TREE SEED SUPPLY CHAIN FOR COMMERCIAL TREE SPECIES IN KENYA

KEFRI - GATSBY AFRICA (KCFP) COMMERCIAL FORESTRY PROJECT

A SUMMARY REPORT

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EXECUTIVE SUMMARY

Systematic tree seed production for commercial tree species in Kenya began over a hundred years ago and this lead to a growth of 40,000 ha of plantations during the colonial period. The annual seed demand by then is estimated to have been around 7 kg of *Pinus patula*, 4 kg of *Eucalyptus saligna*, and 13 kg of *Cupressus lusitanica* based on some of the current plantation species. At the pinnacle of plantation development in the country in the 1980s, Kenya had a plantation area of about 170,000 ha. Based on the hectares that were being planted, the annual total tree seed demand to satisfy tree planting targets by the Forest Department would have been about 28 kg of Pines, 56 kg of Cypress and 16 kg Eucalypts based on prescribed acreage ratio for different species.

The Kenya National Forest Programme (NFP), 2016 identifies that the country faces an acute shortage of good quality tree seed and that the use of inferior seed will continue to degrade the quality of forest products from plantations, trees on farms and woodlots. KEFRI has developed a National Tree Seed Production, Certification and Distribution Strategy (2018-2023) which among others address the concerns raised by the NFP to meet demands for quality tree seeds. A sustainable supply of high quality tree germplasm (seeds, cuttings or other propagules) is fundamental to the success of afforestation programmes and tree planting in general. The system has three main components; production, distribution and use which can be formal or informal. In Kenya, seed production for commercial tree species is mainly formal with various activities in the three main components organized and undertaken by KEFRI on behalf of the public. In the recent past, there has been conversion of plantation forest areas to other land uses hence reducing the demand for tree seed for plantation establishment. However, the NFP and the current target of achieving a 10% tree cover target by 2022 has revitalised a need to enhance plantations establishment. KEFRI has therefore undertaken a study and analysed the current status in provision of tree seed in Kenya to highlight conditions and relationships of the important factors of sustainable seed production.

Seed production at KEFRI is under the overall coordination of the Forest Productivity and Improvement Programme headed by a Deputy Director. Seed collection and processing are undertaken by various KEFRI Regional Centres while the National Seed Laboratory undertakes seed quality control and research. KEFRI has a total about 200 hectares of seed sources for production of seed for commercial tree species scattered across the Country.

Production of high quality seed for commercial species is constrained in terms of seed sources, and equipment for seed collection, processing, testing, storage, and distribution equipment. Other constraints are related to difficulties in predicting demand, inadequacy in documentation and certification. Consequently the constraints to commercial tree seed sourcing, handling and supply were identified as;

- Inadequate seed sources
- Lack of modern equipment for seed collection, processing, testing, storage, and distribution.
- Inadequacy in documentation and certification of tree seed
- Unpredictable seed demand
- Use of poor quality tree seed by most stakeholders

This report has endeavoured to elucidate measures that can mitigate the identified constraints. Such measures include;

- Establishing more seed sources from breeding programs
- Contracting farmers for the establishment of seed orchards.
- Equipping the Kenya Forestry Seed Centre (KFSC) with equipment, personnel and adequate funds
- Enhancing documentation and certification of tree seed
- Raising awareness on benefits of using high quality tree seed for commercial forestry
- Promoting use of high quality and certified tree seed for commercial forestry

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1.0 INTRODUCTION

1.1 Rationale for the Study

It is estimated that a total of 1.8 billion tree seedlings would be required to enable the country achieve its 10% tree cover target by 2022. An inter-ministerial committee in 2019 estimated that this target will be achieved by an annual supply of 80 tons of tree seed. This requires that KEFRI increases its annual seed production by 300%. KEFRI has therefore analysed the current status in provision of tree seed in Kenya to highlight conditions and relationships of the important factors of sustainable production, utilisation and conservation of high quality tree seed in the framework of sustainable development in Kenya. This information will assist Kenya in the strategic planning and priority setting of an effective tree seed and germplasm system responsive to the present and future needs of the country.

The theme of commercial forestry in Kenya is gaining currency with realisation that forestry is an attractive investment that can support industrialisation in the rural areas. Consequently, all tree growing entities, whether public and private, will require access to quality tree seed. The objective of the study was to collate information on status of tree seed for commercial tree species and establish existing gaps to unlock the potential of commercial forestry in Kenya.

1.2 Study Method

The study was conceptualised to review the national forest seed demand and supply chain to appreciate details that are important in effectively planning on how to meet the requirements of high quality tree seed for commercial forestry. The scope of the undertaking was limited to the major commercial tree species in Kenya namely; *Cupressus lusitanica*, *Pinus patula*, Eucalyptus, Casuarina and *Grevillea robusta* and *Melia volkensii.* The research approach principally used secondary data and literature review. Information relevant to the study was gathered through analysis of secondary data held in various institutions such as Kenya Forestry Research Institute (KEFRI), World Agroforestry Centre (ICRAF), Kenya Forest Service (KFS), Kenya Plant Health Inspectorate Services (KEPHIS) and in the Internet. To reinforce the review on provisioning of seed for commercial forestry, a study tour was made to various institutions in Kwa Zulu Natal Province in South Africa. The country was chosen as it has a successful commercial forestry sector based on quality seed production. Periodical workshops were held to draft the status document and also to subject it to peer review and validation within and outside of KEFRI.

1.3 Evolution of tree seed production in Kenya

Records show that systematic tree seed production in the region began over a hundred years ago. For example, the forest administrations in Kenya that was set up by the colonial government embarked in

organised seed collection of some indigenous species and importation of a few seeds way back in 1902 (Oyalo, 1994). The practice of provisioning tree seed for commercial forestry species has remained a priority in the country with quantities required progressively increasing over time.

1.4 Evolution of tree seed supply in Kenya

Records show that by time of independence, Kenya had about 61,000 ha of fast growing softwood plantations with a vibrant saw milling sector and was investigating the possibility of a pulp and paper mill (Mugo *et al*. 2010). In terms of seed demand, the amount required for sustainable plantation forestry development would have grown by a third from the figures of 1950 to an annual total tree seed demand not exceeding 40 kilograms (pine – 10 kilos, eucalypts 6 kilos and cypress 20 kilos). By this time, the country had formalised the process of seed production through tree breeding initiatives and establishment of seed sources. Tree improvement and management of seed production areas started in 1936 and species trials started in 1940s continued through to 1960s, and to a lesser extent in 1970s (KEFRI, 2018). In the late 1970's a small forestry seed unit within the silvicultural department of the Kenya Agricultural Research Institute (KARI) provided seeds of exotic industrial plantation species.

At the pinnacle of plantation development in the country in the 1980s, Kenya had plantation areas of totalling 170,000 ha (Mugo *et al*. 2010). Based on the hectares that were being planted, the annual total tree seed demand to satisfy tree planting targets by the Forest Department would have been about 28 kilos pines, 56 kilos cypress and 16 kilos eucalypts based on prescribed acreage ratio for different species.

In the 1980's, Kenya faced several environmental crisis such as soil erosion and unmet demand for energy requirement whose root cause could be attributed to increasing populations. Against this background, the Kenya Forestry Seed Centre (KFSC) was formed in 1985 with support of the German Agency for Technical Cooperation (GTZ) as a sub-programme of KEFRI. The overall goal was provision of certified, site appropriate, high quality tree seed in sufficient quantities. KFSC was formed to enable the country cope with challenges of supplying diversified tree species including indigenous tree species to cope with the totality of environmental conservation. However, KFSC still recognised the importance of meeting the demand of seeds for commercial tree species

Kenya Forest Seed Centre enhanced its capacity to provide tree seed and the amount collected and supplied grew. However, due to forest mismanagement through illegal allocation of forest lands and political interference that took root in the 1990s, there was decline in quality of plantations raised. Consequently, the impact of the seed supplied to the forest department was not readily visible. An analysis of plantation stocking in the county reported in the Forestry Outlook Study for Africa (FOSA) – FAO report indicated that the country had by 1999 a stocked plantation area of approximately 78,000 ha. Of this area, 48.8% was cypress, 34.7% was pines and 8.3% was

Eucalyptus spp. This area was in contrast to a stocked area of about 163,820 ha by 1992 (KFMP, 1994) and a projected 134,000 ha by year 2000 (http://www.fao.org/3/AB569E/AB569E04.htm).

1.5 Seed supply to meet current commercial forestry programmes

The current forestry development is guided by the National Forest Programme (2016 to 2030). The National Forestry Programme (NFP) is guided by the constitution of Kenya 2010 which has set a target that the country should achieve a tree cover of 10%. The NFP has set agenda for development and coordination of the forestry sector to meet the needs of Kenyans, based on Kenya's Constitutional values and principles of Vision 2030 that aims to have the desired forest cover of 10% realised by 2030. The goal of the NFP is sustainably managed forests and allied natural resources for socio-economic growth and climate resilience. The NFP has the Forest Productivity Cluster whose thematic objective is to increase forest and tree cover and optimise management of forest resources. The role of quality tree seed is recognised by the NFP. The NFP identifies that the country faces an acute shortage of good quality tree seed and that the use of inferior seed will continue to degrade the quality of forest products from plantations, trees on farms and woodlots. KEFRI has developed a National Tree Seed Production, Certification and Distribution Strategy (2018-2023) which among others address the concerns raised by the NFP to meet demands for quality tree seeds. The strategy has a goal of producing high quality tree seed in sufficient quantities with main objectives being:

- Conduct a baseline survey to establish the actual national demand for tree seed
- Produce adequate amount of high quality tree seed of priority species and
- Undertake research and development in support of production of high quality tree seed

2.0 TREE SEED SUPPLY CHAIN IN KENYA

2.1 Situation analysis

The Kenya government forest policy, as stipulated in draft Sessional paper No. 9 of 2005, is to increase national forest cover to 10% to conform to acceptable international standards. To achieve this, the government set an annual planting target of 360 million seedling which has been revised to 500 million seedlings annually in order to achieve the 10% tree cover by 2022. The bulk of this production is for planting outside forest reserves, and the balance will be for replanting forestland which has been cleared but not replanted, or whose stocking are unsatisfactory.

Quality tree seeds in sufficient quantities is critical in production of seedlings for afforestation, reforestation, commercial plantations and farm forestry. The main producer of quality tree seed in the country is KEFRI which currently meets 25% of the national demand with a potential to double production.

The tree seed industry in Kenya is complex and can be described by different models of demand and supply. KEFRI produces seeds of the major plantation species such as *Cupressus lusitanica*, *Pinus patula*, Eucalypts, Casuarina, *Grevillea robusta* and *Melia volkensii* which are basically demanded by the Kenya Forest Service. KEFRI also plays a critical role in production of seeds of rare, endangered and threatened species for conservation including *Lovoa swynerttoni* and *Osyris lanceolata*. KEFRI also produces seed for other tree species that are widely planted by farmers, such as *Calliandra callothyrsus*, *Dovyalis caffra*, *Markhamia lutea*, *Acacia mearnsii*, *Senna siemea*, *Moringa oleifera* among others. Other agents are engaged in tree seed production including individual farmers, NGOs, CBOs, and faith based organisations. However the quality and quantity of the seed produced cannot be ascertained. The bulk of these seed end up in production of seedlings used in farm forestry and reforestation programmes.

In spite of the fact that establishing tree seed demand and supply is accepted as crucial, only one national study on status of tree seed supply has been undertaken in Kenya to date. In 2007 in a study on the "Status of the Tree Seed Industry in Kenya and Role of Kenya Forestry Seed Centre" commissioned by KEFRI, FORENCON Company Limited summarized that KFS is the main client for seed of commercial tree species from KEFRI. KEFRI through its Seed Centre has endeavoured to establish a production system based on scientific and technical principles for the provision of high quality tree seed which include: establishment and management of seed sources; seed collection processing, testing, storage and distribution.

2.2 Trends in Tree Seed Demand for Commercial Tree Species

The major commercial tree species in Kenya have been *Cupressus lusitanica*, *Pinus patula*, Eucalyptus, Casuarina and *Grevillea robusta*. However, recently the species have been diversified to include *Melia volkensii,* Over the years, KEFRI supplied seeds for establishment of commercial tree species in gazetted forest land. However, in the last decade, the establishment of plantation in Government estate has slowed down slowing of demand. In the past, there have been conversion of plantation forest area to other land use hence reducing the demand for tree seed for plantation establishment. The reduction in demand of quality forest seed from KEFRI has also been caused by interference by some CFAs who collect, distribute and use seed of unknown quality in plantation establishment and have also encroached on forest land. There were also instances of non-adherence to planting programmes leading to planting back logs.

The goal of NFP is to promote tree planting on farm, private plantations, reforestation and afforestation which is expected to increase demand for high quality tree seed. Commercial forestry has been proposed as a viable option for enabling the country achieve its objective of increasing the forest cover. The role of quality tree seed is crucial in making commercial forestry succeed in Kenya. KEFRI has therefore prioritised and undertaken a study on the status of the seed supply chain for commercial tree species.

3.0 TREE SEED PRODUCTION FOR COMMERCIAL TREE SPECIES IN KENYA

3.1 Tree seed sources for commercial tree species

Seed stands and seed orchards established by tree breeders are preferred sources of seeds for commercial tree species as tree growers gain from tree improvement efforts. Genetic gain estimations of up to 67% have been achieved through improvement of *E. grandis*, where the mean annual increment in volume has increased from 30 m^3ha^{-1} to 50 m^3ha^{-1}, subject to optimal management, silvicultural and site conditions (Oballa *et al.* 1996). As the process of tree breeding is expensive and time consuming, it is difficult to meet seed demand for commercial tree species exclusively from seed orchards. KEFRI therefore collects seed from superior performing trees and establish seed stands that also provide commercial tree growers with seed that confer similar qualities in yield as seed from orchards. KEFRI also selects well performing stands in plantations and in natural stands and manage them for production of seeds of high genetic quality. However in terms of productivity, the seed will not match the seeds from seed orchards or established seed stand. Nevertheless, as the seed has a wide genetic diversity, trees established from such seed have inherent resilience to cope with diversified or intensified vagaries of nature such as disease outbreaks. KEFRI has a total area of around 400 ha of seed sources for commercial tree species. The approximate areas for each category of seed source are: 82 hectares seed orchards, 23 hectares established seed stands, and 335 hectares selected seed stands.

3.2 Tree seed collection and processing in KEFRI

Kenya Forestry Seed Centre emphasises maintenance of genetic diversity by collecting seed from a large number of individuals. In commercial forestry, tree improvements aspects such as grafting, crossing and selection aim at providing users with species with advantageous qualities in terms of its genotypic and phenotypic characters which implies a narrowing of genetic base in seed orchards. KFSC in collecting in such orchards collect at the clone level emphasising on collecting from as many recommended clones and ramets as possible. To avoid over representation of any one clone, the rule of thumb is that not any single clone should contribute more than a third of the volume in the composite seed lot.

Seed collection

The tree seed production for commercial tree species from 2015/16 to January 2021 is shown in Table 5. Over this period, close to 3,000 kg of seed has been collected capable of raising of close to half a billion seedlings that could occupy approximately 340,000 hectares.

Table 1. Tree seed production for commercial tree species (2015 to 2021)

Species	Year / kg of seed collected						Total (kg)
	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	
Casuarina equisetifolia	7	2	43	0	7	147	**206**
Casuarina jughuniana	5	10	0	46	42	69	**172**
Cupressus lusitanica	0	167	162	450	392	1466	**2637**
Eucalyptus camaldulensis	74	55	77	174	80	49	**509**
Eucalyptus grandis	62	27	71	89	31	88	**368**
Eucalyptus urophylla	6	0	4	45	0	0	**55**
Grevillea robusta	0	0	0	0	0	0	**0**
Melia volkensii	0	18	92	54	49	208	**421**
Pinus patula	81	0	67	229	93	67	**537**
Total year kg	**235**	**279**	**515**	**1086**	**693**	**2094**	**4905**

Seed processing

Initial tree seed processing is undertaken at all collection centres. Some fleshy collected fruits such as Prunus ferment if stored in bulk for any length of time and the fermentation impairs seed viability. KFSC has developed technology for prolonging shelf life of some recalcitrant tree seed for about 3 weeks. However, seeds of most commercial tree species used in Kenya are orthodox seeds (seed that can be dried and stored before use).

Muguga seed collection centre has a hot room that allows for seed extraction even during the cold seasons. KEFRI has developed technologies for difficult to extract seed such as *Melia volkensii* and *Vitex keniensis*. Kenya Forest Seed Centre employs different measures to clean seed such as winnowing, hand sorting, mechanical blowers and shakers, and use of screens.

3.3 Tree seed testing and certification at KEFRI

3.3.1 Seed testing

Seeds are tested for species purity, genetic integrity, moisture content, seed purity and germination following ISTA guideline. At the field level, a taxonomist identifies trees during seed source identification. The identification is crucial for closely resembling species such as casuarinas and eucalypts. A cutting test is done to examine a sample of seed to establish the state of development or maturity of the seed, incidence of damage by pests and diseases and whether the seeds are empty or

filled. The cutting test can result to deferment of collection if seed required more time to mature or abandonment of collection if the incidences of pests, diseases or emptiness is above reasonable threshold.

At the laboratory, a quick moisture content test is key in determining whether to dry or store the seed. A slow moisture content determination is done to confirm that seed moisture content for a particular species has been attained for orthodox seeds. Seed purity is a ratio of the weight of clean seed to the weight of the chaff separated from a sample of a given seed lot. It is important to determine purity of a seed lot so that this factor can be used in determining how many seedlings can be expected from a given weight of seeds based on the germination percent and the number of seeds per kilogram.

Seed weight is done to determine the number of seeds in a given weight. When the seed weight is combined with purity and germination, the customer can be supplied with the correct amount of seed. Germination capacity is the percentage by number of pure seed, which will produce normal seedlings. KEFRI undertakes germination test for all seed lots before storage. Retrial germination test is done for seed that are stored for extended period in line with of KEFRI ISO procedure No. 7 of R&D procedures manual. Where a quick estimate of germination result is required, a Tetrazolium Test (TT) is conducted for the respective seed lot. Under this test, an estimate of germination can be obtained within 24 hours.

Seed health test involves identifying potential threats from insects and diseases that may reduce the quality of seed. It is routinely carried out at KFSC to identify insects, fungi and bacteria which are detrimental to seed quality. The results of the tests are used to guide prescriptions of remedial measures which may include dusting with fungicides and insecticides during storage and sowing.

3.3.2 Seed certification

Seed certification is governed by both international and national legal frameworks and conventions. The International Convention on Plant Protection is implemented through a National Designated Authority (NDA). In Kenya, the NDA is Kenya Plant Health Inspectorate Service (KEPHIS). The Seeds and Plant Varieties Act CAP 326 empowers KEPHIS to undertake seed certification activities. This Act provides the legal basis for authorization of competent private or public persons to undertake specified certification activities. The objective of the authorization is to complement KEPHIS and to enhance efficiency in seed certification process.

Currently KEFRI is involved in advising KEPHIS on import and export of tree seed for issuance of import and phytosanitary certificates. The two institutions are in the process of developing regulations and procedures for tree seed certification to be undertaken at KEFRI.

3.4 Status of tree seed storage

In ensuring that seed viability is maintained KFSC has invested in seed storage facilities that comprise of cold rooms in Muguga, Maseno and Kakamega with a capacity of about 22 tons. The stores have temperature conditions of between subzero and +10 ^{0}C to preserve seeds under controlled environment that maintains seed viability for long periods.

3.5 Status of tree seed demand and supply

In Kenya, demand for tree seeds is largely driven by the government's afforestation and reforestation programs, individual entrepreneurs, NGOS and recently faith based organizations. While the governments focus is more on plantation and farm forestry species (*Eucalyptus grandis*, *Pinus patula*, *Cupressus lusitanica*, and *Grevillea robusta*) the NGOs tend to focus more on indigenous and multipurpose tree species especially for environmental conservation, fodder and nutrition. At the KFSC this study was able to get a nine year supply data for commercial tree species (Table 2.) However there was no concrete seed demand data for commercial tree species.

Table 2. Tree seed supply for commercial tree species (2010 - 2018)

Species	Seed supply in Kg								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
Casuarina equisetifolia	0	0	0	0	0	0	0	0	118
Cupressus lusitanica	127	357	557	450	229	229	150	236	473
Eucalyptus grandis	502	655	551	490	420	465	461	403	262
Markhamia lutea	80	135	48	83	69	71	45	70	124
Melia volkensii	0	0	0	0	43	0	81	128	167
Pinus patula	277	159	194	139	118	93	196	425	313
Vitex keniensis	277	142	152	93	102	98	61	93	188
Gmelina arborea	155	147	46	169	50	77	84	44	247
Tamarindus indica	175	97		67	39	0	79	77	43
Acacia senegal var.Kerensis	112	0	0	0	0	0	40	41	125
Acacia tortilis	129	0	166	47	0	0	77	35	122
Grevillea robusta	0	0	0	0	218	260	378	461	294

3.6 Status of tree seed marketing and distribution

Seed distribution in Kenya is regulated under seeds and plant varieties Act, Cap 326 that guides the distribution and exchange of seeds. The distribution process entails proper seed storage, packaging, labelling and transportation of seeds to various distribution points. KEFRI markets and distributes high quality tree seed through KFSC which is a registered seed merchant by the regulator (KEPHIS). The KFSC also provides information to users on seed handling, pre-sowing treatment and sowing methods.

KEFRI continuously and systematically determines consumer needs, pricing, packaging and advertisement of available seed to meet market demand. The KFSC currently distributes seed through

its centres at Muguga, Londiani, Maseno, Kitui, Karura, Nyeri and Gede. However, this distribution is inadequate as it lack nationwide penetration.

In its endeavour to reach a wider customer base, KEFRI undertakes marketing using print media, below line marketing like interactive online website, holding of market days, exhibiting during agricultural shows and social media. Most of KEFRI tree seed is sold locally. However, some tree seed is sold internationally. KEFRI works closely with KEPHIS to ensure all aspects of certification are adhered to for smooth transfer of materials to those international clients. Table 9. shows the amount of seed of commercial tree species that has been sold to international clients from 2015 to 2019.

Table 3. Sale of tree seed to the export market by KEFRI (2017 - 2018)

County	Species	Quantity(Kg)
	Eucalyptus camaldulensis	5
	Eucalyptus grandis	50
	Eucalyptus saligna	10
	Markhamia lutea	30
	Pinus patula	15
	Grevillea robusta	10
South Kivu	*Eucalyptus grandis*	2.5
	Eucalyptus saligna	3
	Eucalyptus camaldulensis	1.5
Ethiopia	*Cupressus lusitanica*	20
	Grevillea robusta	45
	Pinus patula	35
Tanzania	*Grevillea robusta*	100

3.7 Tree seed documentation

Seed documentation serves to give a seed lot a unique reference number that allows suppliers and users keep track of the performance of a particular seed lot. Even for a physiologically and genetically high quality seed lot an error in its documentation makes the seed lot lose its value. Documentation also facilitates seed exchange and trade. In KEFRI seed documentation is done throughout the seed production system. All seed production data is currently stored in excel while seed distribution data is filed in ACCPAC. The aspects documented for every seed lot are shown in Table 10 below:

Table 4: Documentation of tree seed at KEFRI

Aspect	Details captured
Seed stand establishment and development	Species, origin/provenance of basic material, identity of genotypes, silvicultural tending, phenology, area, maps, edaphic, geographic, ecological and climatic conditions, mapping of the stand, sketch map of its location
Seed source	Species, origin/provenance of basic material, category of seed source, locality (sketch map), ecological and climatic conditions, ownership, area, edaphic factors, topography, accessibility, year of planting
Phenology	Species, locality, area, date of recording, flowering integrity, fruiting stage and expected date of maturity
Seed collection and handling	Date of collection, collector, species, seed source, cutting test, method of collection, transportation containers, duration of temporary storage, extraction method and drying method
Seed test results	Species, cutting test ,purity, moisture content, seed weight, health (insects pests and pathogens) other tests eg tetrazolium test)
Seed lot	Seed source details (as presented), collection and handling, seed test results, identity or batch number
Seed storage	Species, seed lot identity/batch number, weight stored, running balance
Seed dispatch	Species, seed lot identity/batch number, customer, weight required, weight issued, date dispatched, seed advice note

3.8 commercial tree seed Production by other stakeholders

3.8.1 KEFRI registered tree seed suppliers

KEFRI has only a limited number of established seed sources for *Grevillea robusta*. Due to the high demand for Grevillea seed, KEFRI has contracted 7 private producers to be its seed suppliers for the species. In 2017-2018 FY, the private seed suppliers delivered 563.4 kg of Grevillea seed (Table 11).

Table 5: Grevillea seed supplied to KEFRI by private seed suppliers (2017-2018)

Species	Provenance	Supplier/ Company	Batch No.	Test No.	MC%	Purity %	Seed weight	Germ. %	Quantity Supplied (kg)
Grevillea robusta	Sipili	Bildad	268-101/17	5139	10	96.4	76,175	73	176.45
	Laikipia	George	268-102/17	5145	10.4	94.8	76,365	63	204.2
	Loitokitok	Aramco	268-104/17	5153	9.3	98	83,612	61	182.7
Total									**563.4**

Only in moisture content were some seed lots slightly above the recommended limits. However, the status of seed sources from which the private suppliers collect seed are not documented in terms of age, area or number of trees, the seed origin or provenance. The only available data is what is captured in the seed lot label such as the collection date, the species, collector and location of the seed source.

3.8.2 Unregistered entities

Tree seed is collected by individual farmers, community based organisations, faith based organisations, companies and NGOs. The desktop study was unable to establish the quantities of tree seed collected by such entities. For large companies such as Raiply, Comply and PPM, who plant seedlings raised in their nurseries located in government forests, most of their seeds are purchased from KFSC, and in some cases from private suppliers. Other companies such as the tea estates either obtain their seeds from their own plantations, purchase seeds from KFSC or import small quantities of high quality elite material mainly from South Africa or Australia (Table 12).

Table 6. Tree seed imported into the country in the years (2016 - 2018)

Species	Year	Weight (Kg)	Origin	Merchant's Name
Eucalyptus Grandis	16	0.5	South Africa	Tree Biotechnology Project
Corymbia citriodora	16	0.5	Australia	Tree Biotechnology Project
Corymbia lenryi	16	0.27	Australia	Tree Biotechnology Project
Eucalyptus radiata	16	0.16	Australia	Tree Biotechnology Project
Pinus Spp	16	2.5	Jordan	Tree Biotechnology Project
Eucalypus spp and hybrids	18	0.05	South Africa	Kakuzi Ltd

5.0 GAPS ANALYSIS

Table 7: Gaps and mitigation measures in tree seed supply chain

SNo.	Identified gap	Mitigation measure
1	Inadequate seed sources	• Establish more seed sources from breeding programs • Contract farmers for the establishment of seed orchards
2	Modern equipment for seed collection, processing, testing, storage, and distribution.	Equip the Kenya Forestry Seed Centre (KFSC) with equipment, personnel and adequate funds
3	Inadequacy in documentation and certification of tree seed	Enhance documentation and certification of tree seed
4	Unpredictable seed demand	Raise awareness on benefits of using high quality tree seed for commercial forestry
5	Use of poor quality tree seed	Promote use of high quality and certified tree seed for commercial forestry