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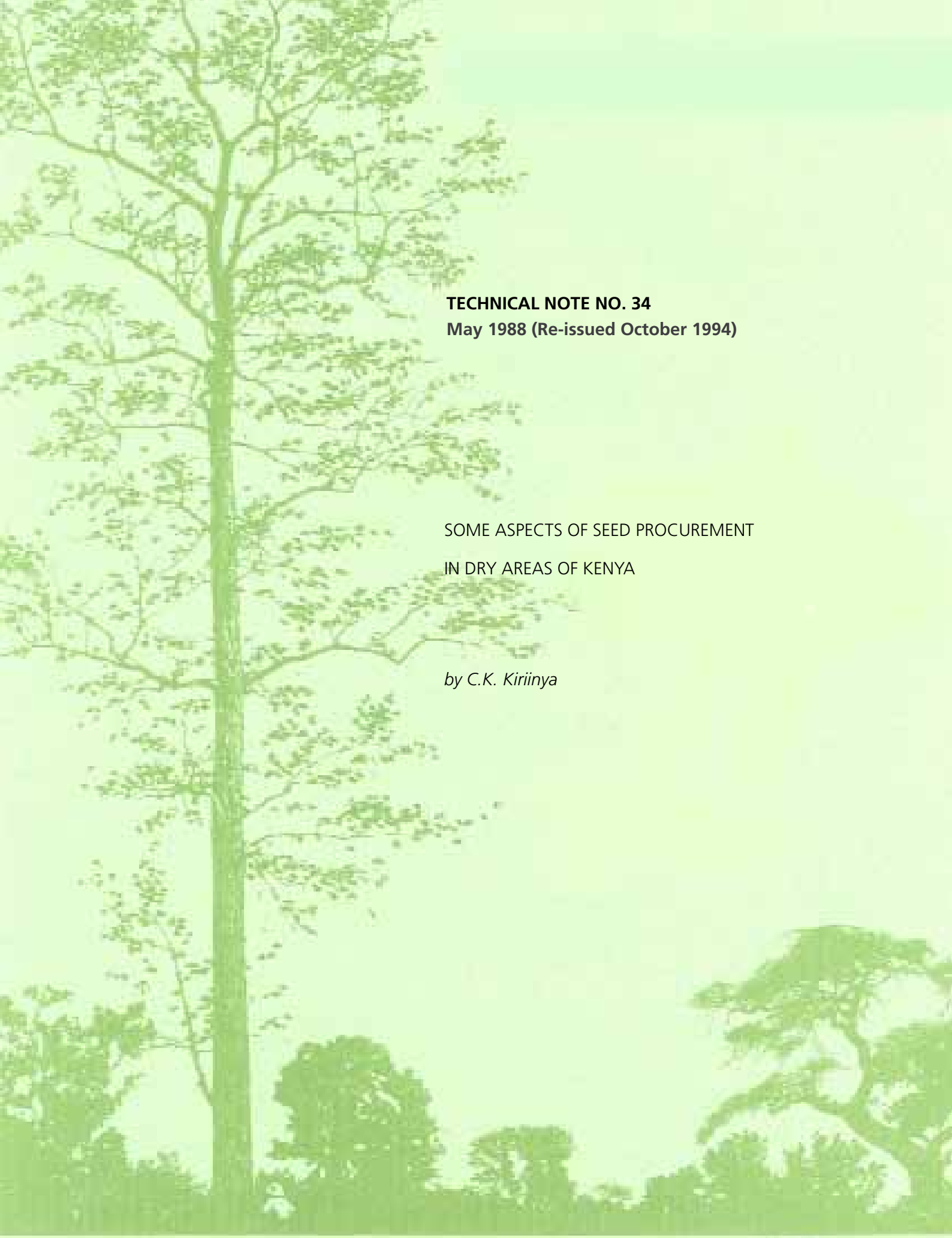

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SOME ASPECTS OF SEED PROCUREMENT IN DRY AREAS OF KENYA

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1. INTRODUCTION

In many countries of the world the number of trees planted increases each year. A recent survey (Lanly 1982) has estimated that the area of forest plantations in tropical countries will increase from 11.4 to 17.0 million ha. between 1980-1985, an increase of 48% over five years. In Kenya our target is 100 million trees per year. In addition to new planting, replanting of harvested plantations of non-coppicing species must be carried out on a considerable scale each year.

Forest plantations are a powerful tool in foresters' continuing efforts to increase productivity per unit area, the only means of reconciling the increasing demands for forest products and services on one hand with decreasing area of land available for forestry on the other. Plantations also offer the means of using, on a large scale, the genetically improved material developed by tree breeders. Although there is no case for the indiscriminate replacement of all natural forests by plantations, their judicious use by providing an alternative source of forest products can reduce pressure on the remaining natural forest and so help to conserve it as a habitat and a source of genetic diversity.

Considerable improvements in the productivity of tropical tree species suitable for industrial plantations have been achieved through international programmes to explore, collect seed, evaluate and conserve species and provenances (Kemp 1973). This kind of research has scarcely been applied at all to non-industrial tree species. In recent years attention has focused on planting trees to meet the needs of rural communities giving priority to social as opposed to industrial objectives (FAO 1977). The need for large-scale tree planting for firewood production in many countries is now clearly recognized (NAS 1980).

2. IMPORTANCE OF SEED

Not only do plantations have a major role as producers of timber, pulpwood, and wood-based panels for forest industries, but fuelwood and pole plantations and farm woodlots are of local importance in many countries. Tree planting is not confined to block plantations; shelter belts and dispersed planting for soil stabilization, habitat improvement, urban and rural amenity or as part of agroforestry system, all benefit human environment. With such a variety in planting purposes it is not surprising that the scale of tree planting and the variety of species planted continue to grow in so many countries, and Kenya is no exception. The current greatly increased interest in agroforestry opens up a whole new range of species for trials of mainly multipurpose species. This new development will introduce new opportunities and new problems in seed collection and handling. Owing to deforestation and general lack of firewood and fodder as well as to severe environmental abuse in general, priority is being given to dry lands in the search for suitable genetic material.

With a few exceptions, species are propagated from seed and the suitability and quality of the seed have a big effect on the success of plantations raised from them. The use of good seed from stands of high genetic quality is widely recognized as the best means of ensuring fast-growing and healthy plantations capable of yielding high-quality wood (Aldhous 1972). Seed quality comprises both genetic and physiological quality.

It must be stressed that »good seed« implies seed which is both of high viability and vigour and is genetically well suited to the site and for the purpose for which it is planted. Physiologically good seed may lead to successful establishment of a plantation but this is of little value if it is very slow-growing due to bad

site or if it produces the wrong kind of wood because the provenance or genotype was incorrectly chosen. On the other hand, there is little point in producing genetically improved seed at an increased cost if it is killed by poor handling techniques and has to be replaced or supplemented by inferior seed in order to achieve planting targets. Good seed handling is an essential complement to genetic improvement.

Quantity as well as quality of seed production is important. Variation in the quantity of seed produced in natural stands affects the forester's decision as to the years in which to collect seed and the trees from which to collect it. More intensive management affords him the opportunity to stimulate heavy seed production in genetically superior crops through deliberate treatment, e.g. thinning in seed stand, or a combination of initial spacing, irrigation, fertilization and thinning in seed orchards.

3. SEED AND ITS DEVELOPMENT

Most vegetation used by man whether natural or planted is propagated from seed. Understanding of the development and behaviour of the seed is therefore essential to activities directed towards afforestation. Hence some knowledge of the biology of seed is essential to their proper handling. Knowledge of flowering phenology enables the collector to select the timing and methods of seed harvesting most appropriate to the species, while handling, storage and pretreatment of seed will benefit from a knowledge of how seed develops in nature.

Seed plants are divided into two main groups, i.e. the gymnosperms or conifers and the angiosperms (the true flowering plants). Thus seed may develop either from cones or from true flowers. A seed is a reproductive unit which develops from an ovule, usually after fertilization. In the angiosperms, development of the fertilized seed is normally accompanied by development of the fruit.

The interval between flowering and maturation of seeds and fruits varies greatly with species even within the same genus. In Eucalyptus it varies from one month in *E. brachyandra* to 10-16 months in *E. diversicolor* (Boland *et al.* 1980). In *Pterocarpus angolensis* the interval between flowering and fruit maturation is 8 months (Boaler 1966). The shortest interval on record between flowering and seed maturation for a tropical timber species is apparently 3 weeks. It should be noted that mature fruits do not invariably indicate mature seed. Still less can the number of sound seeds be predicted from the number of fruits; for example in *Tectona grandis* the number of sound seeds per fruit can vary beetween 0 and 4 (Kamra 1973) and still greater variation is possible in other genera.

4. SEED COLLECTION AND HANDLING

4.1 Seed Collection

Species which bear ripe seed in adequate quantities at all times present few problems to the experienced seed collector, but such species are few. Some species bear seed throughout the year but only a little at any one time and this makes seed collection slow and expensive. For the majority of species the seed season is concentrated within a few weeks and the collector's objective is to collect as much of the seed as possible within the short period while the seeds are mature but the fruits have not yet fallen or dehisced. In semi-arid regions no seed stands or seed orchards have been established, hence collection is made in natural forests with many different species or from a number of different widely scattered sources. This calls for trained collecting teams to operate with the right equipment in the right place at the right time.

Seed collection of non-industrial species is usually easier than for industrial species which necessitates elaborate tree climbing techniques and equipment; collection is usually carried out by tree climbers who cut off the fruits. For many species, fruits or seeds may be dislodged by shaking them on to polythene sheets or sacks extended below the tree. Problems may arise in collecting because the fruit of several species all ripen at about the same time. Since the pods of many legumes dehisce very quickly on ripening, appropriate arrangements have to be made when planning collecting strategies. Many fruits, e.g. those of Acacia and Prosopis are eagerly sought by cattle and goats. A few species fruit lightly and sporadically while others fruit abundantly only every two or three years. Climatic irregularities impose further limits.

Destruction rates of seed particularly of legumes by insects of the Bruchid family range from 20-100% (Doran *et al.* 1983) and this means that quantities of collectable seed are limited and collections must be spread over several years. Of the species studied, Bruchid attack has been particularly severe for *Acacia albida*. Birds, mammals, insects, fungi and bacteria all do damage in flowering as well as in fruiting stages.

The seed of a few species, for example some *Terminalia spp.*, can be attacked by insects on the tree and may have to be picked unripe and ripened artificially.

4.2 Seed Extraction

Seed contained in a soft fleshy pulp should usually be cleaned immediately after collection. Otherwise, if the fruits are allowed to lie in a heap, they will ferment. With winged seeds care is needed to prevent them from blowing away. Dehiscent pods usually open automatically when dried or are easily broken up. Some of them, like *Hura sp.* and *Bauhinia sp.* dehisce violently and these together with those containing light winged seed should be covered to avoid losing the seed.

Although seed collection presents few problems, seed extraction is more laborious for many of the legumes which have hard indehiscent pods, e.g. *Prosopis spp.* and *Acacia farnesiana*.

Manual beating or threshing followed by sieving or gravity separation have been successfully used for most species. *Prosopis juliflora* and *Prosopis chilensis* present particular problems to which no truly satisfactory solution has been found. Several methods cited in literature have been tried (Brown and Belcher 1979; Saxema and Khan 1974) but these have either not proven satisfactory or involve mechanical equipment unsuitable for field use.

Indehiscent hard pods like *Pterocarpus angolensis* can be sown after cutting or chipping one side (FAO 1956). Many species including *Cassia nodosa*, *C. fistula*, and similar species can be broken up by pounding them without damaging the seed. The seed is removed from the opened fruit by winnowing in the same way as a grain crop.

4.3 Cleaning

The seed of many species, particularly of the Eucalypts, is often mixed with chaff. In the case of most Eucalypts this makes up 80-90% of the total weight. The seed can be cleaned by sifting through wire gauze of appropriate mesh. It is important not to confuse these particles with the seed itself.

Seeds infested by insect borers can often be separated by floating in a bucket of water. The good seed sinks and can then be dried for storage.

4.4 Storage

Once it has been collected, extracted and cleaned, the seed is carefully dried to about 12% moisture content and stored. In semi-arid areas most seeds can be stored quite satisfactorily in cotton bags or sacks, the only safeguard required is to keep them away from rodents and insects. Sealed metal containers or screw-cap glass bottles are much better.

4.5 Pretreatment

Most legumes exhibit seed dormancy due to the hard seedcoat which is almost impervious to water. This means that germination is slow and irregular and necessitates the application of some type of pretreatment. Numerous techniques have been used including treatments with cold, hot, or boiling water, acid or mechanical scarification, dry heat and microwave energy. Owing to the great variation in seed size and seed coat properties both between and within species, careful calibration of all methods is required in order to treat the seeds effectively without damage. With small, little known and valuable research seed lots it is particularly important to obtain high and uniform germination.

For this reason manual scarification by chipping, nicking or filing is recommended. Chipping one quarter of the way around the circumference from the micropyle is the most reliable method and should reflect most closely the germination capacity. Many seeds particularly those with hard seed coats retain their viability for many years but germination in subsequent years declines progressively. Therefore samples of each seed lot are tested for viability in both nursery beds and laboratory at regular intervals in accordance with standard germination tests.

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