PAISPO
Provision of adequate tree seed portfolios

World Agroforestry Centre

EFCC
ETHIOPIA

Norway's International Climate and Forest Initiative (NICFI)

Training of Trainers, Seed procurement

Consultancy Report

March 2020

TRAINING

Training of Trainers, Seed procurement

Consultancy Report

Lars Schmidt

Consultant, University of Copenhagen

Provision of Adequate Tree Seed Portfolios (PATSPO)

Sebeta, 1-7 March 2020

Report from consultancy

Training of Trainers, Seed procurement

PATSPO, Sebeta, 1-7 March 2020

Lars Schmidt,
Consultant, University of Copenhagen

Introduction

Following a number of mainly theoretical training courses on seed science and technology in 2018-19 under the project PATSPO (Provision of Adequate Tree Seed Portfolios), the regional seed centers in Ethiopia requested subsequent training to be more focused on development of practical skills in connection with seed procurement. PATSPO therefore launched preliminarily two 'on-the-job' training sessions in March – April 2020 (TOR annex II). The present report pertains to the first of these trainings, which were launched in Sebeta Regional Seed Center with 3 participants from FRC in Addis, 5 from Sebeta and 5 from Mekele. There were total 13 participants plus two instructors (Annex III). The field exercises were conducted mainly in Suba Forest Reserve about 2 hours' drive from Sebeta.

The objective of the training was formulated into 12 tangible objectives (Annex I) stating what participants were expected to be able to do by the end of the course. An overall objective was to enable participants to make species specific seed procurement and handling protocols and instructions to fellow staff in seed procurement section of the centers. Activities thus included the full range of activities from seed source identification, selection of seed trees, collection, processing, testing to calculation of seed requirement and end use assessment. Focal species were selected hands-on in the field, since it was necessary to have a reasonable population and good seeding trees to be able to perform all the practical procurement activities. During the activities, information on trees and seeds were compiled. That information was cooperated into short Seed Leaflet following the outline / templates of UoC and PATSPO leaflets. That is also a tangible output was produced from the training.

The consultancy included 2 days pre-work in Addis for finalization of the programme, and 4 days after-work in Addis for reporting, compilation of data from the field into seed leaflets, and preparation of course outline for the next course

Teaching methods

During the course, different types of teaching methods were used:

- Lectures (including translation). Short introductory lectures were conducted in English and with a summary in Amharic (Annex III)
- Guided tour around the premises of Sebeta Regional Seed Center with demonstration of seed processing, laboratory and storage facilities.
- Field work in Suba, - collection of botanical specimens, seed source description, seed collection methods (from the ground and by climbing), crop assessment, maturity indices and observations.
- Laboratory work including cutting test, seed weight, fruit weight, purity calculations, viability test by tetrazolium chloride
- Data form filling including seed demand calculation
- Participant's presentations for the class, - seed procurement programme

Participant's evaluation

A final oral evaluation was conducted since a substantial part of the time was used for field work and transport. However, there were only minor feedback and suggestions for improvement. One participant mentioned that the time was too short to complete all the activities planned. The evaluation indicated that participants were generally happy with the contents of the course.

Trainer's observations and evaluation

- Participants are generally positive and engaged in the activities.
- There is a great improvement of communication and dialogue as the training proceeds, - a challenge to get participants to articulate themselves more freely at an earlier stage of the training. Maybe 'ice-breaker' exercises should be introduced as early socialization.
- There were power cut most of the time during the initial theoretical training session. Since it is a regular event in the country, non-electronic devices should have been used to a higher extent. The PATSPO posters prepared during previous training were suitable, but the A3 size is too small to be viewed from a distance. Flip-over or whiteboard would have helped.
- Much time was used in the field to orient ourselves with conditions and species. Pre-visits to the site would have allowed better on-site planning. However, the pioneering had the advantage that participants were eager to exploit opportunities. The one group working on *Albizia shimperiana* had difficulties carrying out some activities since there were only few trees. A better pre-survey would have identified fruiting *Juniperus procera* that occurred commonly in the forest and which contained more 'substance'.
- The four focal species turned out to give an excellent opportunity to cover a broad range of challenges since the species were very different and all contained specific problems and challenges. Examples were dioecism and pollination in *Hagenia abyssinica*, seed dispersal; recalcitrance and bird dispersal in *Croton macrostachyus*, plus tree selection in exotic plantation species in *Cupressus lusitanica*; and maturity issues and farmland seed source challenges in *Albizia schimperiana*.
- The theoretical sessions on theory of seed collection and processing were conducted as normal classroom presentation by the consultant.
- The seed harvesting methods could have been more efficient with the use of throw-lines and hooks for collection of *Albizia schimperiana*. Only a few participants ventured into actual climbing practice.
- After each lecture, co-trainer Miss Kedra Mohammed, conducted a summary of the lecture in Amharic. It seemed to work well since participants could easier express their experiences and questions in their native tongue.

Next training

Next training will be held from 15-22nd April in Bahir Dar with same focal topic on general seed procurement but with different focal species, which will be determined by the regional seed centre based on species importance and availability. .

Acknowledgements

Thanks to organizers including both PATSPO leaders (Søren Moestrup and Kiros Hadgu), co-trainer Kedra Mohammed and practical organizer Mekdes Sime. Also thanks to the management of RSC who provided training room facilities at the seed center in Sebeta

Training skill objective

Course objectives: The training course will enable participants to elaborate and apply a full seed procurement programme for selected species.

Skills, knowledge and capacities: By the end of the course, students should be able to:

1. List fruit and seed maturity criteria for a number of selected species
2. Collect voucher material for species documentation and verification, and carry out a verification check
3. Assess fruit loads based on survey counts
4. Fill in seed documentation forms correctly and clear
5. Assess seed health and document possible problems by conducting short tests
6. Apply safe and efficient seed collection methods with minimum damage to seed crops and trees
7. Apply fast field cleaning and extraction to reduce bulk
8. Assess and describe general fruit and seed conditions based on simple tests and observations
9. Elaborate a seed processing plan, including extraction, cleaning and drying, based on observations and test of incoming fruits and seed
10. Measure seed purity, seed weight and moisture content by standard seed testing methods
11. Elaborate seed and fruit conversion factors based on volume and weight
12. Write general guidelines on seed procurement for selected species based on observations and records from field and processing station

Provision of Adequate Tree Seed Portfolios (PATSPO) in Ethiopia, 2017-2020

TERMS OF REFERENCE

Consultancy on 'on-the-job-training (x 2)' in tree seed procurement for seed centre staff

February - May 2020

1. BACKGROUND

Provision of Adequate Tree Seed Portfolios (PATSPO) to enhance productivity and resilience of Forest Landscape Restoration in Ethiopia is a project supported by a grant from the Government of Norway through the Norwegian International Climate and Forest Initiative (NICFI). The project is implemented by the World Agroforestry Centre (the International Centre for Research in Agroforestry - ICRAF) in close collaboration with the Ethiopia Environment and Forest Research Institute (EEFRI) under the Ministry of Environment, Forest and Climate Change (MEFCC), and other institutions working in the tree seed sector in Ethiopia. PATSPO is a four-year project 2017 – 2020 based on an agreement between the Royal Norwegian Embassy in Ethiopia (RNE) and ICRAF.

PATSPO is designed to support Ethiopia in its ambitious programmes of forest landscape restoration with a commitment to restore more than 20 million ha of degraded forest landscapes within the next 20 years.

A major challenge of forest landscape restoration work is that it generally requires the use of planting material in large quantities of a broad spectrum of genetically diverse, healthy and productive tree species.

PATSPO addresses this major challenge by providing a multiple tree species programme able to provide:

1. organizational setup of the tree seed sector, including stakeholder identification and roles and responsibilities, based on a sector analysis;
2. species specific knowledge for most priority tree species;
3. a built up of the tree genetic resources for the future, comprising exploration, mobilisation, conservation, establishment, management and improvement; and
4. capacity to monitor and deliver quality seed and seedlings of multiple species required for large scale restoration.

All staff of the four RTSCs and FRC are engaged in one or more aspect of seed procurement from seed collection, labelling, documentation, processing, drying, testing, and storage. All the seed centres have expressed the need for more practical training of their staff in seed procurement. Based on the expressed demand PATSPO is organising two similar training courses in practical on-the-job-training in seed procurement, each of one-week duration. The courses will cover the following main element of tree seed procurement:

- Maturity criteria, - via cutting test and visual criteria
- Species documentation, - voucher collection and field pictures for later verification
- Fruit load assessments, based on spot counting
- Seed health, checking infestation rates and pest organisms
- Collection methods, adapted methods for accessing the crown with minimum damage to the tree and optimal efficiency (time calculation)
- Fast field processing to reduce bulk (e.g. removal of branchlets and leaves)
- Assessment of conditions of fruits and seeds at arrival to seed processing unit (general inspection of fruit loads)
- Extraction of seeds from fruits, - checking of methods of wet and dry extraction, and mechanical extraction
- Cleaning procedures (methods and sequences, test of effectivity and efficiency of different methods by purity tests)

- Drying methods to achieve low moisture content (test of moisture content via fast and oven-dry standard methods)
- Storage methods, - open or closed storage, ambient temperature or cold storage
- What is relevant to document in the field to the processing station?
- Field documentation e.g. location, provenance, GPS, seed source type, insects
- Seed to fruit records: Number of seeds per fruits, weight and volume of fruits and weight of volume of seeds; - fruit => seed conversion factor.
- Standard test records: Seed weight (seeds per kg, 1000-seed weight, - average and variation, purity, moisture content, germination / viability

The first course will take place at Sebeta RTSC from 2-6 March with 5 participants from Mekele RTSC, 5 participants from Sebeta RTSC and 3 participants from FRC in Addis Ababa.

The second course will be held at Bahir Dar RTSC from 20-24 April with 5 participants from Hawassa RTSC, 5 participants from Bahir Dar RTSC and 3 participants from FRC in Addis Ababa.

The courses will be a mixture of limited lecturers and more practical activities and discussions in the field.

A consultant from UCPH will plan and implement the courses with support from PATSPO staff.

This consultancy supports the delivery of output area number four mentioned above.

2. OBJECTIVE

The objective of the consultancy is: i) to train staff members from RTSCs and FRC in practical aspects of tree seed procurement from seed collection, labelling, documentation, processing, drying, testing, and storage.

3. METHOD OF WORD

The consultant will work together with the PATSPO staff during his stays in Ethiopia. Before arriving to Ethiopia, the consultant develops and prepares the training material for the courses. The practical arrangements will be done by PATSPO and the final course preparation by the consultant and the staff from PATSPO participating in the course implementation, when the consultant has arrived in Ethiopia.

4. OUTPUTS

Consultant and the PATSPO Tree Improvement Officer will in collaboration with the PATSPO team plan the training courses and prepare a detailed programme for both courses. The specific outputs of the consultancy will be:

- Two training courses in tree seed procurement implemented.
- Short consultancy reports to PATSPO.

5. ACTIVITIES

The consultant and the PATSPO staff will:

- Prepare detailed programmes for the two courses and how to use the material prepared by the consultant before arriving to Ethiopia
- Discuss implementation of the courses and practicalities with PATSPO
- Implement the training courses
- Prepare short report on the course preparation, - implementation and - results.

6. STAFFING

The consultant is Lars Holger Schmidt from University of Copenhagen.

7. TIMING AND DURATION OF THE ASSIGNMENT

The consultancy will be of two months duration in the period between 27 February and 20 May 2020. The consultant will spend in total approximately 4 weeks in Ethiopia and 5 weeks in Denmark for preparation and reporting.

The consultant will stay in Ethiopia during the period 27 February to 11 March and from 16 to 29 April 2020. The consultant will spend the first days at the PATSPO Office in Addis Ababa preparing for the courses together with the PATSPO staff, and some days before leaving for debriefing and discussions with PATSPO.

8. REPORTING

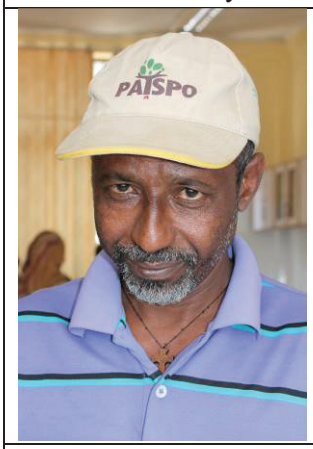
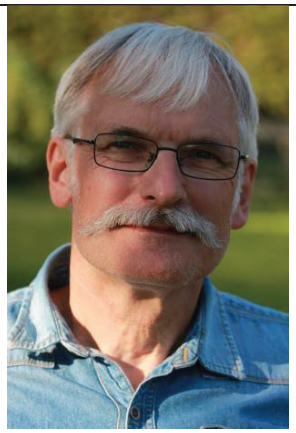
The reporting from the consultancy will be a short report on the course preparation, - implementation and – results from the courses.

9. SUPPORT FROM PATSPO

PATSPO will support the consultant with technical- as well as practical issues like inviting participants, booking accommodation and domestic air tickets, as well as all other practical issues. When in Addis Ababa the consultants will work from the ICRAF Office at the ILRI Compound.

PATSPO 20 February 2014

Participants, On-theJob seed training, Sebete 1-6 March 2020

			
Tilahun Amente	Hagos G/libanos	Lemessa Bekele	Lidiya Chala
			
Regassa Adugna	Haftom Mezgebe	Aynalem Tekeba	Kalkidan Daba
			
Dawit Welay	Fantu Kinfe	Biruk Tesfaye	Semegnush Alemayoh
			
Tameru	Kedra Mohammed	Tiglu Seboka	Lars Schmidt

Day to day programme

TOT programme, Sebeta and Suba, 1-6th March

Sunday 1st March	12:30, Driving to Hamid Hotel 9:30, Arrival Suba, 10:30 Training room, Course outline and briefing 11:00 -12:00 Theory of field work for posters 12:00-13:30 Lunch Break 13:30 – 16:00 Forest walk with botanists, familiarizing with species and area
Monday 2nd March	9:00 Course opening, practicalities, objectives, presentations of teachers and participants 9:30 Lecture, seed source registration and crop assessment 11:00 Visit to Suba, crop assessment and species survey 16:30 Return to Sabeta
Tuesday 3rd March	8:30- 9:30 Training room: Practical information for field work: Collection of herbaria material, fruit and seed volume and weight, descriptives etc 9:30 – 10:00 Grouping on themes and species 10:00 – 12:00. Climbing demonstrations and exercises 13:00 to rest of day : group work on species
Wednesday 4th March	8:30-9:30 Sum up of previous days field work, - status and shortages 9:30 – 12:00 Lab work on seeds and fruits 13:30 – 16:30 Exercises with filling in forms pertaining to qualitative and quantitative parameters
Thursday 5th March	8:30 – 16:30: Full day at Suba forest with field exercises on seed source description for two focal species viz. Cupressus lusitanica and Hagenia abyssinica. Visit to highland forest of Hagenia at 3000 masl with registration of individual tree position, size and gender
Friday 6th March	8:30 – 9:30. Lecture. Storage, procurement strategies and the importance of documentations. 9:30 – 13:30 Group work on procurement programme with subsequent presentation and discussion points and feedback from trainer





Forest seed collection

Lars Schmidt,
Institute of Geoscience and Natural Resources,
University of Copenhagen





General rule on seed collection

The simplest and cheapest applies as long as it doesn't compromise seed quality

Quality=
Genetic quality
Physiological quality

Note: Inbreeding influence both genetic and physiological quality

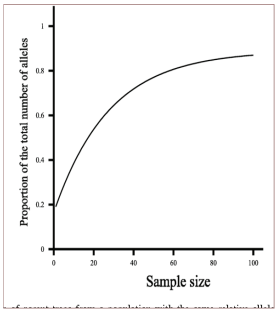
What could compromise seed quality?

Genetic:
- Number of seed trees
- Quality of seed trees
- Distance between seed trees
- Identity of seed tree

Physiological quality
- Maturity
- Precocious germination
- Predation / infestation
- Dispersal

Number of seed trees

- A large number of seed trees assures a high diversity.
- Diversity assures assembling of a large part of the gene pool
- Rule of thumb: 25 widely dispersed trees in the population
- Collect approximately the same amount of seed from each tree



Distance between seed trees

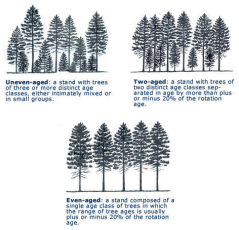
Select trees that are unlikely to be in the same family

Distance between trees, D

Density (trees per hectare):

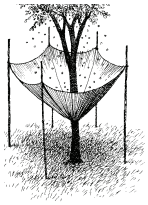
$$\frac{10.000\ m^2}{D^2 m^2}$$

If not evenly distributed, use correction factor 1.4



Collection from the ground after natural fall

Applicability and limitations:
- Seed size, dispersal, terrain, ground vegetation
- Post dispersal deterioration (predation, decay, germination)
- Accessories: Tarpaulins, nets , funnels, seed traps
- Mechanical accessories: sweeping, vacuuming
- Accept of debris depends on ease of cleaning



Collecting from the ground after shaking

Applicability and limitations:
- Maturity aspects, - pre-dispersal release
- Access to crown, - often in combination with climbing or elevated platforms
- Accessories: Simple devices like hooks and ropes. Mechanical tree shakers
- Often contamination with immature fruits
- Use nets or tarpaulins or clean seeds afterwards

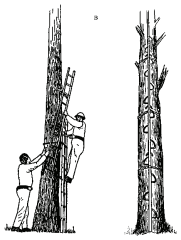

Lodging of fruit bearing branches

Applicability and limitations:

- Seed size, dispersal, terrain, ground vegetation, impact on future seed production
- Extended handles and poles

Collection by climbing, - via the bole

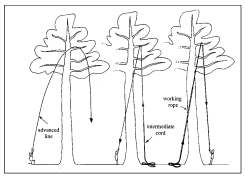
Ladders

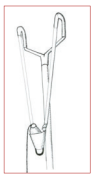


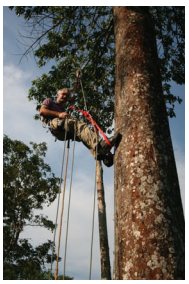
Tree bicycle

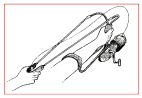
Climbing spurs

Advanced line technique









Tree and crop damage from collection

Damage to tree

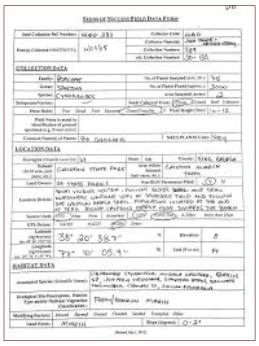
Damage to next years' crop

Recording seed collection

Recording form:

Species

- Seed source position
- Number of seed trees
- Phenotypic collection
- Conditions of seed / fruits



Temporary field processing and storage: Orthodox seed

Pre-processing:

Reduce bulk (pre-extraction)

Reduce external deterioration (fruit decomposition)

Reduce internal deterioration (metabolism pre-storage conditions)





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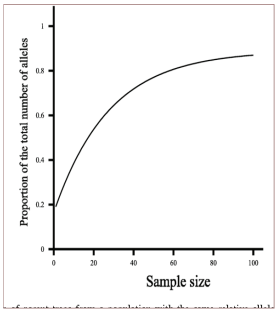

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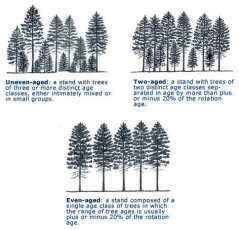

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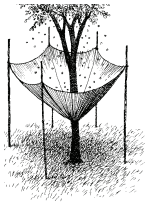

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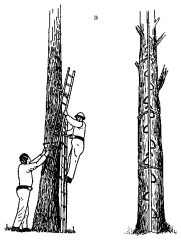

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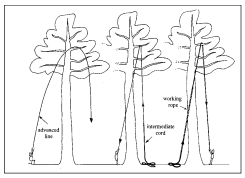

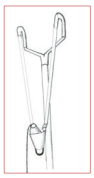

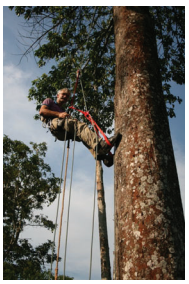

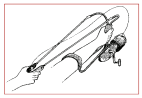

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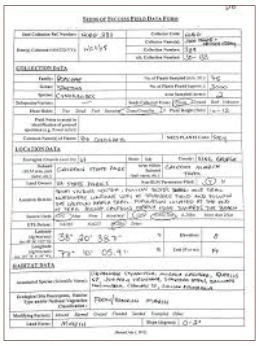

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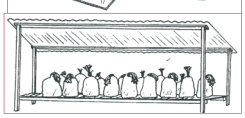


Extraction of forest seed

Lars Schmidt,
Institute of Geoscience and Natural Resources,
University of Copenhagen

What is extraction?

- Relieving seeds from surrounding tissue, preferably as single-seed or single-embryo units that can be conveniently handled during subsequent processing, storage and sowing.
- The extracted unit may be a seed, part of the seed or seed with the entire or part of the fruit
- The extracted 'seed' is the 'pure seed' unit in seed testing

Seed extraction - objective

Removed material
- Redundant bulk
- Easily deteriorating / decomposable material
- Material that may harbour infections
- Germination inhibitory material
- Material that interferes with mechanical sowing

Remaining material

Morphological seed or smallest unit that can be maintained without physical damage, e.g.:
- Entire seed
- Seed minus wings, aril, hairs
- Pyrene (w/ 1 or more seeds)
- Nut

Practical considerations

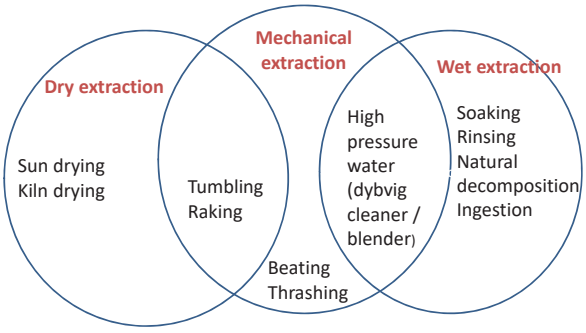
Does non-seed material do any harm?

Potential damage during extraction (mechanical, physiological)

Ease / labour involved in extraction

Possible negative consequence for germination

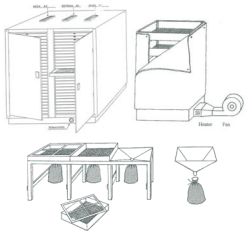
Dry, wet and mechanical extraction



Dry extraction

Methods

Sun drying or kiln drying



Applicability

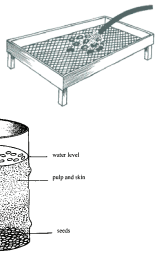
Dehiscent dry fruits:
- Cones
- Capsules
- Folicles
- Dehiscent pods
- Dry multiple fruits

Most dry fruits open naturally at maturity
Serotinous fruits open only at very high temperature (e.g. fires)

Wet extraction

Methods

Soaking
Rinsing



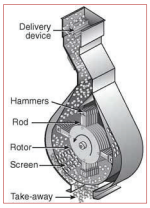
Applicability

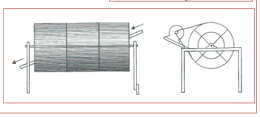
Fleshy (animal dispersed fruits)
Berries and pomes
Drupes
Fleshy compound fruits
Arillate and sarcotestal seeds
Fleshy cones (Juniperus)

Dry mechanical extraction

Thrashing
Tumbling
Beating
Milling

Indehiscent dry fruits:
Samaras, some pods

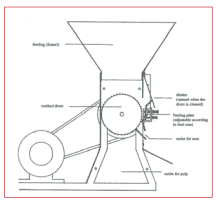


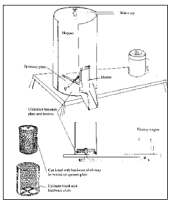


Wet mechanical extraction

- Manual brushing / squeezing
- 'Dybvig ' separator
- Coffee depulper
- Wet tumbling
- High water pressure
- Modified household blender

NB: Beware of overtreatment

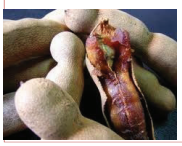




Difficult extraction

Combined fleshy fruits/seed in dry covers:
Dry extraction followed by wet extraction:
Examples: Magnolias (Manglietia)

Dry fruits with seeds embedded in sticky endocarp or compound fruit
Examples: Tamarindus, Prosopis, Dialium, Ficus



De-winging

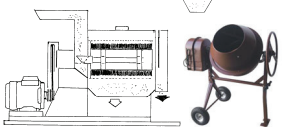
Removal of fruit or seed wings e.g

- Pinus
- Abies
- Casuarina
- Acer
- Carpinus

Other appendices

- Arils

Wetting and drying
Manual breaking
Mechanical abrasion (tumbling in drum with abrasion material)
Brushing machine



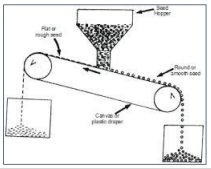
Cleaning of forest seed

Lars Schmidt,
Institute of Geoscience and Natural Resources,
University of Copenhagen

Cleaning = separation

Cleaning is a separation process. A proper seed cleaning process leaves the seed lot in a fraction of pure seed (smallest extractable unit) and impurities, which may consist of inert matter and other seed.

Degree of cleaning is documented in a purity test.



Seed cleaning: Eliminating non-seed material

Reasons for cleaning

- Bulk reduction (elimination of redundant material)
- Ease storage (elimination of potential infective material)
- Ease sowing (making seed lot more uniform)
- Clean seed is sell-able, - better price for clean seed

Pure seed – clean seed

'Pure seed' is seed that is likely to germinate

Clean seed is seed without debris (dirt)

Examples of debris: Soil, detached fruit or seed parts (wings, arils etc.), non seed / fruit plant material (branchlets, leaves etc.), other seed, insect infested, broken, empty, or dead seed

Contamination may be inert (originate from collection) or contamination happened during handling (e.g. from machines or storage containers)

Separation

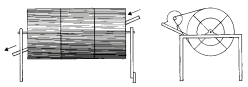
Matters can be separated if they are different and the difference can be recognised

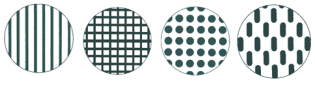
Most seed cleaning separates according to physical characters e.g.

- Size
- Gravity
- Form
- Surface structure

Separation based on size and form: Sifting

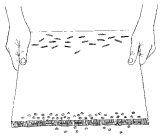
- Hand sieves
- Different openings
- Stacked sieves
- Indented cylinders
- Tumblers

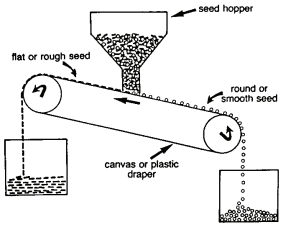




Separate according to surface and gravity point: Friction and form

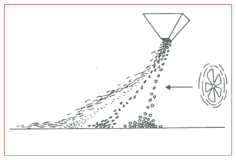
– Hand screens
– Rotating belts



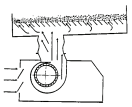


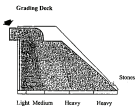
Separation according to gravity: Winnowing seed blower

Winnowing
Flotation (in liquid)



Separation according to gravity and surface friction: gravity table





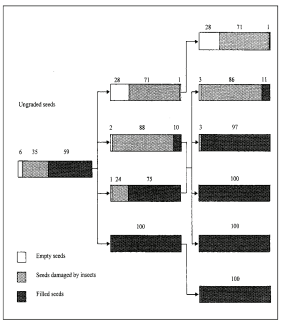
Cleaning by flotation

Principle: Light seed, insect infested seed and debris float, filled seed sink

Pour the seeds in a bowl,
Skim off floating stuff
Pour out water
Dry the seed

Cleaning sequence

– Separate according to simplest parameters first
– Continue cleaning of un-cleaned seed with different methods
– Example of cleaning sequence: Sifting, gravity, surface form, flotation.
– Note: Seeds may not need to be 100% clean (and a lot of work may be needed to increase from almost pure to 100% pure)



How clean is clean?

Purity percentage, 100, 75, 50, 25% ?

What determines purity percentage target?

How is purity connected to germination percentage?

Storage of forest seed

Lars Schmidt,
Department of Geoscience and Natural Resources, University of Copenhagen

Objectives of seed storing

Maintenance of buffer stock (demand / customer service)

Rational seed collection strategy

Keeping seeds viable until use (sowing, distribution)

Conservation of genetic material (e.g. rare species)

Note I: Seed may go from collection to germination without any intermediate handling or storage

Note II: Some seed have limited storability, - collection on demand

What to keep in seed stores?

All relevant species
All relevant provenances
Rare species

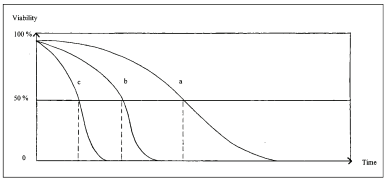
Length of storage:
For most species about ½-1 years seed use
Long term storage > 10 years
Short-term storage of e.g. recalcitrant seed few days to few weeks

Seed store management:

- Management of flow (input-output) of deteriorating biological material
- Packing, documentation
- Seed lot register (species, provenances, quantities)
- Calculation of demand and supply
- Quality testing

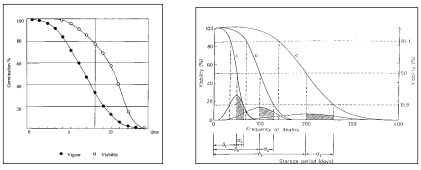
Storage conditions for orthodox seed

- Dry and cool ⇒ longer storability
- Storage rule: 5°C reduction equivalent to 1% moisture content reduction

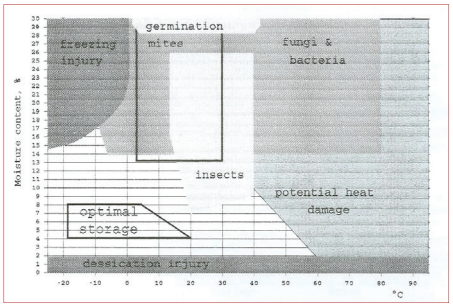


Predicting storage life of seed, - viability curves

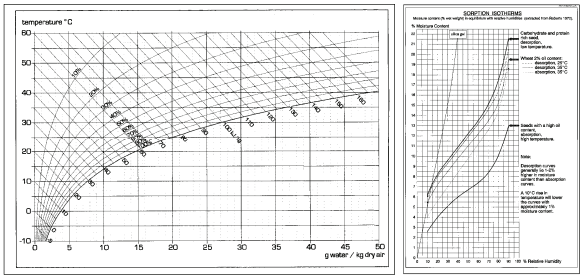
- Mathematical expression of viability curves
- Viability vs. vigour
- Accelerated ageing



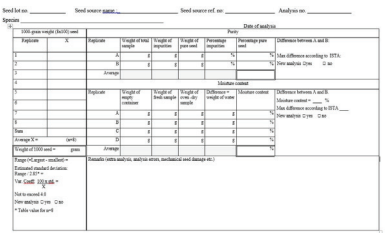
Storage condition



Moisture content and equilibrium moisture content II

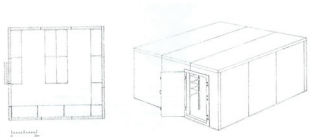


Moisture measurement



Store rooms and storage containers in practical seed handling

- Turnover rate
- Seed distribution centres
- Size of store rooms
- Storage containers



Long term storage

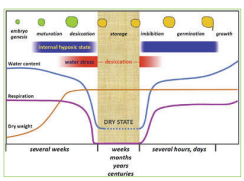
- Conservation seed banks
- Cryo-preservation (freezing conservation)

Why can recalcitrant seed not be stored

Physiologically active

No maturation drying

Maturation and germination are continuous processes



How to manage recalcitrant seed?

- Dry to lowest safe moisture content
- Short term storage
- Allow germination

Summary: What determines seed handling?

Use of seeds
- Local immediate use
- Temporary storage
- Long term storage buffer
- Distribution to seed users
- Quality demands from seed users

Biological conditions
- Bulk
- Fruit type – ease of extraction
- Deterioration / germination inhibition
- Physiological seed type - storability

Training exercises

Exercise I: Seed demand estimates

Seed demand is based on assumptions of loss during stages of seed procurement. The assumption ultimately takes point of departure in planting target including replacement plantings since seed propagules must necessarily provide the need for all field plants. We estimate loss during various stages of seed handling.

Please fill in below table with following species: *Cupressus lusitanica, Albizia gummifera, Cordia africana, Casuarina equisetifolia* and *Hagenia abyssinica*.

Species		
Heading	Key figure	Quantity
Number of field plants	Area to be replanted	
	Distance between trees	
	Survival rate in the field	
Number of nursery plants	Nursery survival	
How many seeds needed	Germination percentage	
How many kilos of seed	Seed weight	
How many fruits needed	Number of (viable) seeds per fruit*	
How many kilos of fruits needed	Fruit weight	
How many bags / buckets	Fruit volume	

*Extraction efficiency (how much is lost during extraction and cleaning

Exercise II: Estimating seed production

Tree seed production is an estimate of the total production of harvestable seed from individual trees or from a seed source. Seeds are enclosed in fruits and are produced as a result of successful pollination. Fruits may be produced individual from solitary flowers or as infructescences from flower clusters or inflorescences. The purpose of this exercise is to estimate the number of fruits produced by trees. Usually, it is not possible to count them all. Therefore parts of the crown is counted and the number multiplied over the total canopy. Note that the number of fruits may vary with height and exposure.

Species	
Location	
Estimated height of tree	
Diameter at breast height	
Exposure	

Exposure	Estimated part of crown assessed	Counted fruits	Total fruit count
North			
South			
East			
West			
Total			

Exercise III: Voucher collection

Voucher collection is done to document species identity, which is an essential part of seed documentation. Fresh plant parts are collected from the seed tree (one or more trees in the stand but never from different trees in the same voucher). The material is preserved by drying in a plant press. For proper identification, the material should contain fertile material i.e. flowers and / or fruits. For large material, it may be necessary to reduce bulk, yet the essential structures should be maintained. When access to proper flora material and / or botanical expertise, species are verified.

Species (tentative identification	
Location	
Collection date	

Plant material	Verified to species (✓)	Note on possible alternative
Bark		
Stem		
Branching habit		
Leaf form		
Leaf size		
Leaf base		
Leaf apex		
Inflorescence		
Flower colour		
Flower morphology		
Flower size		
Fruit form		
Fruit size		
Fruit colour		
Other:		

Verified species identity	Date and signature of authority

Exercise IV: Fruit and seed maturity

Mature fruits contain mature seeds. Seeds are normally dispersed when fruits are mature, either by wind or animals. Dispersal characters like colour and softness for fleshy fruits, and dryness and development of wings or hairs for dry wind dispersed fruits. For all fruits hold that fruits or seeds develop abscission structure that makes fruits or seeds easily breaking from the branchlets or opened fruit. Following list contain a number of maturity criteria found in different fruits and seeds. Go through the list for your target species and describe individual characters.

Species	Fruit type
Maturity indicator	Appearance in target species
Colour	
Smell	
Taste	
Structure (softness)	
Abscission structure (on fruits or seeds)	
Dehiscence structure (on fruits)	
Seed coat structure	
Embryo size and development	

Exercise V: Seed collection methods

We usually collect fruits with the seeds inside and extract the seeds later during processing. Fruits are borne on trees, usually in the canopies that are beyond immediate reach from the ground. Fruits can be picked from the canopies by accessing the canopy by various means e.g. long handled pruners, ladders or by climbing, or they can be picked from the ground after natural fall. Seed collection should always be undertaken in an efficient way without damaging neither the fruits nor the mother tree.

Species		Fruit type		
Collection methods	Effect on seed quantity	Effect on seed quality	Effect on mother tree	Safety issues
From ground after natural fall				
From ground with ground cover				
Using long handled pruners to remove infructescences				
Felling trees				
Pruning large fruit bearing branches				
Climbing trees with ladders				
Climbing trees with climbing spurs				

Exercise VI: Fruits and seed condition assessment

Number of seeds in fruits may vary from one fruit to another. Seeds may be empty or attacked by insects. Seeds may also vary in size from one fruit to another or between seeds in the same fruits. For small seeds such variation can only be seen on very accurate analytical weights. For large seed, individual weight can be measured in the field.

Following exercise is carried out in the field or at the processing station after seed harvest.

Species	Fruit type
Quality indicator	Quality description
Number of seeds per fruits (10 fruits)	
Fruits weight (10 fruits)	
Seed weight (all seeds per 10 fruits)	
Empty seeds (count in 10 fruits)	
Insects infested seed (count in 10 fruits)	
Other quality indicator	
1	
2	
3	

Exercise VII: Seed Processing

Processing includes extraction, cleaning (separation from debris), and drying of seed to prepare them for storage. Following exercise is a baseline for a practical protocol for seed processing on species level. In fruits have different Maturity level it may be relevant to separate fruits in maturity stages where nor fully mature fruits are after-ripened to full maturity or thrown away.

Pre-curing and extraction

Species	Fruit type
Fruit factor	Treatment
Immature fruits	
Mature fruits	
Closed dry fruits	
Open dry fruits	
Closed indehiscent dry fruits	
Hard fleshy fruits	
Green fruits	
Non-fruit material	

Cleaning

Species	Fruit type
Debris type	Cleaning method
Empty dry fruits	
Fruit hairs or wings	
Small dry fruit fragments	
Insect infested seed	
Green, immature seed	

Exercise VIII: Seed testing

All seed testing is quality testing. Qualities are seed weight, seed purity, seed moisture content and seed germination. Seed testing is performed under standard protocols so that results can be compared with other test results using the same method. Some seed tests are destructive meaning that the seeds will change during the test and cannot be used for other tests. Examples are moisture content and germination. A test like seed weight is not destructive and the same seed can be used again for example for germination.

Seed weight

Number of seeds in sample	Seed weight, sample									
	1	2	3	4	5	6	7	8	Average	STD

Purity

Replicate A					Replicate B					Average, two samples
Weight of total sample	Weight of impurities	Weight of pure seed	Percentage impurities	Percentage pure seed	Weight of total sample	Weight of impurities	Weight of pure seed	Percentage impurities	Percentage pure seed	

Moisture content

Replicate	Weight of empty container	Weight of fresh sample	Weight of oven -dry sample	Difference = weight of water	Moisture content
A	g	g	g	g	%
B	g	g	g	g	%
C	g	g	g	g	%
D	g	g	g	g	%
Average					%

Cutting test

Number of seeds in sample	Percentage fresh seed per sample, sample								
	1	2	3	4	5	6	7	8	Average

Exercise IX seed procurement

A full seed procurement programme includes all aspects pertaining to provision of good quality seed from selection of seed source through collection and testing to distribution of seed to end user. Consider following questions in connection with your elaboration of a procurement programme for your target species

1. Who will plant the species?
2. Where will the species be planted and for which purpose?
3. Where and how many seed sources (provenances) would you need in a country-wide network?
4. How will you practically organise collection (time, methods etc.)?
5. How will you establish contact to possible seed buyers?
6. What are the limiting factors for seed provision?
7. How will you overcome limiting factors / difficulties in seed procurement?
8. What type of seed research would be needed ?
9. How do you get seeds to the end users?

Participants contact lists

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Hagenia abyssinica (Bruce ex Steud.) J.F.Gmel

Taxonomy and nomenclature

Family: Rosaceae

Synonyms: *Hagenia anthelmintica* (Kunth) Eggeling.

Vernacular/common names: East African rosewood ,Kosso, kousso, cusso (En), Mturunga, mdobore (Sw), Kosso (Amharic).

Distribution and habitat

Indigenous to mountainous regions of eastern, central and southern Africa, from the Sudan and Ethiopia in the north, through Kenya, Uganda, Rwanda, Burundi, Congo DR, and Tanzania, to Malawi and Zambia in the south.

It is mostly found above 2000 masl in high rainfall areas of 1000-1500 mm. It occurs in mixed afromontane forest with *Podocarpus*, *Afrocarpus*, and *Juniperus procera*, often at the upper forest zones, where it may grow in almost pure stands. Mature trees are tolerant to fire but small trees are sensitive to grazing.

Uses

H. abyssinica has attractive wood, mainly used for decorative purposes. A decoction of dry female flowers is widely used as a medicine against tapeworms and other parasites in Ethiopia. Flowers are attractive to bees and the species is thus useful in apiculture. .

Botanical description

Relatively small dioecious tree, rarely more than 20 meters high and 40 cm in diameter. The trunk is short and often croocket with thick branches. The bark is thick, pale brown and pealing off in papery flakes. Young branches hairy.

Compound leaves, up to 40 cm long with 5-9 pairs of leaflets. The petiole is flat and covered with long, dense hairs, up to 15 cm long, with 2, up to 1.5 cm wide, thin, leafy lateral wings (adnate stipules) at base surrounding the twig as a sheath; The leaflets are up to 10 cm long and 2 cm wide, with a finely serrated margin, green above, silvery-haired below. The flowers are borne in large, terminal, much branched panicle inflorescences, up to 60 cm long with zig-zag rachis and containing several thousand flowers. Male and female flowers are borne on different individuals. The flowers are whitish, orange or pinkish during the main flowering, turning pale and straw-colored. The whole inflorescence often remain on the tree long time after the main flowering. Male flowers have small corolla and 15-20 filaments. Female flowers are flat, 1½-2 cm in diameter with 5 corolla lobes, two pistils of which usually only one develops into a fruit.

Illustration from Köhlers medicinal plants

Fruit and seed description

Fruit: The nut remains within the flower and the nut with flower is dispersed by wind as a unit. Flowers without seeds are usually retained in the inflorescence with the result that there are many empty flowers without seeds. The individual fruit is a globose to ovoid achene up to 2.5 mm in diameter, with a thin, papery, pale to brown pericarp, white-hairy at top, enclosed by the dry persistent hypanthium with the epicalyx serving as wings. Each fruit contains one seed.

Seed: The seed is 1-2 mm long, subglobose, usually with a wrinkled, brown, glabrous testa. Here are about 400–500 seeds per gram.

Flowering and fruiting habit

Dioecious species with flowers assembled in large inflorescences. In Ethiopia the main flowering season is in October to February (dry season). Pollination by bees. Inflorescences are often retained on the tree for a long time. Female inflorescences turning infructescences are sometimes shed and dispersed as a unit by wind.

Harvest

Harvested by the use of long handled pruners to cut off entire infructescences. Tarpaulings may be spread under the trees prior to harvesting as flowers tend to break off easily.

Processing and handling

Dry infructescences may be disintegrated by mechanical beating. Infructescence stems can be removed manually. Flowers containing fruits can be disintegrated manually, by brushing or thrashing, and flower parts removed by winnowing. The entire flower with seed may also be sown.

Storage and viability

Seeds are orthodox and can be stored under dry conditions.

Dormancy and pretreatment

No dormancy reported

Sowing and germination

Seeds are sown in seed beds with a small cover of sand. Germination takes about 3 weeks

Selected readings

Bekele-Tesemma A, Birnie A, Tengnäs B 1993. Useful trees and shrubs for Ethiopia: identification, propagation and management for agricultural and pastoral communities. Technical Handbook No 5. Regional Soil Conservation Unit/SIDA, Nairobi, Kenya. 474 pp.

Jansen PCM, Getachew Aweke, 2002. *Hagenia abyssinica* (Bruce) J.F.Gmel. In: Oyen LPA, Lemmens RHMJ (Eds). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands.

Authors: Girma Eshetu, Kedra Mohammed, Lars Schmidt

Cupressus lusitanica Mill.

Taxonomy and nomenclature

Family: Cupressaceae

Synonyms: *Cupressus benthamii* Endl., *Cupressus lindleyi* Klotzsch ex Endl.

Vernacular/common names: Mexican cypress, East African cypress, Portuguese cedar, (En)., Cyprès du Portugal, cèdre de Goa, cyprès de Goa, cyprès du Mexique (Fr)., Msanduku (Swahili)

Distribution and habitat

Natural distribution in Central American highlands from Mexico in the north through Guatemala, Belize, Honduras, El Salvador and Nicaragua. Introduced as a plantation forest tree into tropical Africa, where it is widely planted at higher elevations, e.g. in Kenya, Malawi and Ethiopia.

C. lusitanica is mostly found above 1000 masl, and may grow up to 3000 (-4000 meters) altitude, albeit with slow growth at the highest elevation. Optimal average annual temperature is 12–30°C, with annual precipitation of 800–1500 mm and a short dry season. It also grows well in high humidity zones with rainfall up to 4000 mm rainfall and in mist zones in mountains, but is not tolerant to water logging. It is resistant to moderate frost and snow. It prefers deep, moist, well-drained, fertile, neutral to slightly acidic loamy soils. It is moderately fire tolerant and regenerate prolifically from seed after an event of fire.

Uses

The species in primarily grown as a timber species with multiple uses in construction, furniture, farm implements, poles etc. The wood is also used for papermaking and is a good fuelwood. It is also planted as a 'service' tree for shade, windbreaks, live fences and as ornamental.

Botanical description

Evergreen tree of up to 35 meters tall. The bole is straight, erect, and cylindrical. Often moderately buttressed. Bark of young trees smooth, orange-brown to red-brown; on old trees often vertically grooved, grey and exfoliating in large strips.

Pyramidal crown in young trees. Branches often thin, spreading horizontal or slightly ascending with drooping branch ends

Leaves reduced to simple, decussate, scale-like structures on spreading twigs. Scales are 1–2.5 mm long; on leading branchlets up to 10 mm long, apex incurved and acute, margin minutely toothed, green or glaucous-green.

Male cone terminal, solitary, oblong, more or less quadrangular, 3–5 mm long and 2–2.5 mm wide, yellowish green when young, turning pale brown when mature. 10–16 decussately opposite cone scale, slightly keeled, each bearing 3–4 pollen sacs. Female cones terminal, solitary or grouped,

a, spray with three mature cones; *b*, branchlets; *c*, seeds.

Illustration from PROTA

Fruit and seed description

Fruit: Mature female cones globose-angular, 10–20 mm in diameter, green or purplish-glaucous, turning brownish to dark grey when mature. 6–8 (–10) cone scales, decussately opposite, each

covering 8–12-seeds. One mature fruit weighs 3.5-4 grams. There are about 160 fruits per liter.

Seed: Seeds slightly flattened and angular, 3–4.5 mm long, 3–4 mm wide. Brown or yellowish brown, usually with two 1–1.5 mm wide wings. The 1000-seed weight is 3–6.5 g, i.e. 155,000-330,000 seeds per kg.

Flowering and fruiting habit

Monoecious. Fruiting may start after 5-9 years. Pollination by wind. Flowering takes place during the dry season. Development from pollination to mature cones take 2 years. Some cones remain closed up to several years (serotinous) and only open upon high temperature.

Harvest

Cones are preferably harvested when the first cones starts to open to dehisce their seed. The colour changes from brownish to greyish. The cones may be stripped from the branches on the tree during climbing, or from cut off fruit bearing branches. Since development from pollination to maturity takes two years, there are new and old cones on the same branches. Hence, pruning fruit bearing branches inevitably means that following years cones are removed.

Processing and handling

It is recommended to remove cones from the branches and not let the branches dry with the cones, since the scaly leaves can be difficult to separate from the seed. The cones can be dried under direct sun or in rakes using warn air. Serotinous cones open only after exposure to direct sunlight or high kiln temperature. The seeds will fall out of the cones with minimal mechanical impact. The empty cones can be removed manually or by shifting. Seed lots may contain empty (without embryo) seeds. These may be removed by flotation.

Storage and viability

Seeds are orthodox and can be stored for long periods of time provided they are dry. Viability can be prolonged by cold storage.

Dormancy and pretreatment

Seeds germinate best if prior exposed to cold stratification e.g. few days in imbibed stage in a refrigerator.

Sowing and germination

Seeds are sown in seedbeds with sandy medium. Germination is epigeal and germination normally takes 20–35 days

Phytosanitary problems

Cupressus lusitanica is attacked by the cypress aphid *Cinara cupressi*, which can cause serious damage. The pest is spreading in Africa and some places have abandoned cultivation because of the pest damage.

Selected readings

Bein E, Habte B, Jaber A, Birnie A, Tengnäs B, 1996. Useful trees and shrubs in Eritrea: identification, propagation and management for agricultural and pastoral communities. Technical Handbook No 12. Regional Soil Conservation Unit, Nairobi, Kenya. 422 pp

Brink M, 2007. *Cupressus lusitanica* Mill. In: Louppe D, Oteng-Amoako AA, Brink M (Eds). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherland

Croton macrostachyus Hochst. ex Delile

Taxonomy and nomenclature

Family: Euphorbiaceae

Synonyms: None

Vernacular/common names: Woodland croton, forest fever tree, broad-leaved croton (En). Croton à feuilles larges (Fr). Mtumbatu (Swahili). Besana (Amharic)

Distribution and habitat

Distributed throughout tropical Africa including Madagascar.

Uses

Used for tool handles and small construction purposes but is considered an inferior wood due to easy attach by borers. Its main use is as medicinal plant where it has been used for multiple purposes throughout its range of distribution. The species is presumably suitable as a framework species for forest restoration since its seeds are much sought after by birds.

Botanical description

Deciduous tree, up to 25(–30) m tall; bole cylindrical, up to 100 cm in diameter; bark grey to grey-brown, finely fissured and cracked. Inner bark pale brown to reddish brown, smell peppery. Young branches densely stellate hairy. Leaves alternate, simple, stipules linear, up to 15 mm long, soon falling; petiole up to 12(–20) cm long, with 2 stalked glands at top; blade ovate-elliptical to almost circular, up to 17(–25) cm × 14(–20) cm, base cordate, apex acuminate, margins irregularly toothed, densely stellate hairy on both sides, whitish green beneath. Inflorescence a slender, terminal raceme up to 35 cm long, either with only male or female flowers or male and female flowers variably mixed.

Flowers unisexual, 5-merous, regular, yellowish to white, fragrant; male flowers with pedicel 3–10 mm long, calyx campanulate, lobes ovate to triangular, 2.5–3.5 mm long, margins densely white hairy, petals oblong to oblanceolate, 3–4.5 mm long, stamens 15–17, free; female flowers with pedicel 2–4 mm long, fleshy, calyx as in male flowers but lobes more triangular, persistent in fruit, petals linear or absent, up to 1.5 mm long, ovary superior, rounded, densely stellate hairy, 3-celled, styles 3, 2-fid to base, 3–6 mm long, twisted and curved.

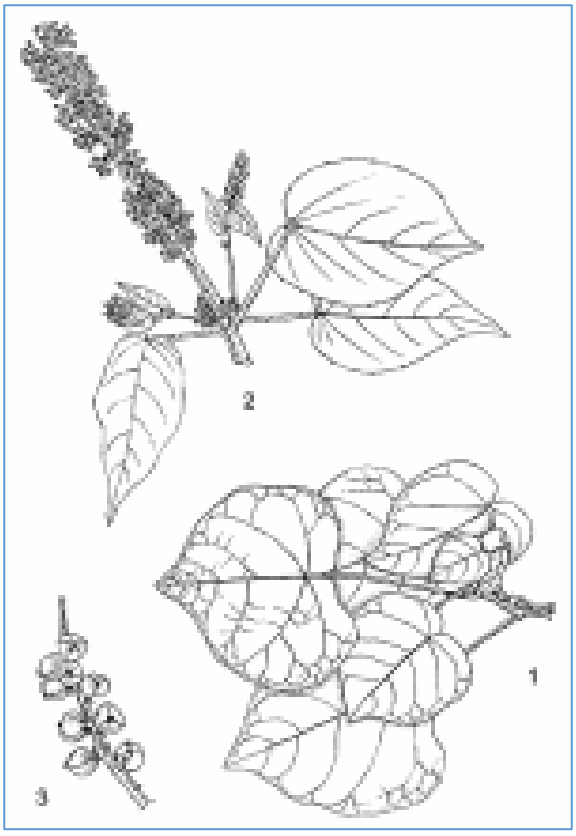

Illustration from PROTA

Fruit and seed description

Fruit: Dehiscent capsule, almost globous with 1-1.2 cm in diameter, almost sessile. Pale green, slightly 3-lobed, stellate hairy, apex centrally depressed, 3-locular, containing 3 seeds, hanging from a central columella. There are about 160 fruits per litre.

Seed: Triangular in cross section. Seeds ellipsoid, 6–8 mm × 4–5.5 mm, with lobed caruncle, cream-coloured. There are about 16, 000–27,000 per kg.

Flowering and fruiting habit.

Monoecious or dioecious. Flowering during the rainy season with seed maturation during the dry season. In highland Ethiopia (Addis, Suba) fruiting takes place in March-April. Fruit development takes 4–5 months. Pollination by insects. Seed dispersal by a wide variety of birds.

Harvest.

Fruits are mature when the capsules start splitting open. There is little colour change. Another indication is activities by birds picking the seeds from the opening capsules. Harvested by cutting off infructescences with a long handled pruner.

Processing and handling.

The infructescences with attached capsules are dried in shade or briefly in the sun until they open to release the seed. Sun-drying should be done with care since seeds may dry out and lose viability. Seeds are desiccation sensitive but can be dried to about 15% m.c.

Storage and viability.

Usually high viability of fresh seed, but the viability declines rapidly under ambient storage conditions. It is recommended to dispatch the seeds to the nursery as soon as possible after collection.

Dormancy and pretreatment

The seeds may contain inhibitory compounds in the caruncle and it is recommended to rinse the seeds before sowing.

Sowing and germination

Germination is epigeal. Germination takes 3–8 weeks. Sowing medium a mixture of sand and compost (1:2). Transplanting at two-leaf stage

Phytosanitary problems

Fruits often infested by insects

Selected readings

Bekele-Tesemma A, Birnie A, Tengnäs B, 1993. Useful trees and shrubs for Ethiopia: identification, propagation and management for agricultural and pastoral communities. Technical Handbook No 5. Regional Soil Conservation Unit/SIDA, Nairobi, Kenya. 474 pp.

Mairura FS, 2007. **Croton macrostachyus** Hochst. ex Delile. In: Schmelzer GH, Gurib-Fakim A (Eds). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands.

Authors: Girma Eshetu, Kedra Mohammed, Lars Schmidt ……..

Albizia schimperiana Oliv.

Taxonomy and nomenclature

Family: Leguminosae, Mimosoideae

Varieties: Var. *schimperiana*, var. *amaniensis* (Baker f.) Brenan var. *tephrocalyx* Brenan

Synonyms: *A. amanuensis* Baker f., *A. maranguensis* Engl.

Vernacular/common names: Large-podded albizia (En), Mkenge (Sw), Sassa (Amharic).

Distribution and habitat

A. schimperiana is widespread widespread in eastern to southern Africa from southern Sudan and Ethiopia southwards to eastern DR Congo, Zimbabwe and Mozambique.

Grows at high elevations from about 900-2,600 masl, annual temperature of 14-20°C and annual rainfall above 1000 mm. It is often found scattered in farmland.

Uses

The wood is hard and is used as a general construction wood and for furniture and farm implements. Also used for shade tree, soil improvement and apiculture. Fresh leaves have high protein content and can be used as fodder, but digestibility is low due to the content of digestive inhibitors like alkaloids. In Ethiopia ground seeds mixed with water are used as an insecticide.

Botanical description

Deciduous tree up to 30 m tall with cylindrical bole. Low branched and very wide crown when exposed. Crown flattened or rounded, often umbrella-shaped. Bark rough, grey or brown, young twigs brown pubescent.

Leaves alternate, bipinnately compound. Petiole with sessile gland above near the base. Stipules caducous. Rachis sparsely to densely pubescent. 1-10 pairs of pinnae, each with 6-21 pairs of leaflets. Leaflets almost sessile, obliquely rhombic or oblong, 2—2.5 cm long, 0.8-1-5 cm wide, rounded to acute at apex, pubescent below.

Inflorescence an axillary head on a 2.5–5 cm long peduncle.

Flowers regular, 5-merous, white or pale yellow. Pedicel 1–6 mm long, brown pubescent; calyx 1.5–2.5 mm long, with long tube toothed at apex, brown or sometimes grey pubescent outside; corolla 3–7.5 mm long, brown or sometimes grey pubescent outside; stamens numerous, 7–12 mm long, united at base, with creamy white filaments; ovary superior, gradually tapering into slender style.

Distinguished from *A. gummifera* i.a. by its narrower leaflets and larger indehiscent pods

Fruit and seed description

Fruit: Oblong, indehiscent, flat pod, 15–34 cm long, 2–6 cm wide, with a 1.5–2 cm long stipe. Shortly pubescent when young turning pale brown when mature. Each pod contain 7-10 seeds.

Seed: Seeds flattened globose to ellipsoid, 9–11 mm long, 6.5–8 mm wide, 2.5-3 mm thick, dark brown in colour with lighter area in the radicle end. The 1000-seed weight is 90–125 g, i.e. 8,000-11,000 seeds per kg.

Flowering and fruiting habit

Flowering occurs at the end of the dry season. Pollination by insects. Development from flower to mature fruit takes about 5 months. The tree is almost leafless during the fruiting time. More than 10.000 pods have been counted on one large tree.

Harvest

Pods are mature when they turn from green to dry straw-coloured and the fruit stalk becomes fragile and easily breaks. The pods can be made to drop from the tree by shaking the branches with hooks mounted on long pole handles or by throwing ropes over the branches. The pods may be collected from spread out tarpaulins or sheets under the tree or picked from the ground.

Processing and handling

The pods are indehiscent and the seeds needs to be extracted mechanically. Dry pods break up easily for example when beating sacks of pods with sticks or by thrashing. Pod fragments can be removed by winnowing.

Storage and viability

The seeds are orthodox and can be dried to low moisture content and stored for long time at ambient temperature. If many seeds are infested with insect larvae, these may be removed by flotation.

Dormancy and pretreatment

Fresh seed have permeable seed coat and may absorb water freely. Dried and stored seed develop physical dormancy and need pretreatment, e.g. nicking by the use of a nail cutter. Bulk scarification by sulphuric acid or hot water treatment.

Sowing and germination

Germination is epigeal. After imbibition, seeds germinate fast and may have unfolded leaves after 3 weeks.

Phytosanitary problems

Seeds are often infested by insect larvae, mostly bruchids.

Selected readings

Bekele-Tesemma A, Birnie A, Tengnäs B, 1993. Useful trees and shrubs for Ethiopia: identification, propagation and management for agricultural and pastoral communities. Technical Handbook No 5. Regional Soil Conservation Unit/SIDA, Nairobi, Kenya. 474 pp

Lemmens RHMJ, 2007. *Albizia schimperiana* Oliv. In: Louppe D, Oteng-Amoako AA, Brink M. (Eds.). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands.

Authors: Girma Eshetie, Kedra Mohammed, Abrham , Lars Schmidt …

Albizia gummifera (J.F.Gmel.) C.A.Sm.

Taxonomy and nomenclature

Family: Leguminosae

Synonyms: *Albizia sassa* (Willd.) Chiov.

Vernacular/common names: Peacock flower, smooth-bark flat-crown (En), Mkenge, mchapia tumbili, mchani mbao, mshai (Sw).

Distribution and habitat

Albizia gummifera is widespread in humid areas throughout Africa, including Madagascar, except from the south. In Ethiopia it occurs mainly in the southwestern parts.

The tree grows in rainforest and riverine forest, sometimes also in savanna vegetation close to forest, from sea level to up to 2500 masl. Ostensibly large provenance variation as the species has a very wide range of distribution.

Uses

Mainly a timber species with good all-round properties for light construction, furniture, cabinet work and various implements. The wood pulp is suitable for paper production. Also planted as an ornamental and shade tree. It is valued as a shade tree for crops, e.g. in coffee plantations in Ethiopia, tea plantations in Malawi and vanilla plantations in Madagascar, and is also planted or retained for soil conservation and improvement. The flowers produce nectar for bees.

Botanical description

Up to 30 m high deciduous forest tree with flattened crown, straight bole and small or no buttresses.Old bark smooth and grey. Young branchlets finely and shortly brownish-pubescent, soon glabrescent and usually deep or blackish-purple,

Leaves alternate, bipinnately compound with 2.5-4.5 cm long petiole with sessile gland near the base, rachis 4.5–11 cm long, pubescent, 5-8 pairs of pinnae, the upper ones longer than the lower ones. Lower pinnae with 4-6 pairs of leaflets, upper pinnae with 12-15 pairs of leaflets. Leaflets obliquely rhombic-quadrate to rhombic-falcate, about 10–20 mm. long and 4-10 mm wide. Obtuse to acute at apex. Glabrous or slightly pubescent on midrib and margins.

Inflorescence an axillary head on a 2.5–5 cm long peduncle. Peduncles finely pubescent; bracteoles mostly caducous, linear, inconspicuous. Flowers, bisexual, regular, subsessile with very short glabrous or puperulous pedicel. Calyx 2.5–5 mm. long, minutely, brownish-pubescent to subglabrous outside. Corolla 6.5–12 mm. long, minutely pubescent outside, white. Staminal tube, 4.5-6 mm, exserted about 1.5–2.8 cm. beyond corolla, white below, crimson above. Ovary superior, ellipsoid, 1.5–2.5 mm long, gradually tapering into a 2.5–3.5 cm long style.

The species appears to be variable in morphology including both leaves and seed form.

Illustration from PROTA

Fruit and seed description

Fruit: Dehiscent pod oblong, flat or slightly transversely plicate, (8–)10–21 cm. long, 2–3.4 cm. wide with 1 cm long stipe, transversely veined, glabrescent, glossy, glandular, turning pale brown to reddish-brown or purplish when mature. Opening with 2 papery valves. 9–12-seeded

Seed: Seeds flattened globose to broadly oblong, 9–12 mm. long, 10 mm. wide. There are 10,000–15,000 seeds per kg. 1000 seed weight is 67-100g.

Flowering and fruiting habit

Flowers bi-sexual. Seasonal flowering is during the main dry season. Pollination by insects. Fruits mature in about 3 months after flowering. The species is tends to shed its leaves during the fruiting time

Harvest

Harvest is done by shaking down pods from the branches using long handled hooks or throwlines across the fruit bearing branches. Seeds will usually remain attached to the dehiscent pod after the peduncle has broken. Collection from the ground eased by pre-placement of tarpaulins or sheets under the tree. As seeds are often attacked by insects, it is advisable to collect pods during early fruiting season.

Processing and handling

The funicle attachment to the pod is broken by drying and mechanical beating. Pod fragments may be removed by winnowing. Insect infested seeds should be removed by flotation since bruchid beetles may continue to develop in stored seed even in cool rooms.

Storage and viability

Seeds are desiccation tolerant (orthodox) and can be dried to low (<5%) moisture content and stored for several years at ambient temperature in airtight containers. The seeds are readily attacked by bruchid beetles, and this must be controlled in seed storage.

Dormancy and pretreatment

Fresh seed with > 8% moisture content can be germinated without pretreatment. Older dry seed need to be scarified to break physical dormancy e.g. by manual nicking with a nail clipper or by the use of hot water or sulphuric acid for bulk treatment.

Sowing and germination

Seeds for planting should be collected from the trees before the pods dehisce, to avoid insect damage. Fresh seeds may have a germination rate of up to 80% in 3–10 days, and do not require pre-treatment.

Phytosanitary problems

Seeds are often attacked by bruchid beetles

Selected readings

PATSPO
Provision of adequate tree seed portfolios

World Agroforestry Centre

PATSPO/ICRAF Office
c/o ILRI Campus, Gurd
Shola, P.O. Box 5689,
Addis Ababa, Ethiopia

Phone: 251-116172000
ext. 2491
Email:K.Hadgu@cgiar.org

Website: https://www.worldagroforestry.org/project/provision-adequate-tree-seed-portfolio-ethiopia