the likelihood of harvesting dry seeds. However, it has high risks of seed contamination with weeds and seed loss as the swath can be blown away in high wind (Najda et al. 2002)

5.2.2 Binding, shocking and delivery to stationary thresher

In this method, a binder is used to cut, bind and shock the grasses and the bundles are then delivered to a thresher. The bundles should be of medium size and loose to allow air circulation for quicker drying. Adjustments should be made to the binder to prevent loss of seeds and the thresher can sometimes be moved around the field to minimise handling of the grass bundles. The thresher should also be adjusted on the basis of characteristics of the individual grass seed species being harvested (Sumner & Milton 1949).

5.2.3 Direct combining

This is the method in which the combine harvester is used to cut grass heads from standing grasses. It is best used in small fields where there is a minimal gap between ripening of seeds. Harvesting should be done when the majority of the seeds are just beginning to shatter and about 5-15% of the seeds are still immature. The combine harvester in this case should be adjusted to avoid cutting the green grass material, only just most of the grass heads. This method is faster and requires less labour; however, the seeds harvested by this method require more cleaning and drying before storage as compared to those harvested by the swathing and combining method (Najda et al. 2002).

5.2.4 Seed stripping

This is an ideal method for harvesting wild grass seed but can also be used in the fields. It involves harvesting of only the grass seed heads. This method is less labour intensive and the harvested seeds require little processing as compared to the cutting and threshing method (Ogillo et al. n.d.). It ensures harvesting of only the mature seeds and results in clean good quality seeds. However, it is very costly and runs the risk of harvesting seeds with a high moisture content.

5.2.5 Manual cutting and threshing

This method involves manual cutting of the seed head with its stalk and the last leaves and then stalking or swathing them in the field to dry. The seeds are then later threshed, and because the seeds are dry only light threshing is needed (Ogillo et al. n.d.).

5.3 Seed processing

Harvested seeds can be manual dried by thinly spreading them under shade and turning them frequently, for aeration, until they are dry (Ogillo et al. n.d.). They can also be dried by artificial circulation of heated or cool air through the bulk seed and in the case of heated air, care should be taken that the air temperature does not exceed 38℃ (Najda et al. 2002). Sacks from the thresher or combine harvester can also be partially filled and left in the field to dry. In this case the seeds should also be turned daily to prevent moulding (Sumner & Milton 1949).

Harvested seeds should be cleaned by removing all undesirable materials such as damp, green materials, stems, immature seeds and weed seeds (Ogillo et al. n.d.). The cleaning process can be done using motorised scalpers and fanning mills or manually with hand-held scalpers and hand picking of undesirable materials (Sumner & Milton 1949).

6. SEED PACKAGING AND STORAGE

The storage life varies among different grass species (Najda et al. 2002); however, it has been noted that the duration of storage of grass seeds is less important than the conditions under which the seeds are stored and as thus it is undoubtedly important to ensure an ideal environment for seed storage (Elias et al. 2018). The seeds can be stored safely when their moisture content is in the range of 8-12% (Najda et al. 2002). Temperatures below 15 ℃ and a relative humidity below 60% are ideal storage conditions for maintenance of grass seed viability (Elias et al. 2018).

7. THE CASE OF THE SOIL CONSERVATION SERVICE OF ICELAND

The Soil Conservation Service of Iceland operates only large-scale production of grass seeds and their operation is solely based on the use of machinery, as can be observed from Figure 2 below.

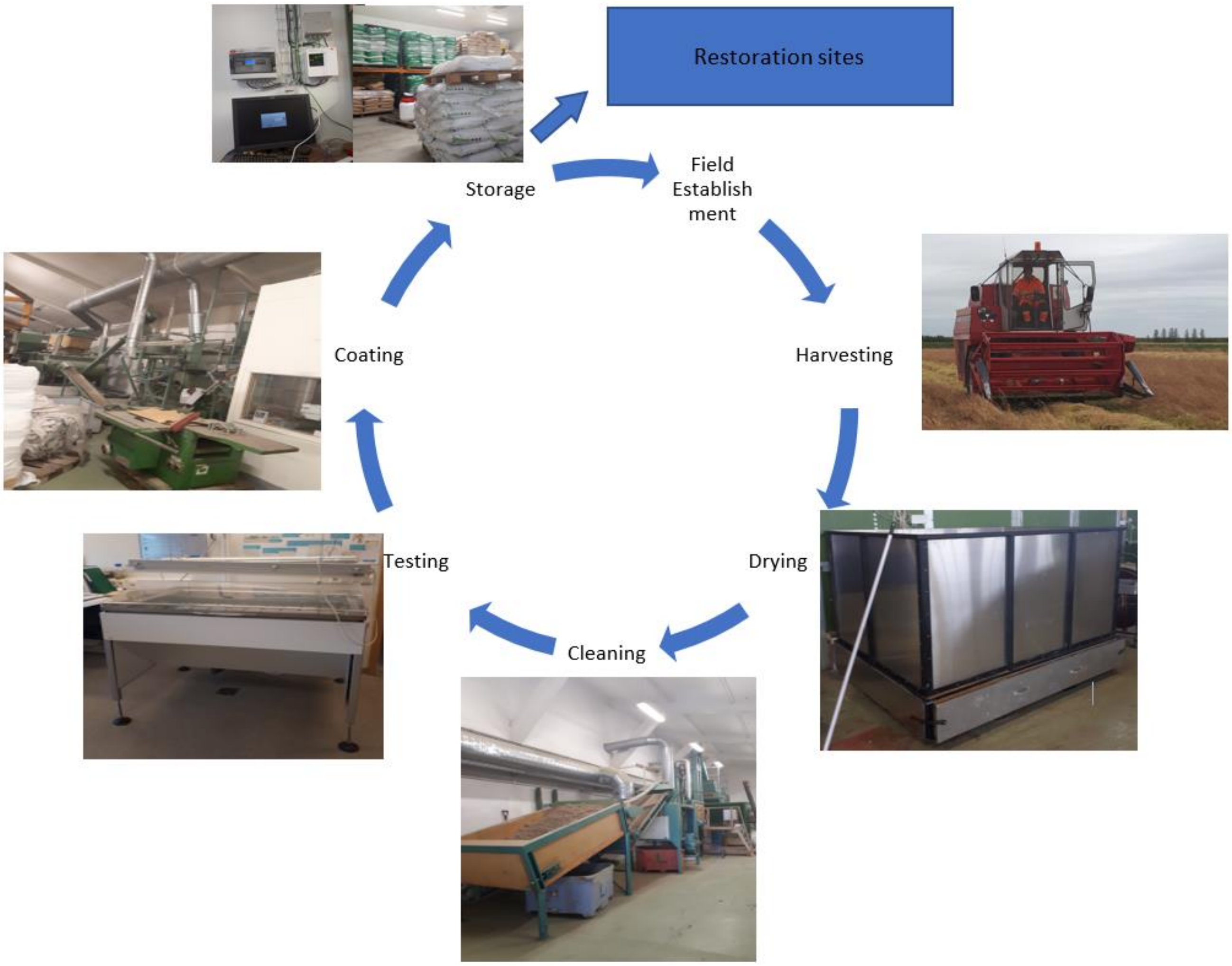

Figure 2. Seed production cycle at the Soil Conservation Service of Iceland showing the process and the machinery used.

8. DISCUSSION

The subject of native grass seed production is still not well studied and therefore there is not much information in the literature about it. Most of the morphological and physiological descriptions of thatching grass and red grass reported here were derived from the literature from Australia. However, there was not much useful management information for thatching grass as it is treated as a weed in Australia and all the management in Australian literature is about control and eradication strategies as opposed to the propagation objective of this study.

There is also almost no species-specific research regarding African caterpillar grass, as can be observed in Table 1 below. This may be due in part to the fact that it is found only in Lesotho, Eastern Cape, KwaZulu-Natal, Gauteng and Mpumalanga in southern Africa, and also the fact that it is recorded as useful only for ornamentals and grazing (Johnson 2003; Clayton et al. 2016). Its tolerance to continuous grazing and trampling, the main problems on Lesotho rangelands, make it a very important species for prevention of soil erosion, and its rarity and palatability to both wild animals and livestock make it a vital species for biodiversity conservation (Johnson 2003; O'Connor et al. 2011).

Table 1. Summary of planting, harvesting, processing, packaging and storage of selected grass species as found by this study. X stands for no data available.

Requirements	Attributes	Red grass	Thatching grass	African caterpillar grass
Planting	Soil type	clay soils and soils with high organic matter content	Lighter textured granites to heavy black, stony soils	Leached, rocky, shallow soils
	Planting materials	Seeds Older tufts	Seeds Older tufts	Seeds Seedlings Older tufts
	pH	X	4-10	X
	Temperature	X	≥25°C	X
	Light regime	X	Slight light	X
	Planting depth	≤1.5cm	≤9cm	X
Growing season		X	Late spring to autumn	
Essential management practices	Burning	X	Annual	Infrequent
Time to maturity	X	X	X	X
Harvesting	Harvesting season	X	X	X
	Harvesting methods	X	X	X
Seed processing		X	X	X
Storage conditions	Temperature	X	X	X
	Humidity	X	X	X
	Seed moisture content	X	X	X
	Seed shelf live	Dependent on storage conditions	Dependent on storage conditions	Dependent on storage conditions

The major parts of this report come from literature from Canada, the United States and Australia. However, this literature did not specifically address the objectives of this study as the native grass seed production of these countries is large scale and limited to species that are not native to Lesotho. Most of the techniques described in this study are general to the grass family as not enough information specific to the selected species was found in the literature. General principles and techniques are ideal for most grasses but not for every grass species, so it is important that Lesotho runs pilot projects to test the usefulness of the general techniques on the country's native species in the native environment.

The methods adopted by the Soil Conservation Service of Iceland are also large scale and rely solely on the use of expensive machinery. As such it is not easy for Lesotho farmers to adopt them; however, it is possible that the DRRM can liaise with other government ministries and supply services to farmers on some of the seed production processes. For example, government tractors can be leased out to cultivate seed production fields and the DRRM can also run germination tests for the seeds produced by farmers prior to marketing.

The DRRM and other government departments such as the Department of the Environment and the Department of Soil and Water Conservation are potential buyers of native grass seeds. There are, however, other opportunities that farmers who choose to go into grass seed farming can explore: domestic fodder for livestock, raw materials for crafting, thatching grass, household energy sources, mulch or compost for use in other crop fields or gardens.

9. CONCLUSIONS AND RECOMMENDATIONS

There is limited global knowledge and lack of localised knowledge about production of the three grasses selected for this study. This study will therefore be used as the basis for setting up a pilot project for development of native grass seed production for revegetation in Lesotho. One pilot project should be set up for each of the three grasses studied in this project, in which seeds would be collected from wild grass stands and sown in seed multiplication fields. Different management practices would be tried on the seed multiplication fields and the most successful cost-effective practices would be recommended to farmers. It would be easier and cheaper to use manual harvesting and processing techniques for the pilot project. The harvested seeds could easily be dried out by thinly spreading them in sheds and then the seeds can be bagged and kept in cool thatched storage houses, and then germination trials can be set up in the fields and on restoration sites in the second growing season.

Increased native grass seed production will make available seeds for rangeland reseeding which will in turn facilitate reclamation of degraded rangelands not only by soil conservation but also by biodiversity conservation. Apart from restoring rangelands, this farming for restoration practice will improve the livelihoods of farmers significantly as they can explore other uses for the grass seed farm by-products.

Lesotho can also follow the example of the Kenya Agricultural and Livestock Research Organization (KALRO) and Agricultural Training Centre (ATC) to enhance adoption of the production of native grass seed. These two institutions that greatly support informal native seed production have been successful in setting up a community-based forage seed production system in Kenya. Their success was achieved mainly through two steps: First, representatives of the community were trained as trainers in the seed production processes through a participatory approach based on experiential learning techniques and participatory training methods. Secondly, the trained representatives, with technical assistance from the institutions, trained other community members and the institutions supplied all farmers with start-up seeds (Kimitei et al. 2010). This approach would be greatly beneficial for Lesotho to adopt during upscaling of pilot research findings.

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