

# SEEDS AND SEEDLINGS:

Notes on the collection and propagation  
of commonly used tree species  
in Kenya



Kenya  
Agroforestry Extension  
By, Edmund Redfield  
1997

**Contents:**

• The Purpose of this booklet	2	<i>Acacia xanthophloea</i>	21
How to use this booklet	2	<i>Leucaena leucocephala</i>	22
Useful Resources	5	<i>Prosopis chilensis</i>	22
Key	6	<i>Prosopis juliflora</i>	23
ANACARDIACEAE	7	MYRTACEAE	23
<i>Schinus molle</i>	7	<i>Callistemon citrinus</i>	23
APOCYNACEAE	7	<i>Eucalyptus camaldulensis</i>	24
<i>Ackocanthera schimperii</i>	7	<i>Eucalyptus globulus</i>	24
<i>Thevetia peruviana</i>	8	<i>Eucalyptus melliodora</i>	25
ARALIACEAE	8	<i>Eucalyptus saligna</i>	25
<i>Polyscias kikuyuensis</i>	8	<i>Psidium guajava</i>	26
BIGNONIACEAE	9	<i>Syzygium guineese</i>	26
<i>Jacaranda mimosifolia</i>	9	OLEACEAE	27
<i>Markhamia lutea</i>	9	<i>Olea africana</i>	27
<i>Spathodea campanulata</i>	10	PALMAE	27
<i>Tecoma stans</i>	10	<i>Phoenix reclinata</i>	27
BOMBACEAE	11	PAPILIONIOIDEAE	28
<i>Chorisia speciosa</i>	11	<i>Erythrina abyssinica</i>	28
BORAGINACEAE	11	<i>Sesbania sesban</i>	28
<i>Cordia africana</i>	11	<i>Tipuana tipu</i>	29
• CAESALPINIOIDEAE	12	PINACEAE	29
<i>Akrocarpus fraxinifolius</i>	12	<i>Pinus patula</i>	29
<i>Caesalpinia decapetala</i>	12	PODOCARPACEAE	30
<i>Cassia spectabilis</i>	13	<i>Podocarpus falcata</i>	30
<i>Delonix regia</i>	13	PROTEACEAE	30
<i>Tamarindus indica</i>	14	<i>Grevillea robusta</i>	30
CANELLACEAE	14	ROSACEAE	31
<i>Warburgia ugandiensis</i>	14	<i>Eriobotrya japonica</i>	31
CASUARINACEAE	15	RUTACEAE	31
<i>Casuarina cunninghamiana</i>	15	<i>Calodendrum capense</i>	31
COMBRETACEAE	15	.....	32
<i>Terminalia mentalis</i>	15	.....	32
CUPRESSACEAE	16	.....	33
<i>Cupressus lusitanica</i>	16	.....	33
<i>Juniperus procera</i>	16	.....	34
EBENACEAE	17	.....	34
<i>Euclea divinorum</i>	17	.....	35
EUPHORBIACEAE	17	.....	35
<i>Croton megalocarpus</i>	17	.....	36
FLAUCORTIACEAE	18	.....	36
<i>Dovyalis caffra</i>	18	Appendix A: Nurseries	37
LAURACEAE	18	Appendix B: Seed collection	40
<i>Persea americana</i>	18	Appendix C: Watering can	42
MELIACEAE	19		
<i>Azadirachta indica</i>	19		
<i>Melia azedarach</i>	19		
MIMOSOIDEAE	20		
<i>Acacia abyssinica</i>	20		
<i>Acacia mearnsii</i>	20		
<i>Acacia melanoxylon</i>	21		

2

## The purpose of this booklet:

One of the most frustrating things about starting nursery work is not knowing what your trees will look like when they germinate, or how long they will take to do so. It's safe to say that the first things to come up will generally be weeds, but some trees can come up fairly fast as well (and you don't want to be killing off the wrong things). Sometimes water will carry seeds from one part of the germination bed to another, or you'll lose track of your notes that tell you which type of tree you planted where. In the end there is no substitute for knowing what you are looking at, and though you will learn slowly as your work progresses, it is a difficult way to proceed (let alone to inspire confidence in the people that you are working with).

This booklet only contains species with which I have had experience. Thus depending upon your location and the species which you are working with there will be some listed here which are of no use to you, and others which you may wish I'd included. Those which you'd like to include can be added into the space for notes on additional species, and may be included in later editions. Likewise, any additions or modifications to what I have written here should be noted for future editions.

While the primary intention of this booklet is to help with identification in the germination bed, several species were included which you may be able to find already germinated on the forest floor after the rains. This of course depends upon how much indigenous forest you have in your area, and the grazing pressures. In places where goats don't go, nature's nursery almost always has something. Thus it pays to know what you are looking at as it prevents a lot of work (seed collection, extraction, storage, germination etc.). To help in both the forest and in the germination bed a simple key has been included. Trees which do well from cuttings and poorly from seed, such as *Ficus*, *Morus*, *Euphorbia*, etc., were not included as you know what you are getting when you cut one, and they "store" well uncut on the tree until you need them. For more information about these species, consult the other useful resources that I've listed.

## How to use this booklet:

The first thing to be aware of is my disclaimer. Trees are living things and as such are subject to variability resulting from genetic

and environmental influences. Thus the drawings and information contained within this booklet are only intended as examples. You will find differences in size, color, amount of time required for germination, etc. It is hoped that the information provided will serve as a useful guide in spite of the occasional discrepancy.

### *Illustrations and Key*

The families have been arranged alphabetically, and then the genus and species listed alphabetically within each family. Because in many cases the characteristics of the cotyledons are consistent within a family, the key also helps break the examples into their families. Thus for those species not included, chances are good that they will have an appearance similar to something from the same genus or family.

### *Species Information*

Each of the seed information headings accompanying the illustrations comes with a range of answers. These will now be briefly explained.

**Propagation:** recommended methods. Which is best for you will depend upon your site - i.e. hesitate to try direct sowing in an arid zone, but don't waste your time on a nursery if you get so much rain you don't need to do one.

**Elevation:** gives an idea of the tree's sensitivity to cold or heat. You can certainly plant trees outside of their optimum range, they just won't do as well.

**Availability:** refers to the availability of seeds on a daily basis

***Intermittent:*** Some years no seeds are available, other years they may be easy to find. Depends upon the weather, and the habits of the tree in question.

***Seasonal:*** Seeds may be available perhaps 1 or 2 times per year. It depends upon the rain at your site, temperatures, etc., and may be very different from year to year.

***Much of the year:*** Available more often than not. Seeds may ripen and wait on the tree for an extended time, or new ones may be offered frequently.

***Year round:*** You should be able to almost always walk outside and collect seed from a healthy tree.

4

**Persistence:** refers to how long seedlings which have newly germinated on the forest floor from fallen seed, will last after the rains. Not relevant to seedlings in the germination bed assuming that the nursery is being cared for.

**Low:** Newly germinated seedlings in the forest floor will not last long. After a short time only a few will be left to become wildings.

**Moderate:** Significant numbers of seedlings should last for a few weeks or a few months. Nursery work or wildings are both good options.

**High:** Will last several months or even a year. Can be trusted to wait and be used as wildings when convenient.

**Seeds per fruit:** refers to the number of seeds supplied by an average fruit. Simply intended to give you an idea of how many you will need to collect to help you meet your needs.

**Extraction:** If you are storing seed, then this is how to separate and prepare it. If you intend to sow your seeds immediately, then much of this work may not be necessary.

**Storage:** Assumes seed has been extracted and dried properly. Also assumes that only room temperature storage is available (how many of us have cold storage?). If storage for a species you are interested in is very short, then consider sowing all of your seed immediately, and maintaining it in the germination bed. Many trees can last for months like this, but die quickly if stored as seeds.

**Pretreatment:** refers to how to break the dormancy of the seeds which you are planting. For more information I recommend reading Albrecht (1993) Chapter 2 (see list of useful resources). Pretreatment will improve your germination rate, and speed of germination.

**Expected Germination:** assumes a healthy, viable seed lot. If you get poor germination (or none) probably your seeds were not good. However, when trying again, increase the amount of light and warmth available to the seeds just in case environmental factors were the problem. Another possibility is that while you were pretreating them, you may have killed them, so be careful.  
*-NOTE- where germination is very high consider direct sowing, or sowing the seeds into the containers in which they'll grow instead of the germination bed.*

**Time to Germination:** gives you an idea of when the seedlings will start to shoot, and or when to declare them dead and try again. While you are waiting is a good time to begin preparing your containers.

**Rate of Growth:** gives you an idea of when the seeds that you are planting will be ready to be planted out as trees. Thus if the rains are only a month or two away you know that a tree needing 3 to 4 months in the

nursery won't be ready in time, and you'll still be caring for it until next year. Of course one that will need 8 months you might as well plant anyway, as it'll need most of the year that you are waiting before it can possibly be ready. When possible timing the maturity of the trees to match the coming of the rains can reduce work. Of course rain is not as predictable as one might like.

**Useful Resources:**

Albrecht, J. (1993) Tree seed handbook of Kenya. GTZ Forest Seed Centre, Muguga. Kenya Forest Research Institute/GTZ, Nairobi. 264 pages.

Beentje H. J. (1994) Kenya trees shrubs and lianas. National Museums of Kenya. Nairobi. 722 pages.


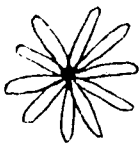
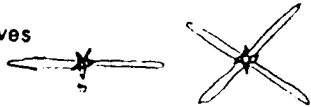

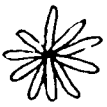

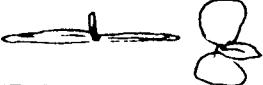
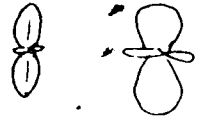




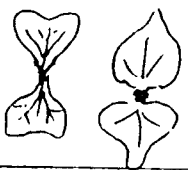





ICRAF (1992) A selection of useful trees and shrubs for Kenya. International Centre for Research in Agroforestry. Nairobi. 226 pages.

KEFRI (1992) Kenya Forest Seed Centre: Seed Catalog. GTZ Forest seed Centre, Muguga.

Noad, T., and Birnie A. (1989) Trees of Kenya. P.O. Box 40034, Nairobi Kenya. 308 pages.

Oyalo, O. (1994) On farm tree seed production. Kenya wood fuel and Agroforestry program (KWAP). Nairobi. 55 pages.

Teel, W. (1984) A pocket directory of trees and seeds in Kenya. Kenya Energy Non Governmental Organizations (KENGO). Nairobi. 151 pages.

Seedling emergence	General shape of first leaves	Typical shape of first leaves	Page
<p><b>Epigeal</b> Cotyledons emerge above the ground, turn green, and act as the first set of leaves capable of photosynthesis before the development of true leaves</p> 		<p>Paired 2 or 4, subsequent leaves small and scale-like</p> 	16
		<p>Many long, hair like</p> 	29
		<p>Many long, broad</p> 	30
		<p>Cotyledon margins entire, 3rd leaf simple, single</p> 	7, 8, 11, 14, 17, 30
		<p>Cotyledon margins entire, 3rd &amp; 4th leaves paired</p> 	7, 18, 19, 26, 27
		<p>Cotyledons with lobes and sinuses, 3rd leaf single or paired with 4th</p> 	9-10, 24-25
		<p>Cotyledon margins entire, 3rd leaf compound</p> 	12-14, 20-23, 28
		<p>Cotyledons simple, 3rd leaf vertical, hair-like</p> 	15
		<p>Cotyledons thick, 3rd leaf simple, may be paired with 4th or even additional leaves</p> 	8, 14, 19
		<p>Cotyledons lanceolate or oblanceolate and very large</p> 	11, 15, 28
<p><b>Hypogeal</b> Cotyledons remain below ground. Development of the seedling is supported by food reserve in the cotyledons until leaves develop</p> 			<p>First leaf grass-like</p> 
	<p>Stem strong, rising some distance to finally produce single or paired simple leaves</p> 		18, 26, 31
	<p>Stem strong, rising some distance to finally produce compound leaves</p> 		12, 20

**Schinus molle** Pepper tree Exotic: South America

**Propagation:** seedlings, wildings

**Elevation:** 1,400-2,100 meters

**Availability**

seasonal  
(frequently not viable)

**Persistence**

moderate

**Seeds per fruit**

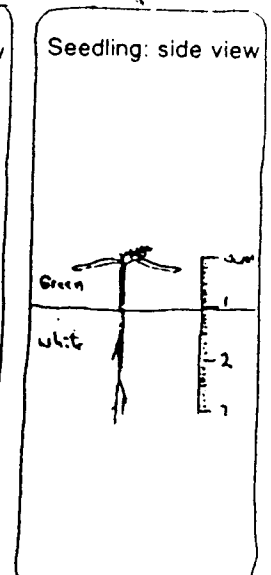
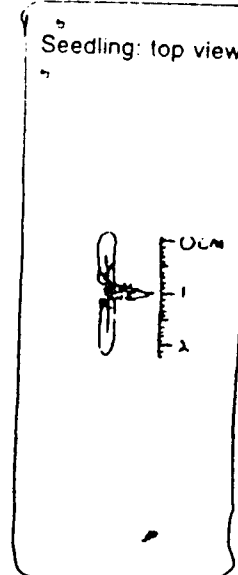
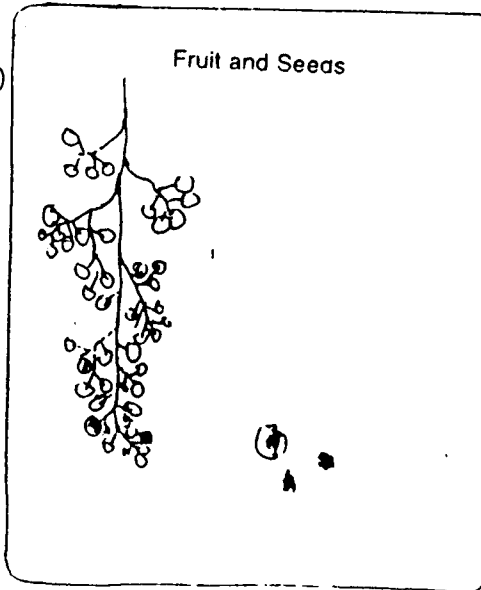
1

**Extraction**

dry, thresh  
and winnow

**Storage**

1 year



**Pretreatment**  
none

**Expected Germ.**  
variable: 30-70%

**Time to Germ.**  
2-4 weeks

**Rate of growth**

very fast, can be ready to  
plant out after 3-4 months

**Note:** Because of the difficulty in determining viability of seeds, this species does best with the collection of newly germinated seedlings following the rains. Many can be found along fence lines where birds rest and deposit the seeds.

Apocynaceae

**Acokanthera schimperi** Poison Arrow Tree Indigenous

**Propagation:** seedlings, wildings

**Elevation:** 1,200 - 2,300 meters

**Availability**

seasonal

**Persistence**

moderate

**Seeds per fruit**

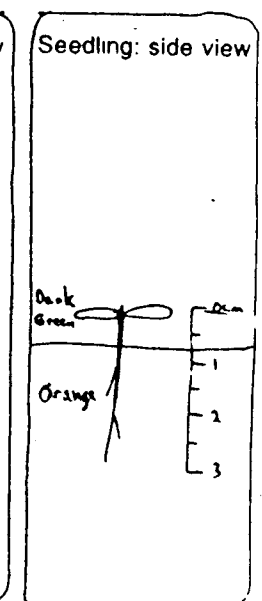
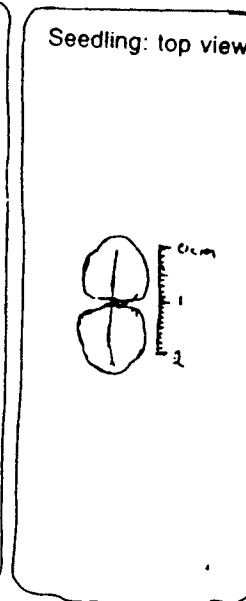
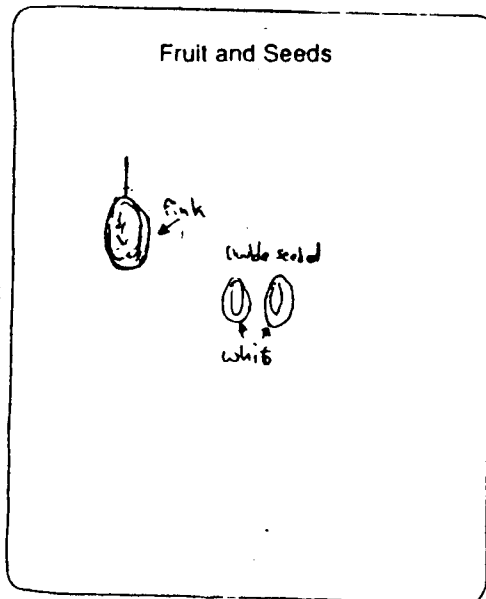
2

**Extraction**

depulping  
washing, drying

**Storage**

3 months



**Pretreatment**  
none

**Expected Germ.**  
poor: 30-50%

**Time to Germ.**  
2-4 weeks

**Rate of growth**

moderate to slow growing,  
can be ready to plant out after  
6-8 months

Thevetia peruviana Yellow Oleander

Exotic: South America

Propagation: seedlings, cuttings

Elevation: 0-2,000 meters

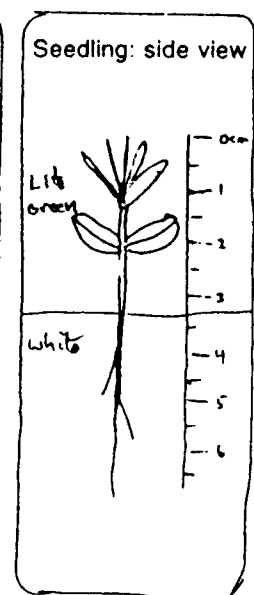
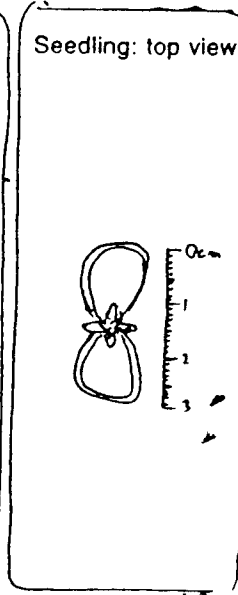
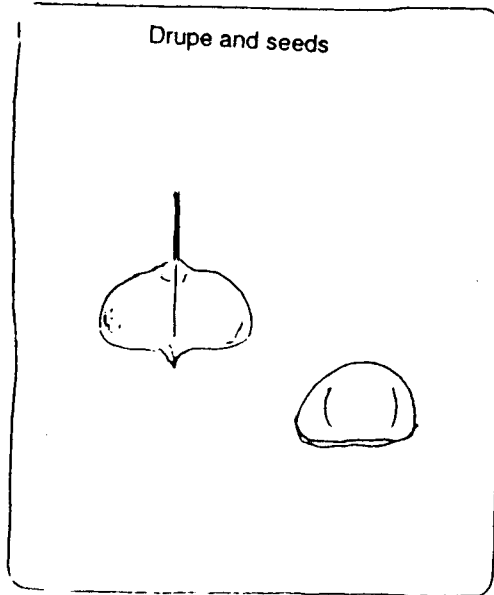
Availability  
seasonal

Persistence  
moderate

Seeds per fruit  
4 inside large woody shell

Extraction  
Depulping, washing, drying (seeds stay in shell)

Storage  
3 months



Pretreatment  
none

Expected Germ.  
good: 50%

Time to Germ.  
3-4 weeks

Rate of growth  
fairly fast, ready to plant out after 4-5 months

*Araliaceae*

Polyscias kikuyuensis Parasol Tree

Indigenous

Propagation: seedlings, wildings

Elevation: 1,750-2,750 meters

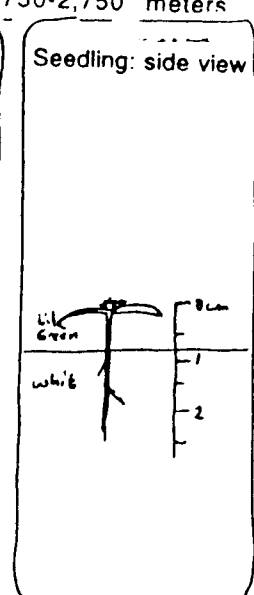
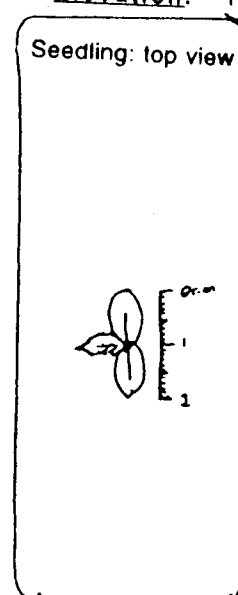
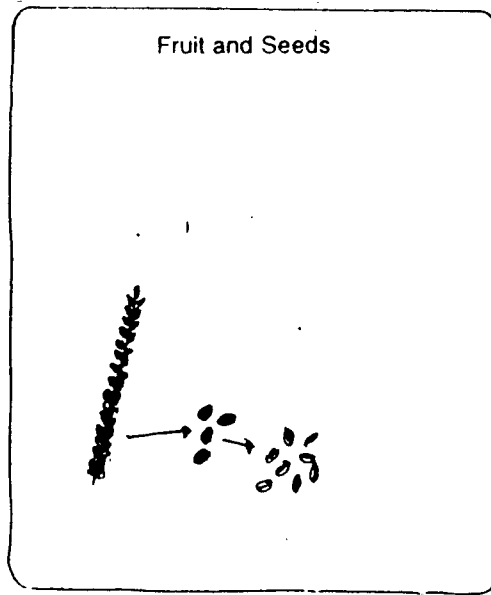
Availability  
intermittent

Persistence  
moderate

Seeds per fruit  
2

Extraction  
depulping, washing and drying

Storage  
1 year



Pretreatment  
none

Expected Germ.  
good: 75%

Time to Germ.  
5-7 weeks

Rate of growth  
fast, can be ready to plant out after 4-5 months

Jacaranda mimosifolia Jacaranda Exotic: South America

Propagation: seedlings, wildings

Elevation: 0-2200 meters

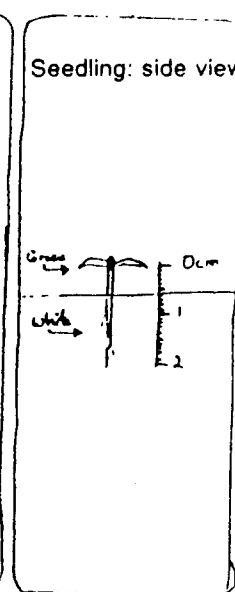
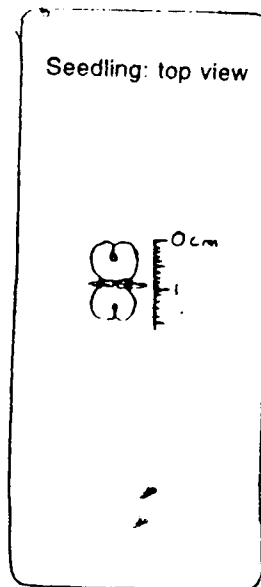
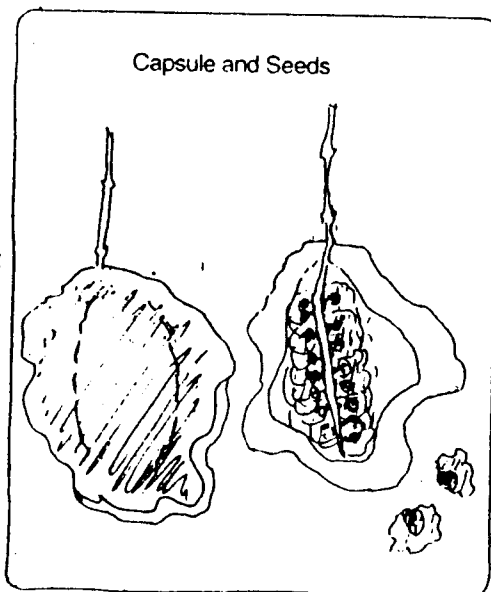
Availability  
seasonal

Persistence  
moderate

Seeds per fruit  
50+

Extraction  
Collect when dry (opening) shake to release seeds.

Storage  
1 year



Pretreatment  
None

Expected Germ.  
50-90%

Time to Germ.  
2 to 3 weeks

Rate of growth  
very fast growing  
ready to plant out  
after 4 months

Markhamia lutea

Markhamia

Indigenous

Propagation: seedlings, wildings

Elevation: 0-2000 meters

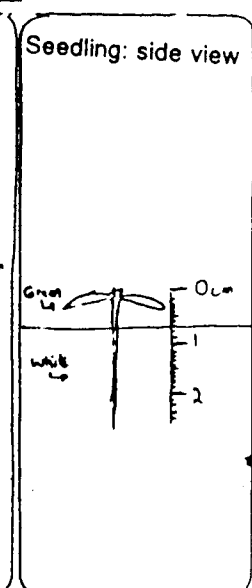
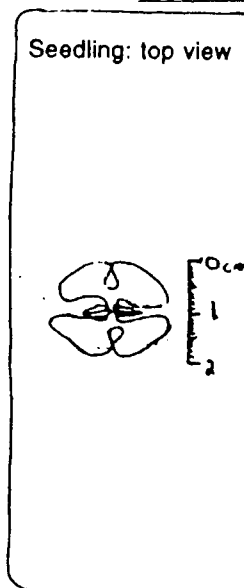
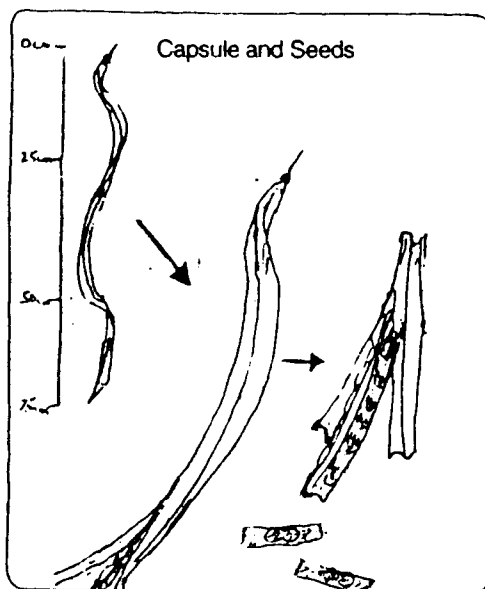
Availability  
Much of the year

Persistence  
Moderate

Extraction  
collect when dry, shake to dislodge seeds

Seeds per fruit  
100+

Storage  
does not store well



Pretreatment  
none

Expected Germ.  
80%

Time to Germ.  
2 to 3 weeks

Rate of growth  
fast growing  
can be ready to plant out  
after 2-3 months

**Spathodea campanulata** Nandi Flame Indigenous

**Propagation:** seedlings, wildlings

**Elevation:** 0-2000 meters

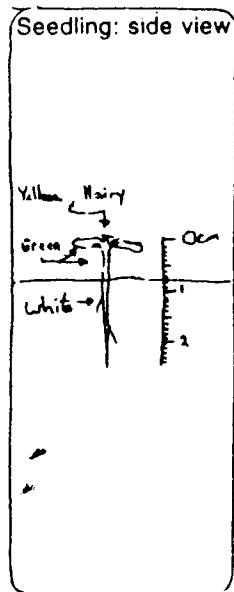
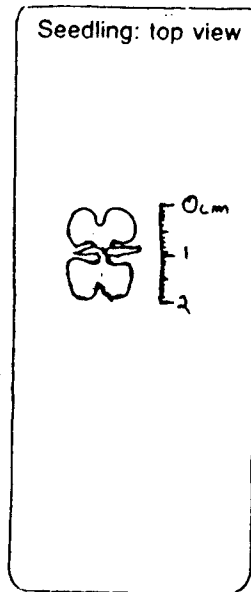
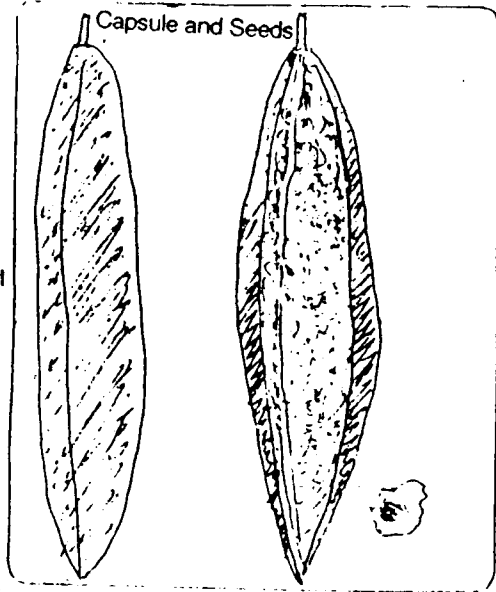
**Availability**  
seasonal

**Persistence**  
low

**seeds per fruit**  
500+

**Extraction**  
Collect when dry, shake to dislodge

**Storage**  
Does not store well.  
-sow fresh



**Pretreatment** none    **Expected Germ.** 50-90%    **Time to Germ.** 2 to 3 weeks    **Rate of growth** fairly fast growing, ready to plant out after 6 months

**Tecoma stans** Tecoma / Yellow bell

**Exotic:** Central America

**Propagation:** seedlings, wildings

**Elevation:** 0-2200 meters

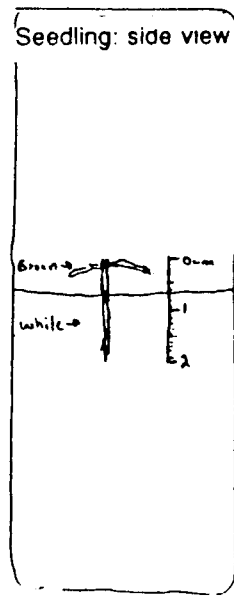
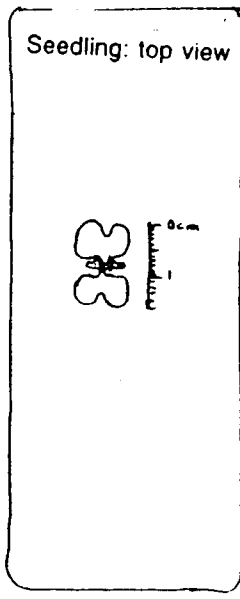
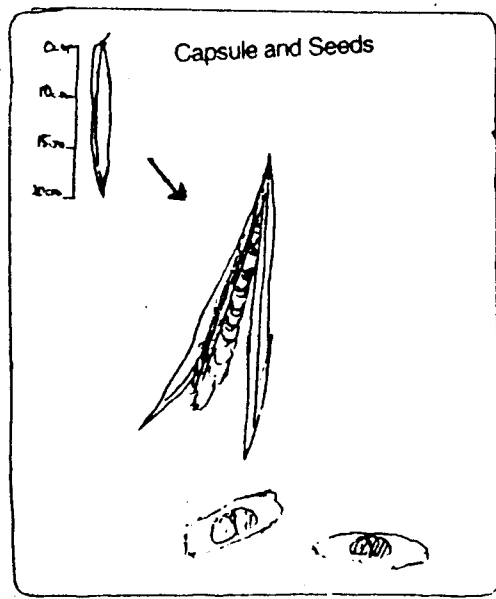
**Availability**  
much of the year

**Persistence**  
moderate

**Seeds per fruit**  
50+

**Extraction**  
Collect when dry, shake to dislodge seeds

**Storage**  
Does not store well



**Pretreatment** none    **Expected Germ.** 50-80%    **Time to Germ.** 2 to 3 weeks    **Rate of growth** very fast growing, can be ready to plant out after 2-3 months

Bombacaceae



Chorisia speciosa Bombax Exotic: South America

Propagation: seedlings, cuttings

Elevation: 0 - 2,000 meters

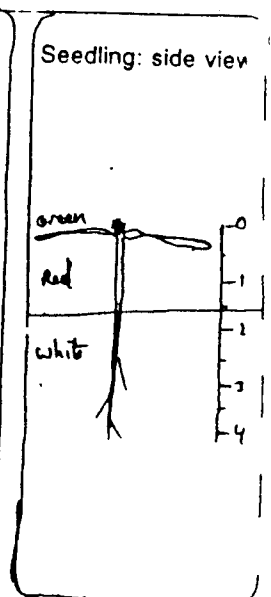
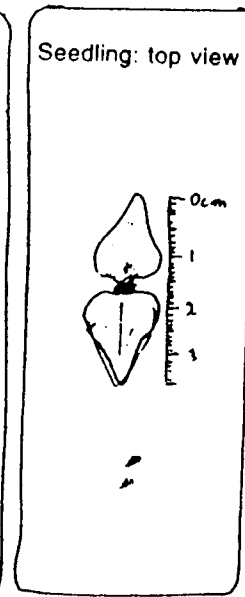
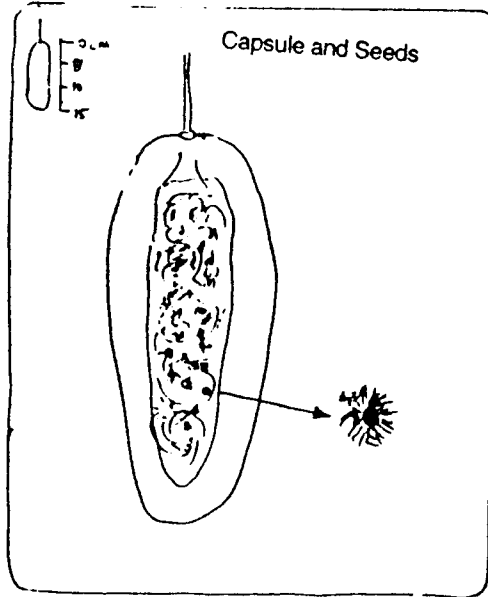
Availability  
seasonal

Persistence  
low

Seeds per fruit  
100+

Extraction  
abraid seeds on wire mesh to remove white fibers

Storage  
1 year



Pretreatment  
none

Expected Germ.  
good: 60-70%

Time to Germ.  
3-4 weeks

Rate of growth  
fairly fast growing, ready to plant out after 4-5 months

Boraginaceae

Cordia africana Cordia Indigenous

Propagation: seedlings, wildings

Elevation: 450-2,100 meters

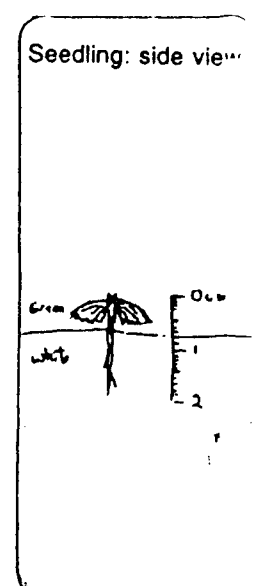
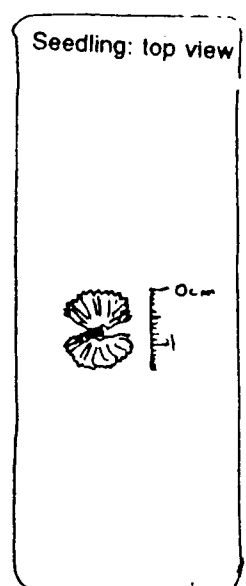
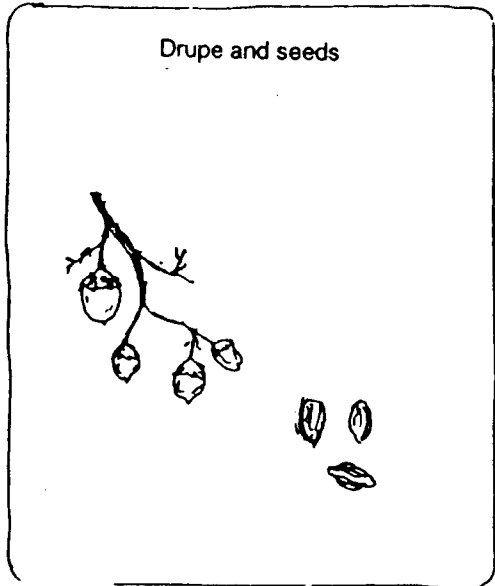
Availability  
seasonal

Persistence  
low

Seeds per fruit  
4-6 inside woody endocarp

Extraction  
depulp with wire mesh, and wash. Seeds remain within endocarp

Storage  
1 year



Pretreatment  
none

Expected Germ.  
good: 75%

Time to Germ.  
6-9 weeks

Rate of growth  
fairly fast, can be ready to plant out after 6 months

Acrocarpus fraxinifolius

Indian Ash Exotic: South & Southeast Asia

Propagation: seedlings, wildings, direct sowing

Elevation: 1000-2000 meters

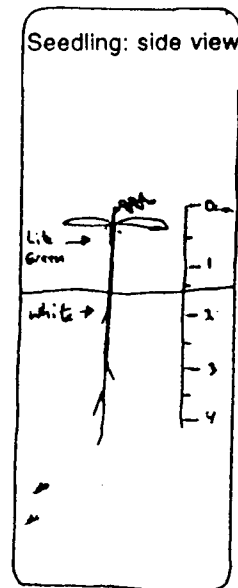
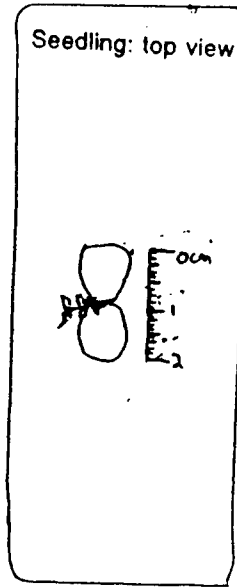
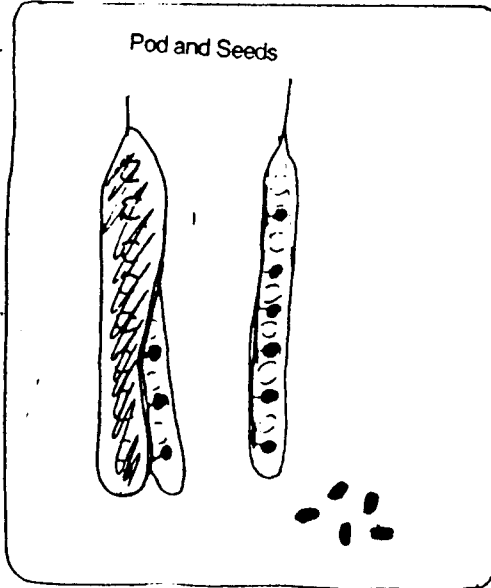
Availability  
much of the year

Persistence  
low

Seeds per fruit  
10 - 20

Extraction  
collect dry,  
thresh

Storage  
1 year



Pretreatment

- nick or soak in cold water

Expected Germ.

poor: 40 - 50%

Time to Germ.

3 - 4 weeks

Rate of growth

fast, can be ready to plant out in 4 - 5 months

Caesalpinia decapetala

Mauritius thorn

Exotic: South & Southeast Asia

Propagation: seedlings, direct sowing

Elevation: 900-2100 meters

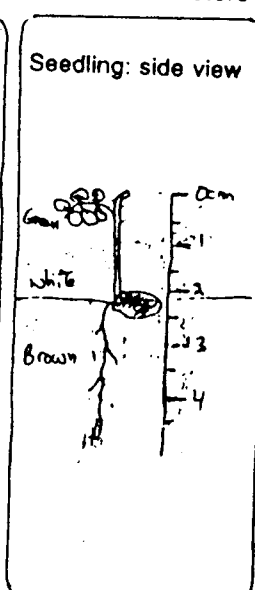
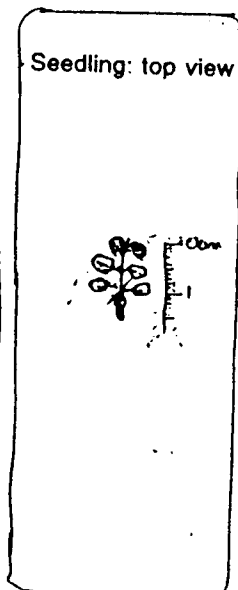
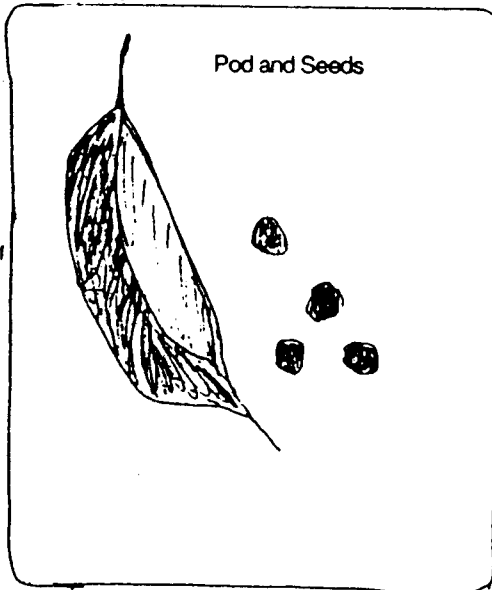
Availability  
seasonal

Persistence  
high

Seeds per fruit  
4-5

Extraction  
collect dry,  
thresh

Storage  
1 year



Pretreatment

soak in cold water for 24 hours

Expected Germ.

good: 60%

Time to Germ.

3 to 4 weeks

Rate of growth

fast, can be ready in 5 months

Cassia spectabilis Cassia

Exotic: Central America

Propagation: seedlings, direct sowing

Elevation: 0 - 2000 meters

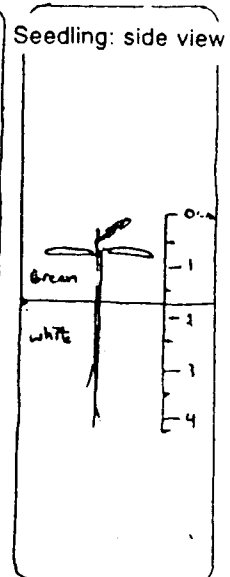
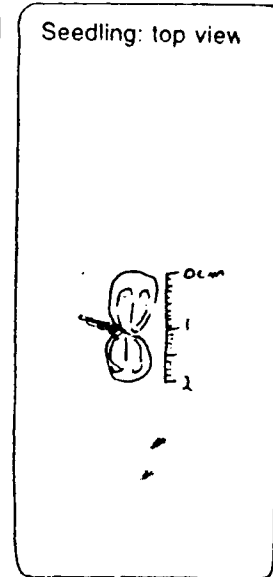
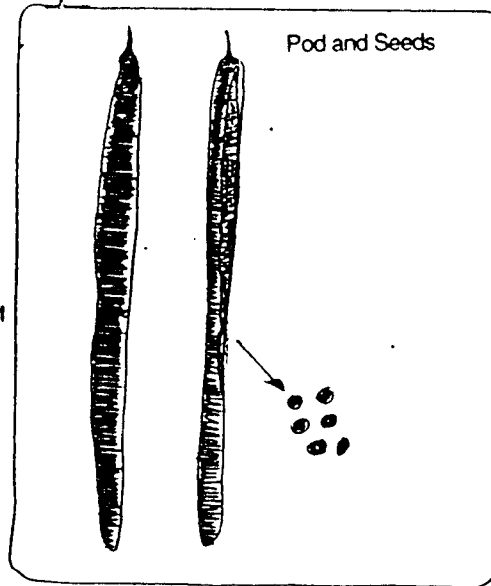
Availability  
seasonal

Persistence  
low

Seeds per fruit  
30+

Extraction  
collect dry,  
thresh

Storage  
1-2 years



Pretreatment soak in hot water over night

Expected Germ. good: 60%

Time to Germ. 3 - 4 weeks

Rate of growth fast, can be ready after 4 months

Delonix regia Flamboyant

Exotic: Madagascar

Propagation: seedlings, direct sowing

Elevation: 0-2000 meters

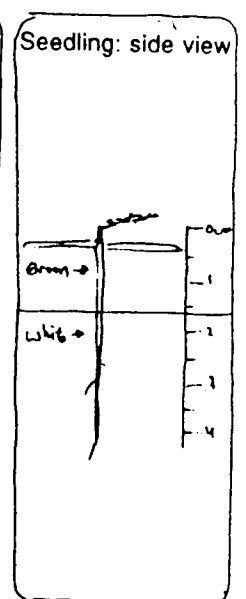
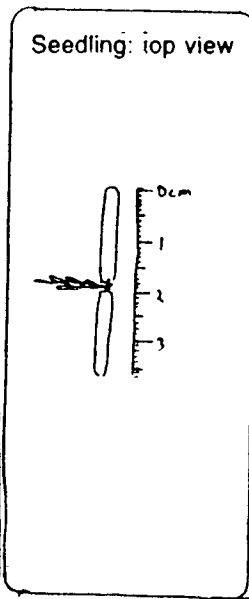
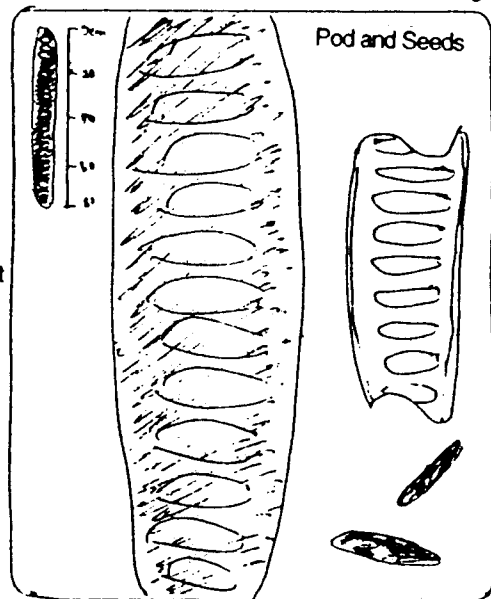
Availability  
seasonal

Persistence  
moderate

Seeds per fruit  
20

Extraction  
Collect dry,  
thresh

Storage  
1-2 years



Pretreatment soak in hot water over night

Expected Germ. good: 40 - 60%

Time to Germ. 1 - 2 weeks

Rate of growth fast growing, can be ready to plant after 4 months

**Tamarindus indica Tamarind**

**Indigenous**

**Propagation:** seedlings, wildings

**Elevation:** 1-1500 meters

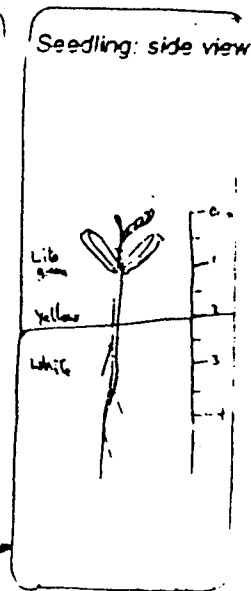
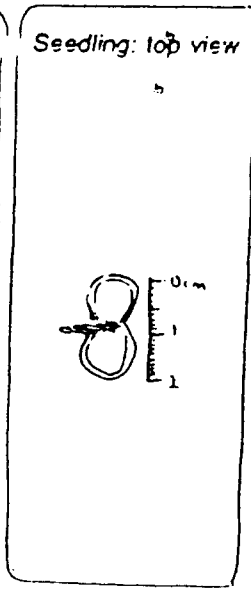
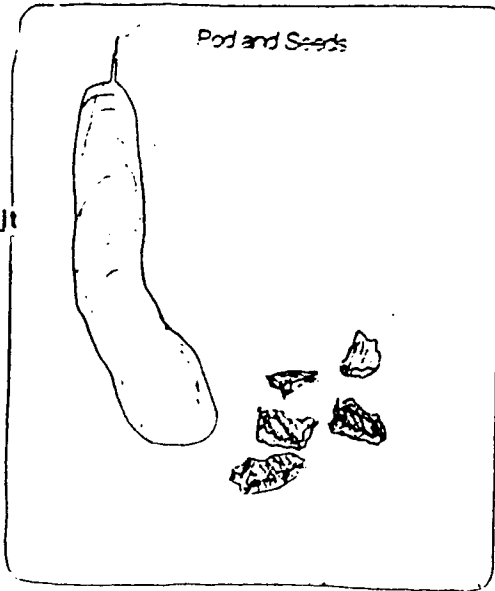
**Availability**  
seasonal

**Persistence**  
moderate

**Seeds per fruit**  
1-10

**Extraction**  
Peel open  
cracked pod  
& remove seed

**Storage**  
1-2 years



**Pretreatment**  
soak in hot water

**Expected Germ.**  
very good: 90%

**Time to Germ.**  
6-7 weeks

**Rate of growth**  
slow growing, seedlings  
need 6 months to 1 year

*Canellaceae*

**Warburgia ugandensis East African Green Heart Indigenous**

**Propagation:** seedlings, wildings

**Elevation:** 1,000-2,000 meters

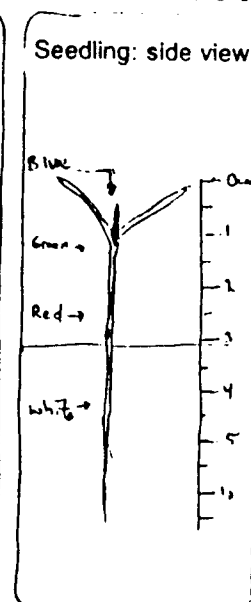
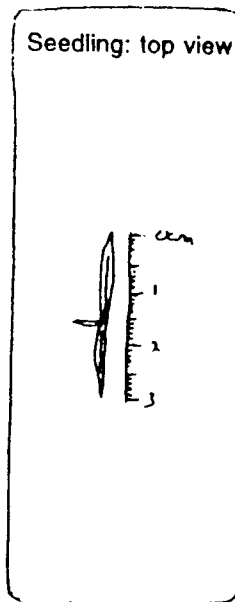
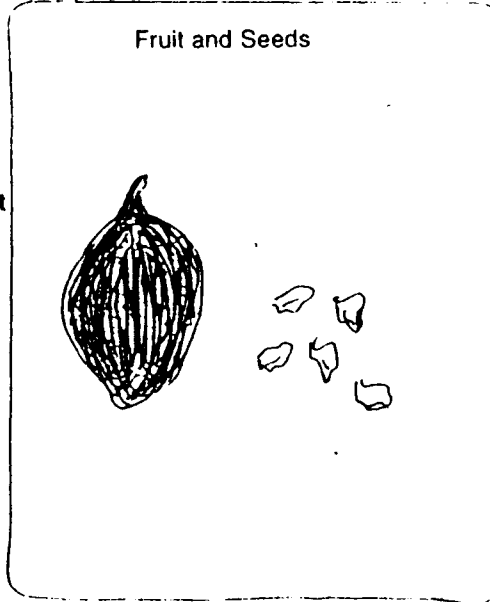
**Availability**  
seasonal

**Persistence**  
moderate

**Seeds per fruit**  
5-10

**Extraction**  
depulp fruit  
with wire  
mesh

**Storage**  
does not store



**Pretreatment**  
none

**Expected Germ.**  
good: 70%

**Time to Germ.**  
2-3 weeks

**Rate of growth**  
slow growing, will need  
at least 6-8 months in  
nursery to be ready to plant  
out.

**Note:** Fruit and seeds rot quickly on the ground- collect directly from the tree, or better yet use germinated seedlings from the forest floor while in season

**Casuarina cunninghamiana** She-oak Exotic: Aust

Propagation: seedlings, wildings

Elevation: 0 - 1,800 m

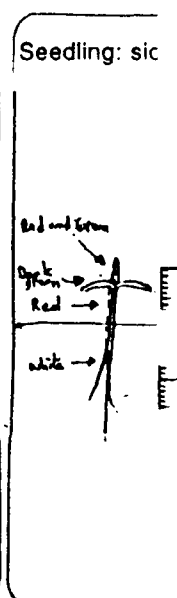
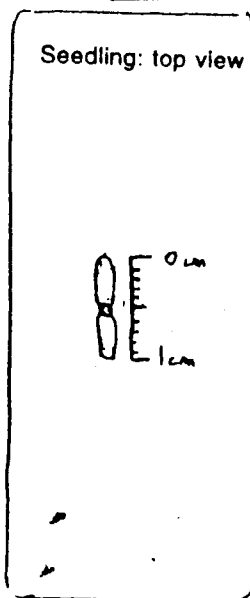
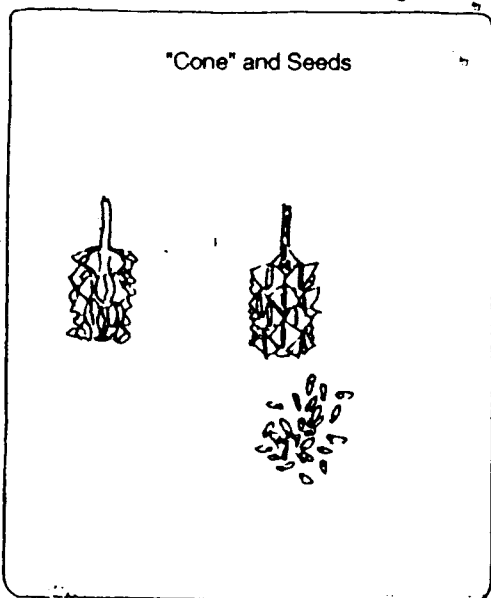
Availability  
year round

Persistence  
low

Seeds per fruit  
50+

Extraction  
dry in the sun  
out of the wind  
-will open and  
release seeds

Storage  
1 year



Pretreatment  
none, though sowing  
in sand can improve  
germination rate

Expected Germ.  
good: 50-90%

Time to Germ.  
2-3 weeks

Rate of growth  
fairly fast, can be pre-  
out after 5-6 months

**Combretaceae**

**Terminalia mentalis**

**Terminalia** Exotic: Austr

Propagation: seedlings

Elevation: up to 2000 m

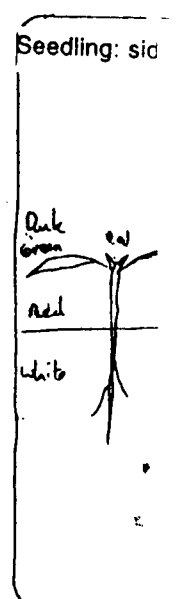
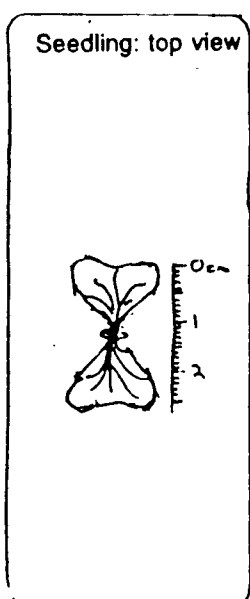
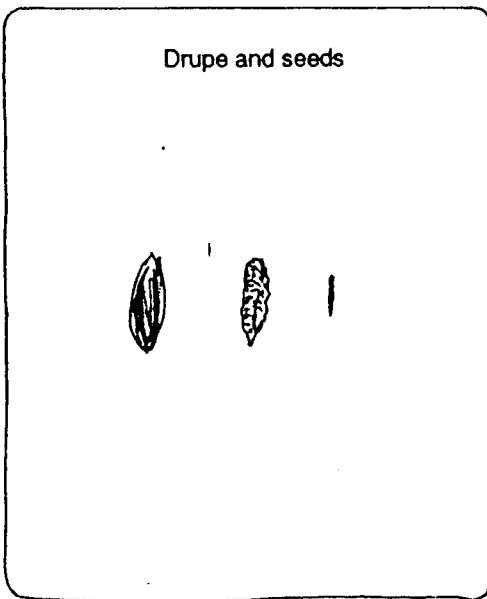
Availability  
very seasonal

Persistence  
low

Seeds per fruit  
1

Extraction  
dry seed, other  
work not needed

Storage  
6 months



Pretreatment  
not necessary, but  
you can cut open the  
shell (avoid damage)

Expected Germ.  
poor: 40%

Time to Germ.  
3-4 weeks

Rate of growth  
moderately slow, but can  
ready to be planted out  
6-7 months

**Cupressus lusitanica** Cypress Exotic: Central America

**Propagation:** seedlings, wildings

**Elevation:** 1,500-2,500 meters

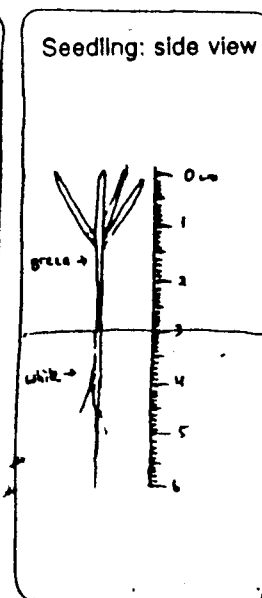
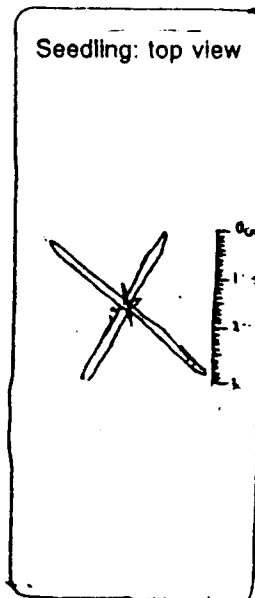
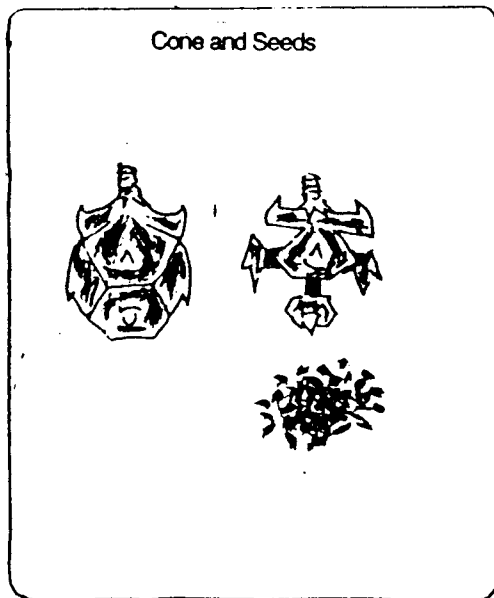
**Availability**  
much of the year

**Persistence**  
low

**Seeds per fruit**  
40+

**Extraction**  
dry in the sun  
out of the wind  
-will open and  
release seeds

**Storage**  
6 months



**Pretreatment**  
none

**Expected Germ.**  
poor: 30 - 45%

**Time to Germ.**  
10 - 20 days

**Rate of growth**  
fast growing, can be planted  
out after 5 months

**Juniperus procera** Red Cedar Indigenous

**Propagation:** seedlings, (small) wildings

**Elevation:** 1,500-3000 meters

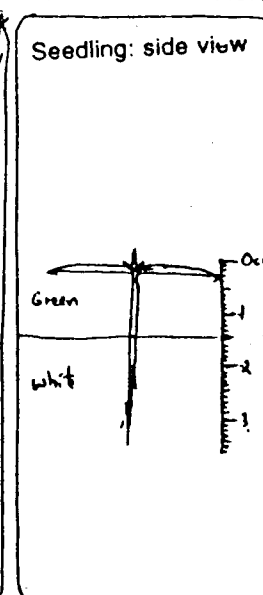
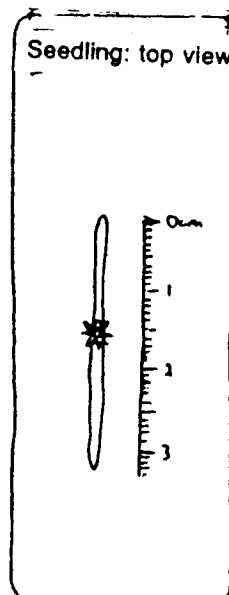
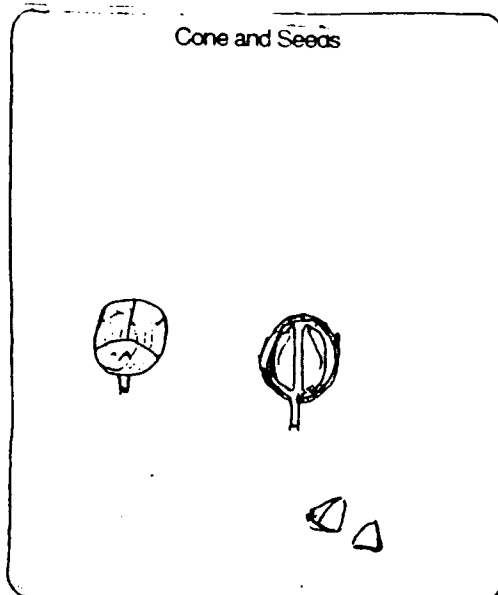
**Availability**  
seasonal

**Persistence**  
moderate

**Seeds per fruit**  
1 - 4

**Extraction**  
drying, pounding  
and sieving

**Storage**  
1 year



**Pretreatment**  
not necessary,  
but hot water  
can help

**Expected Germ.**  
good: 60-70%

**Time to Germ.**  
4-10 weeks

**Rate of growth**  
can be fast growing if  
competition is low, and care  
high- ready to plant out at  
6 months

Euclea divinorum

Euclea

Indigenous

Propagation: seedlings, wildings, suckers

Elevation: 1-2,400 meters

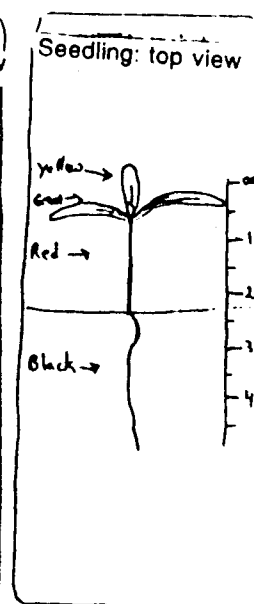
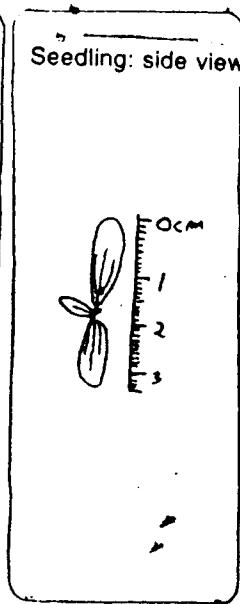
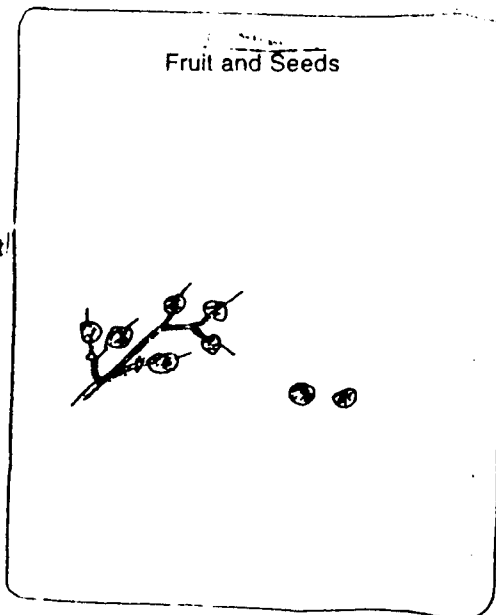
Availability  
seasonal

Persistence  
low

Seeds per fruit  
1

Extraction  
dry fruit,  
thresh

Storage  
6 months



Pretreatment  
none

Expected Germ.  
good: 40-60%

Time to Germ.  
2-3 weeks

Rate of growth  
from seed can be slow,  
but suckers can grow  
quite quickly, and be  
ready in 4-5 months.

Euphorbiaceae

Croton megalocarpus

Croton

Indigenous

Propagation: seedlings, wildings, direct sowing

Elevation: 1,200 - 2,400 meters

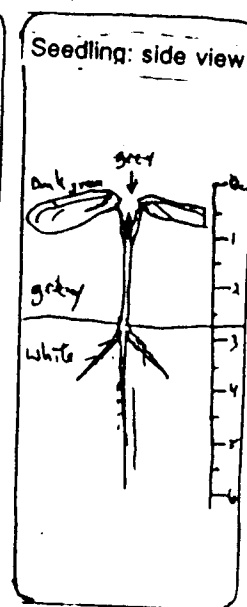
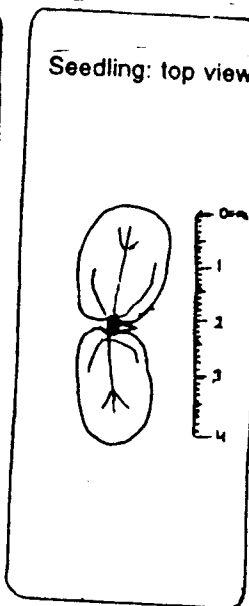
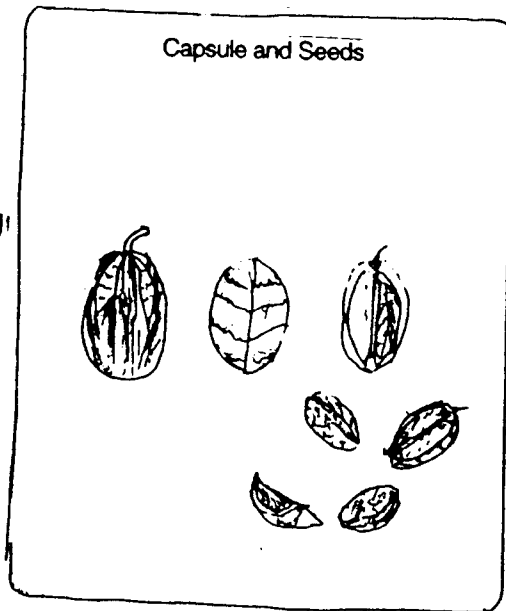
Availability  
seasonal

Persistence  
high

Seeds per fruit  
3

Extraction  
crack shell  
remove seeds

Storage  
6 months



Pretreatment  
none

Expected Germ.  
very good: 95%

Time to Germ.  
5-6 weeks

Rate of growth  
fast growing, can be ready  
to plant out after 4-5 months

Flaucortiaceae

Dovyalis caffra

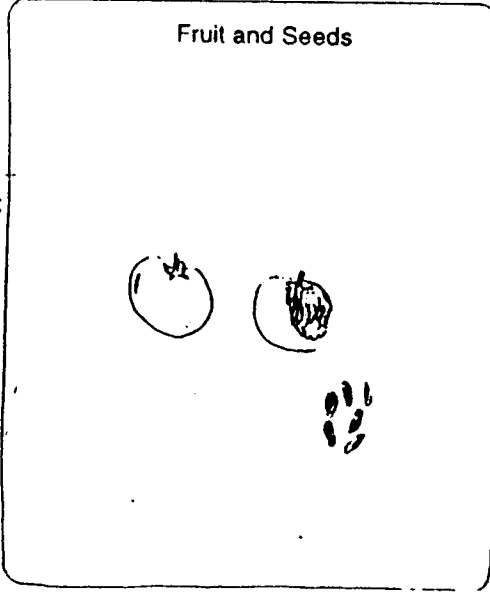
**Kel Apple**

**Exotic: South Africa**

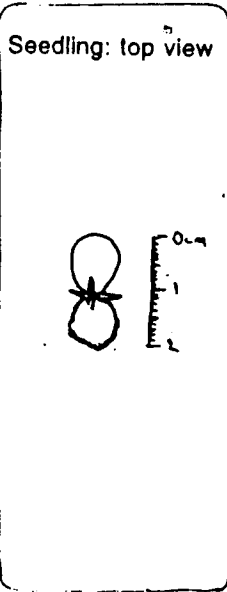
**Propagation:** seedlings, wildings, direct sowing

**Elevation:** 1,200-2,500 meters

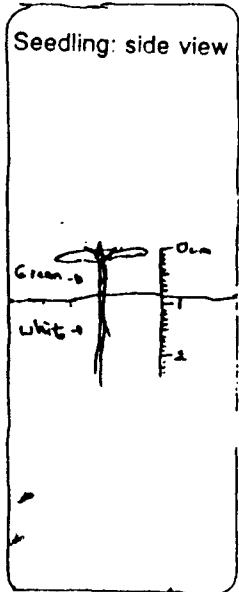
**Availability**  
seasonal



**Seedling: top view**



**Seedling: side view**



**Persistence**  
short term

**Seeds per fruit**  
5-10

**Extraction**  
depulp, and wash seeds

**Storage**  
6 months

**Pretreatment**  
none

**Expected Germ.**  
good: 50%

**Time to Germ.**  
3 weeks

**Rate of growth**  
fairly fast, can be ready to plant out after 5 - 6 months.

Lauraceae

Persea americana

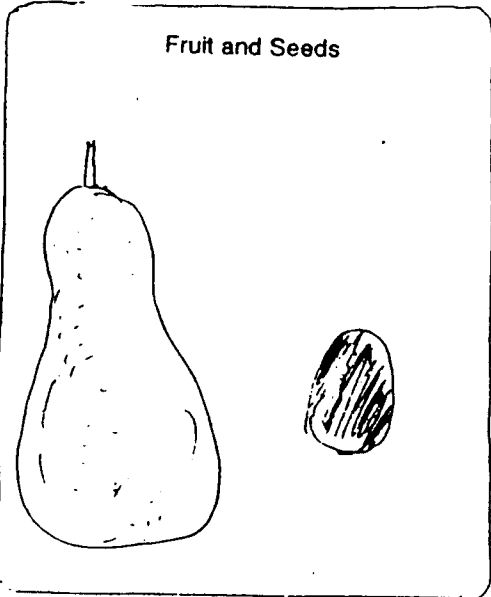
**Avocado**

**Exotic: Tropical America**

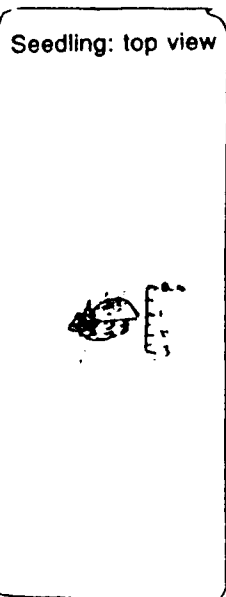
**Propagation:** seedlings, grafting

**Elevation:** 0-2,200 meters

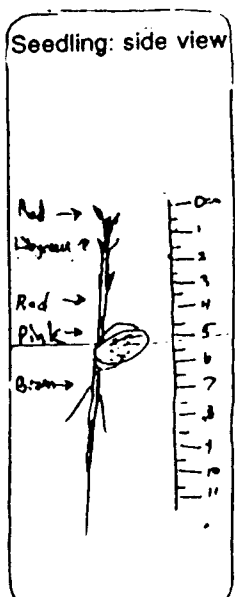
**Availability**  
seasonal



**Seedling: top view**



**Seedling: side view**



**Persistence**  
high

**Seeds per fruit**  
1

**Extraction**  
pulp (or eat) fruit, remove seed

**Storage**  
Does not store

**Pretreatment**  
none, use fresh

**Expected Germ.**  
30-60%

**Time to Germ.**  
4-6 weeks

**Rate of growth**  
fast, because of huge seed, can be planted out after 3-4 months

**Azadirachta indica**

**Neem / Mwarubaini**

**Exotic: India**

**Propagation:** seedlings, wildings, direct sowing

**Elevation:** 0 - 1,500 meters

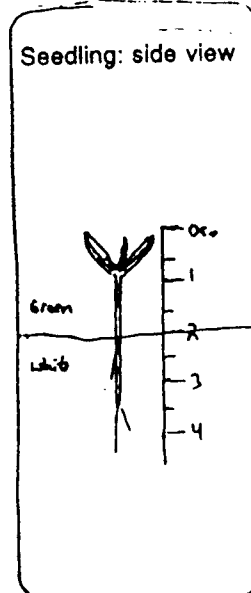
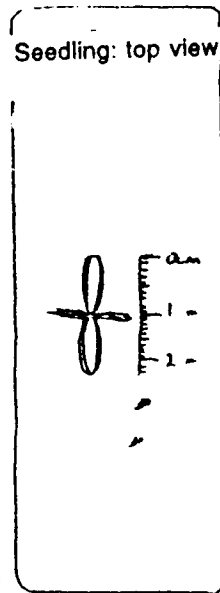
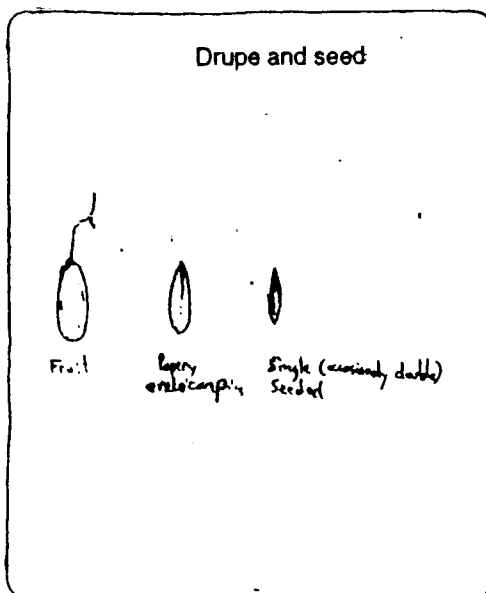
**Availability**  
seasonal

**Persistence**  
high

**Seeds per fruit**  
1, occasionally 2

**Extraction**  
depulping, by rubbing on coffee wire

**Storage**  
• 4-6 weeks



**Pretreatment**  
remove endocarp

**Expected Germ.**  
good: 50-60%  
(if fresh)

**Time to Germ.**  
4 - 6 weeks

**Rate of growth**  
fast growing, can be planted out after 4-5 months

**Melia azedarach**

**Persian lilac**

**Exotic: Austral-Asia**

**Propagation:** seedlings, wildings, direct sowing

**Elevation:** 0-2,000 meters

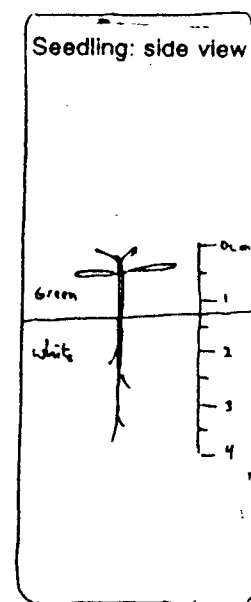
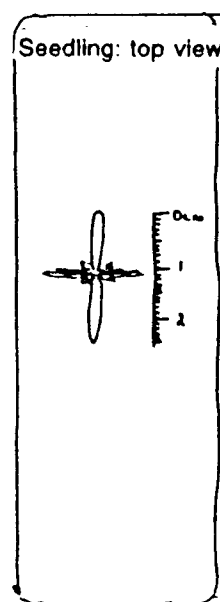
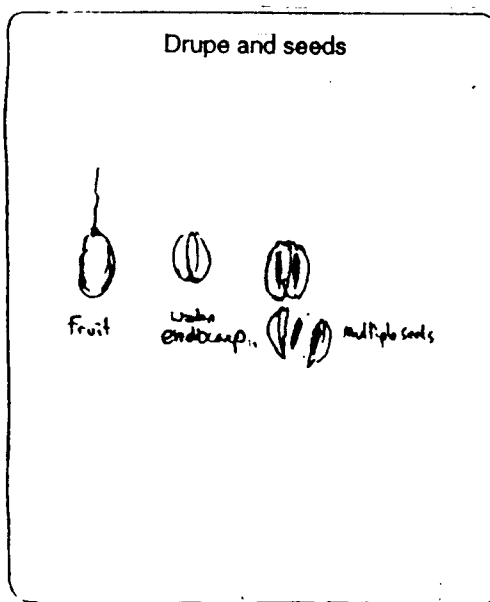
**Availability**  
seasonal

**Persistence**  
high

**Seeds per fruit**  
2-3 inside hard woody endocarp

**Extraction**  
washing and depulping by rubbing over coffee wire

**Storage**  
1 year



**Pretreatment**  
crack open ready to woody endocarp (not necessary)

**Expected Germ.**  
very good: 85-100%

**Time to Germ.**  
5-11 weeks

**Rate of growth**  
fast growing, can be plant out after 5 months

**Acacia abyssinica**

**Umbrella thorn**

**Indigenous**

**Propagation:** seedlings, direct sowing

**Elevation:** 1,200-2,300 meters

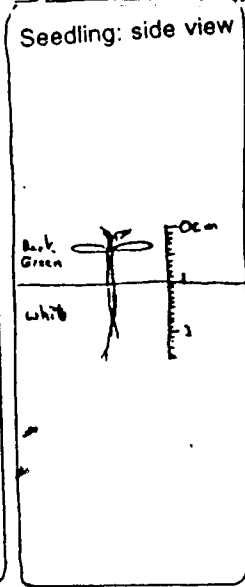
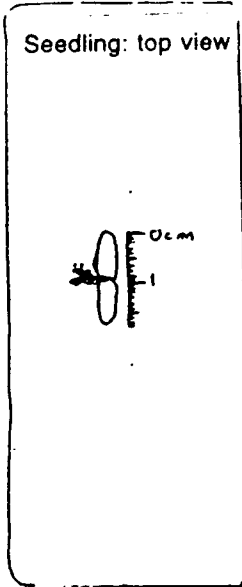
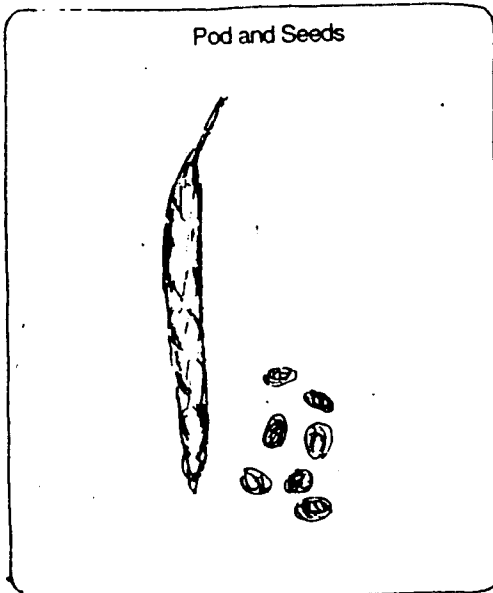
**Availability**  
seasonal

**Persistence**  
high

**Seeds per fruit**  
10+

**Extraction**  
collect dry,  
thresh

**Storage**  
1-2 years



**Pretreatment:** Hot water    **Expected Germ.:** Good: 30-60%    **Time to Germ.:** 1-2 weeks    **Rate of growth:** fast, can be ready to plant after 3-4 months

**Acacia mearnsii**

**Black Wattle**

**Exotic: Australia**

**Propagation:** seedlings, direct sowing

**Elevation:** 1,800-2,400 meters

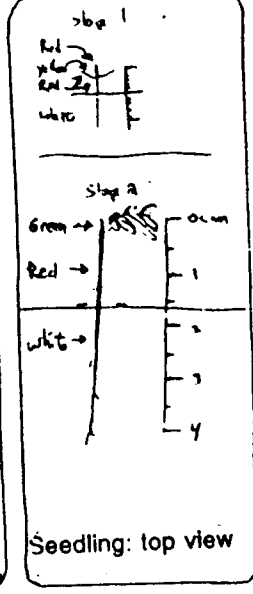
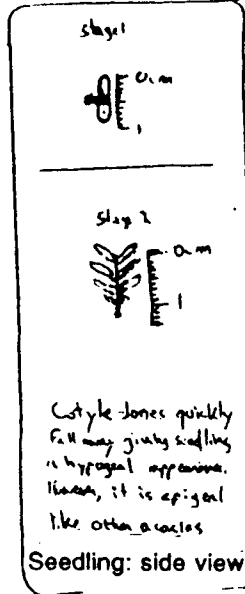
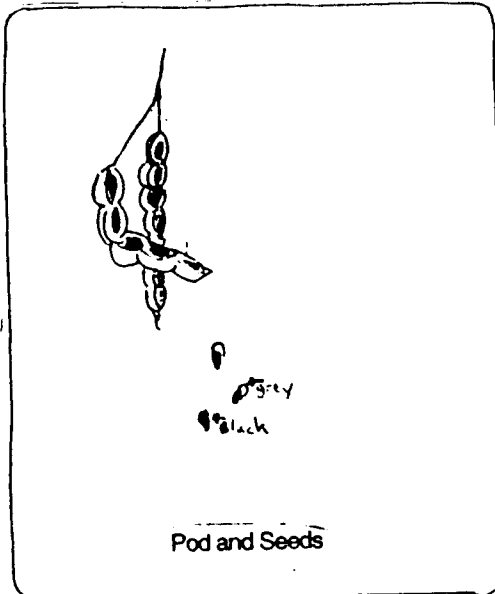
**Availability**  
much of the year

**Persistence**  
high

**Seeds per fruit**  
5-10

**Extraction**  
Collect dry,  
thresh

**Storage**  
1 year



**Pretreatment:** hot water    **Expected Germ.:** good: 50-80%    **Time to Germ.:** 1 - 4 weeks    **Rate of growth:** very fast, can be ready to plant out after 3 months

Acacia melanoxylon

Blackwood

Exotic: Australia

Propagation: seedlings

Elevation: 2,000 - 2,500 meters

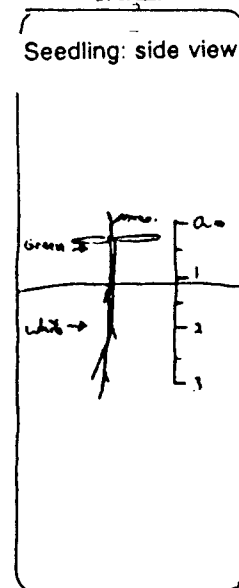
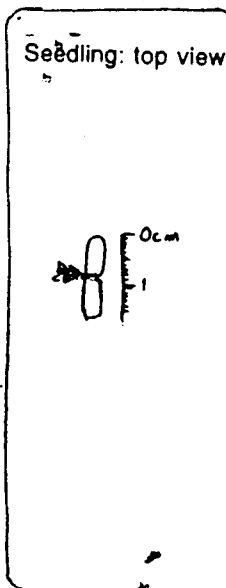
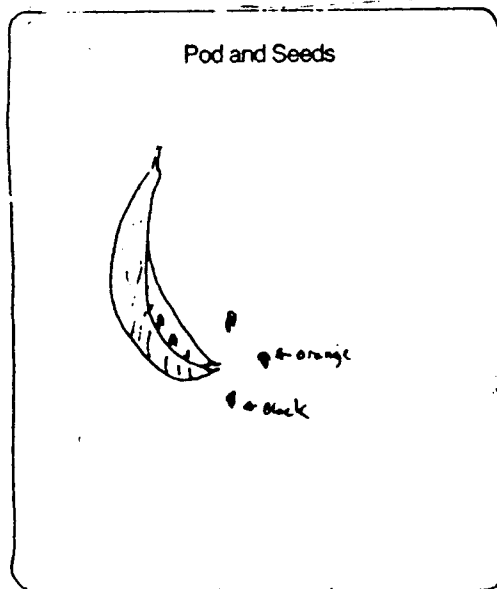
Availability  
seasonal

Persistence  
low

Seeds per fruit  
5-10

Extraction  
collect dry,  
thresh

Storage  
1 year



Pretreatment  
hot water

Expected Germ.  
good: 30-60%

Time to Germ.  
2-4 weeks

Rate of growth  
fast, can be ready to plant out  
after 4 months

Note: This is a phylodinous acacia, thus the compound leaves it begins with will gradually be replaced by broad, apparently simple leaves (Phylodes-developed from the broadened rachis of the compound leaf). This is perfectly normal, and will eventually be the only kind of leaf which the tree produces as it matures.

Acacia xanthophloea

Fever tree

Indigenous

Propagation: seedlings

Elevation: 600-2,100 meters

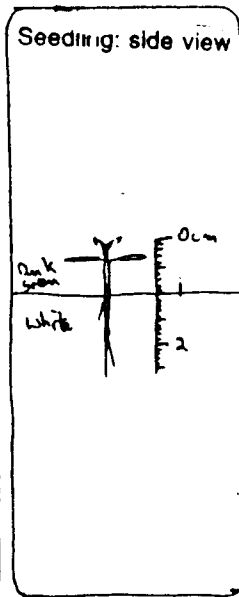
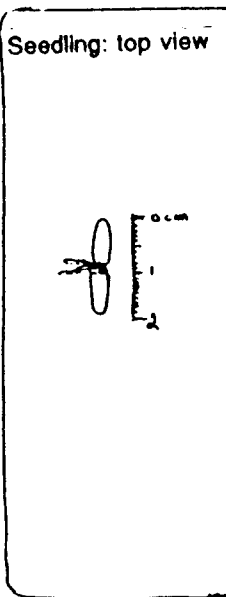
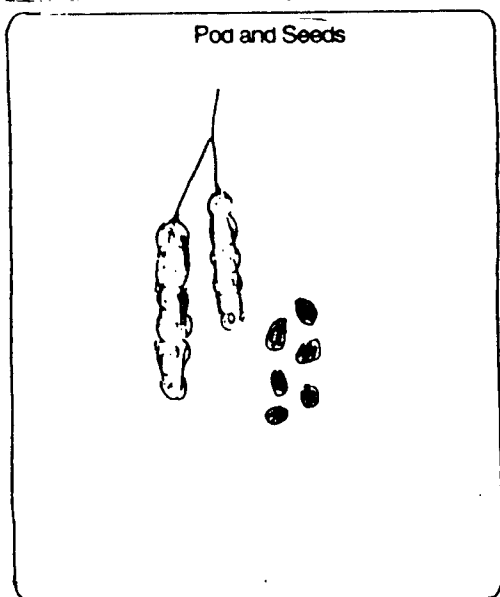
Availability  
intermittent

Persistence  
low

Seeds per fruit  
5-10

Extraction  
collect dry,  
thresh

Storage  
1 year



Pretreatment  
not necessary

Expected Germ.  
good: 40-90%

Time to Germ.  
1-2 weeks

Rate of growth  
moderately fast, needs  
perhaps 6 months to be  
ready to plant out

22

Leucaena leucocephala

Lusina

Exotic: Central America

Propagation: seedlings, direct sowing

Elevation: 0-16,000 meters

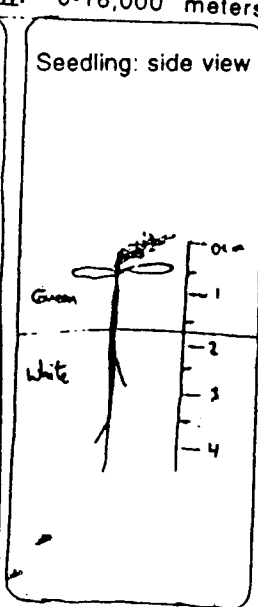
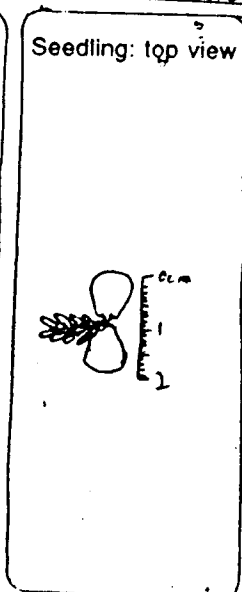
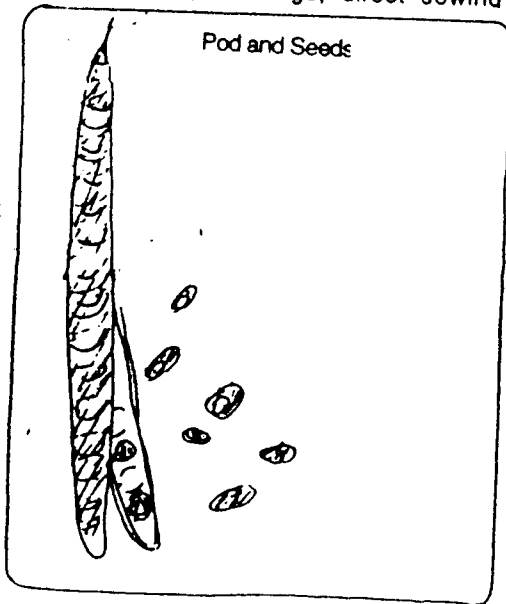
Availability  
much of the year

Persistence  
high

Seeds per fruit  
10-25

Extraction  
collect dry,  
thresh

Storage  
1-2 years



Pretreatment  
nicking or  
• hot water

Expected Germ.  
very good: 80%

Time to Germ.  
1-2 weeks

Rate of growth  
very fast, if seedlings are  
to be used, they can be ready  
to plant out after 3 months

Prosopis chilensis Mesquite

Exotic: South America

Propagation: seedlings, wildings, direct sowing

Elevation: 0-3000 meters

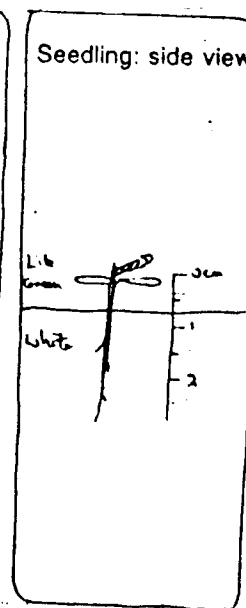
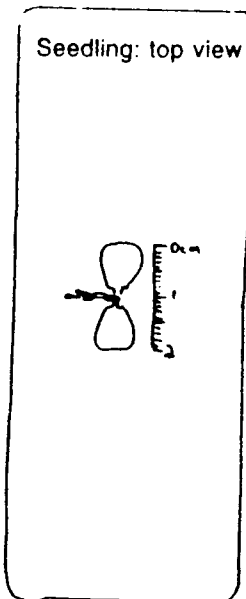
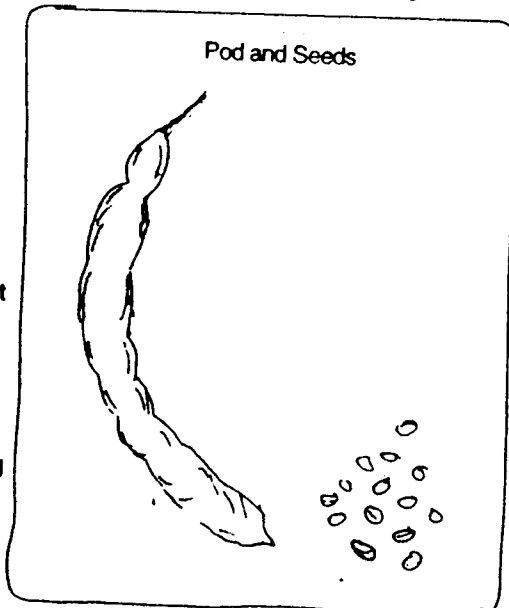
Availability  
seasonal

Persistence  
moderate

Seeds per fruit  
0-15

Extraction  
grinder,  
winnowing, drying

Storage  
1-2 years



Pretreatment  
nicking or cold water

Expected Germ.  
good: 45-80%

Time to Germ.  
2-5 weeks

Rate of growth  
fairly fast in warm areas  
can be ready to plant out  
after 4-5 months

Note A: roots of this species are sensitive to manure and may be "burnt". It is better to sow these seeds without mixing manure into the soil

Note B: this species can become a weed in wet areas, use with care.

**Prosopis juliflora** Mesquite Exotic: North America 23

**Propagation:** seedlings, wildings, direct sowing **Elevation:** 0-1,500 meters

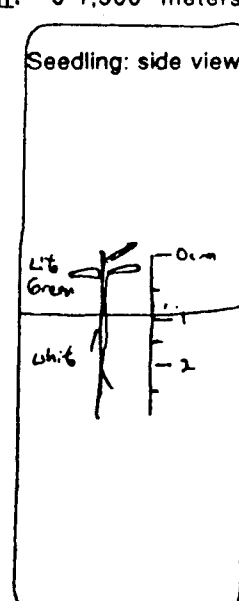
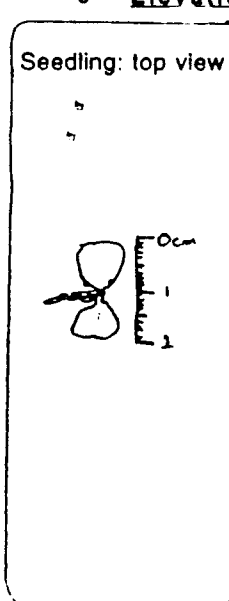
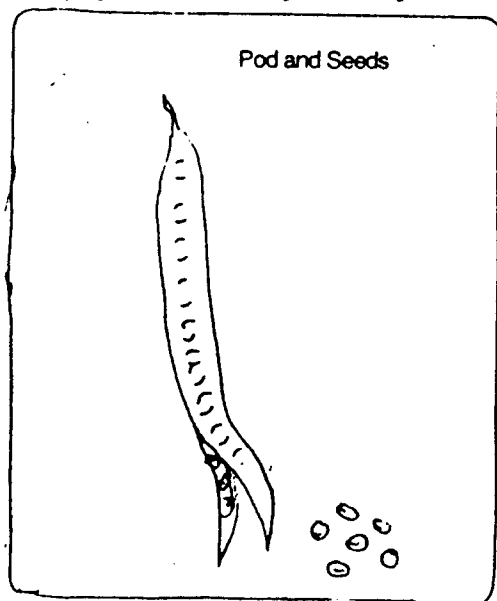
**Availability**  
seasonal

**Persistence**  
moderate

**Seeds per fruit**  
15-20

**Extraction**  
grinding,  
winnowing, drying

**Storage**  
1-2 years



**Pretreatment** nicking or cold water  
**Expected Germ.** good: 50-80%  
**Time to Germ.** 2 weeks  
**Rate of growth** fairly fast in warm areas, can be ready to plant out after 4-5 months

**Note A:** roots of this species are sensitive to manure and may be "burnt". It is better to sow these seeds without mixing manure into the soil  
**Note B:** this species can become a weed in wet areas, use with care.

**Myrtaceae**

**Callistemon citrinus** Bottle brush Exotic: Australia

**Propagation:** seedlings **Elevation:** 0-2500 meters

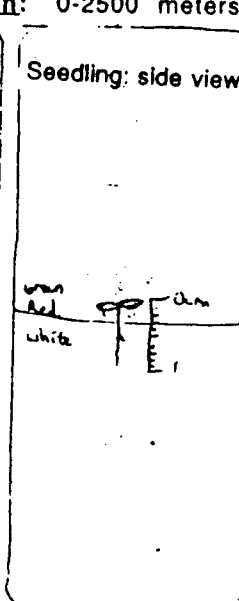
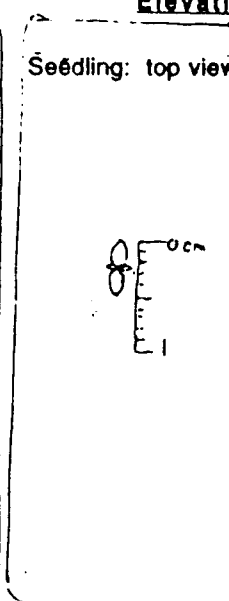
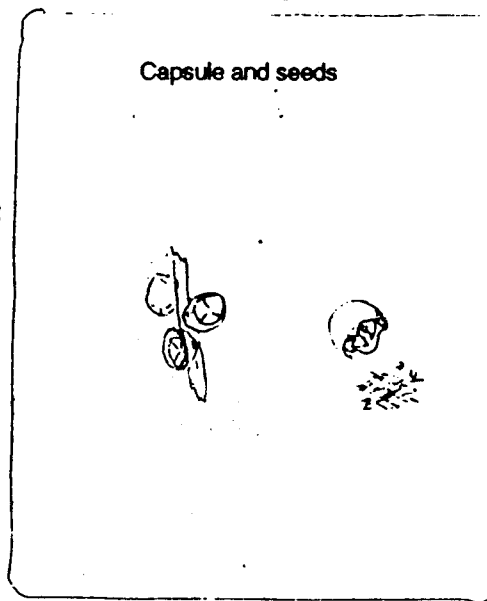
**Availability**  
year round

**Persistence**  
low

**Seeds per fruit**  
countless  
(Dust like)

**Extraction**  
dry in the sun  
out of the wind  
- will open and  
release seeds

**Storage**  
6 months  
to 1 year



**Pretreatment** none  
**Expected Germ.** poor: 30%  
**Time to Germ.** 2 to 3 weeks  
**Rate of growth** very fast, can be ready to plant out after 3-4 months

**Eucalyptus camaldulensis** Red River Gum, Exotic: Australia

Propagation: seedlings

Elevation: 0 - 2000 meters

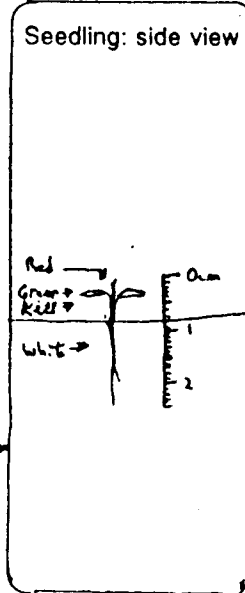
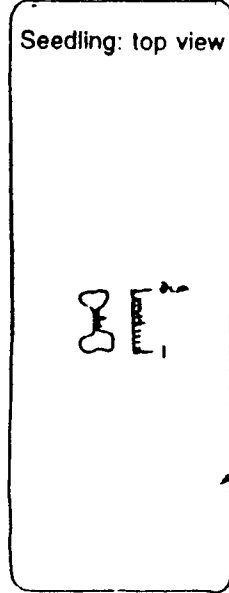
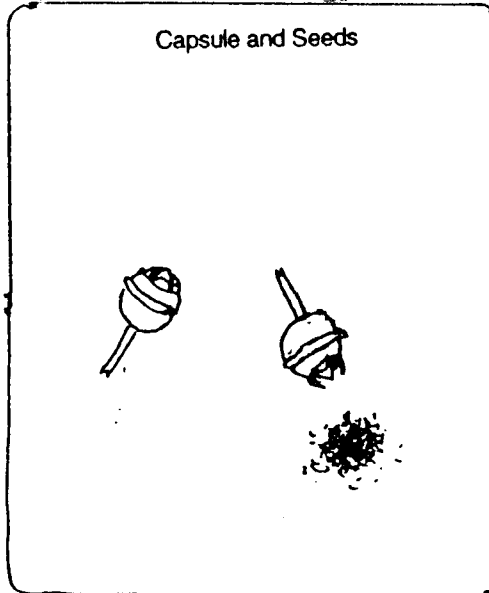
Availability  
year round

Persistence  
low

Seeds per fruit  
countless  
(Dust like)

Extraction  
Dry in the sun  
out of the wind  
-will open and  
release

Storage  
1 year



<u>Pretreatment</u> none, though mixing with soil before sowing helps with spacing	<u>Expected Germ.</u> 15-40%	<u>Time to Germ.</u> 1 to 2 weeks	<u>Rate of growth</u> very fast, can be planted after 3 to 4 months
--	---------------------------------	--------------------------------------	---

**Eucalyptus globulus** Tasmanian Blue Gum, Exotic: Australia

Propagation: seedlings, direct sowing

Elevation: 2000 meters

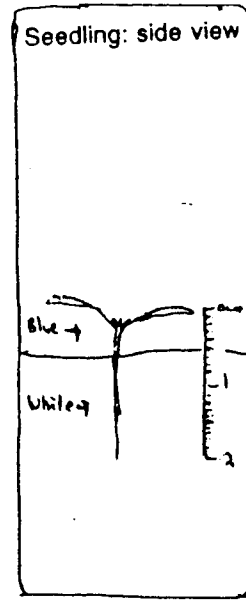
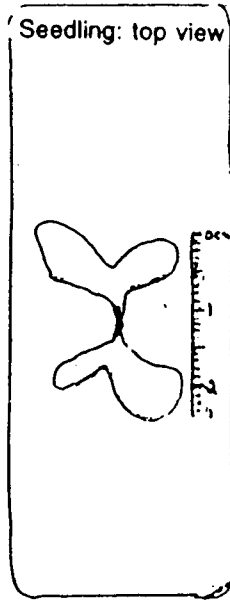
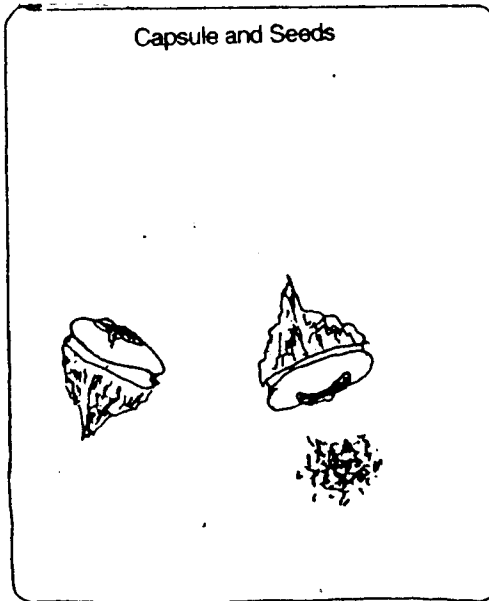
Availability  
year round

Persistence  
low

Seeds per fruit  
countless  
(dust like)

Extraction  
Dry in the sun  
out of the wind  
-will open and  
release seeds

Storage  
1 year



<u>Pretreatment</u> none, though mixing with soil before sowing helps with spacing	<u>Expected Germ.</u> variable: 30-80%	<u>Time to Germ.</u> 1-2 weeks	<u>Rate of growth</u> fast growing, can be planted out after 3-4 months
--	---	-----------------------------------	---

# Eucalyptus melliodora Honey Box Exotic: Australia

Propagation: seedlings

Elevation: 0-2,000 meters

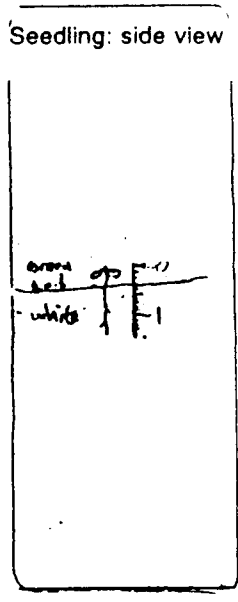
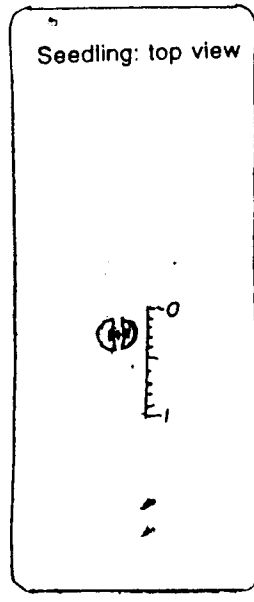
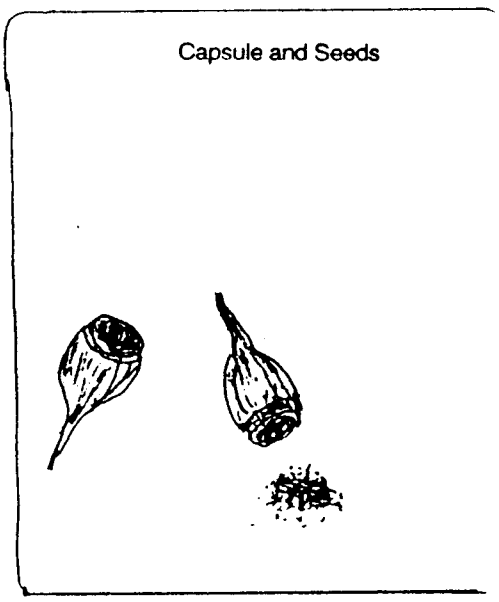
Availability  
much of the year

Persistence  
low

Seeds per fruit  
countless  
(dust like)

Extraction  
dry in the sun  
out of the wind  
-will open and  
release seeds

Storage  
1/2 year



Pretreatment  
none, though  
mixing with soil  
before sowing  
helps with spacing

Expected Germ.  
variable: 50-85%

Time to Germ.  
1-2 weeks

Rate of growth  
fast, can be ready to plant  
out after 4-5 months

# Eucalyptus saligna Blue Gum Exotic: Australia

Propagation: seedlings, direct sowing

Elevation: 1,200-2,400 meters

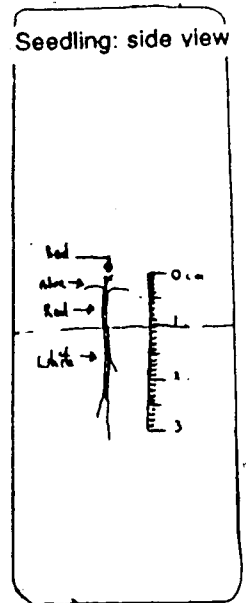
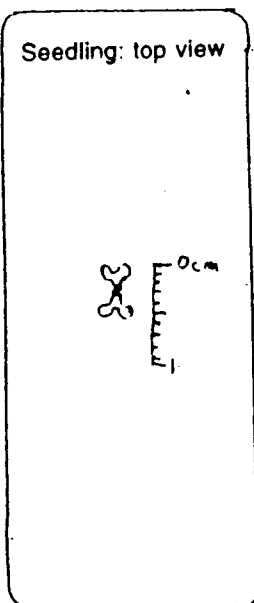
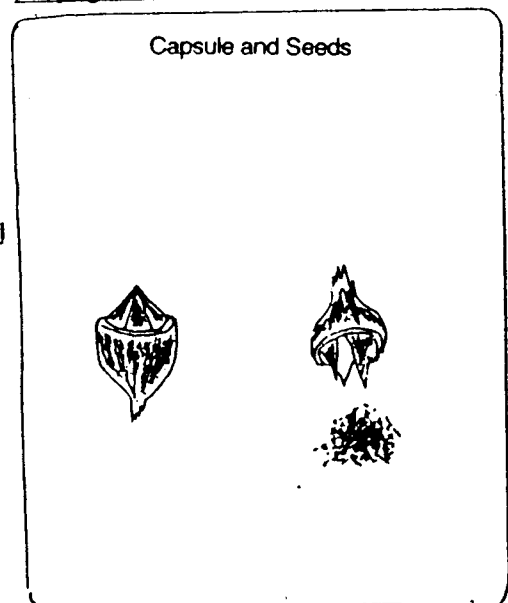
Availability  
year round

Persistence  
low

Seeds per fruit  
countless  
(dust like)

Extraction  
Dry in the sun  
out of the wind  
-will open and  
release seeds

Storage  
1 year



Pretreatment  
none, though  
mixing with soil  
before sowing  
helps with spacing

Expected Germ.  
variable: 30-70%

Time to Germ.  
3 days to 2 weeks

Rate of growth  
very fast, can be planted  
out after 3-4 months

**Psidium guajava**

**Guava**

**Exotic: Central America**

**Propagation:** seedlings, wildlings

**Elevation:** 0-2000 meters

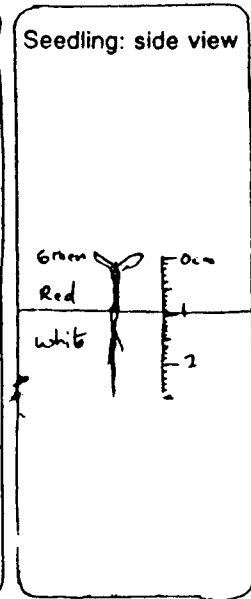
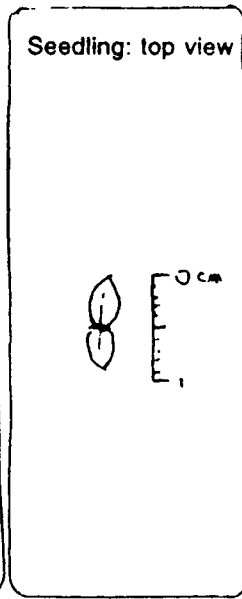
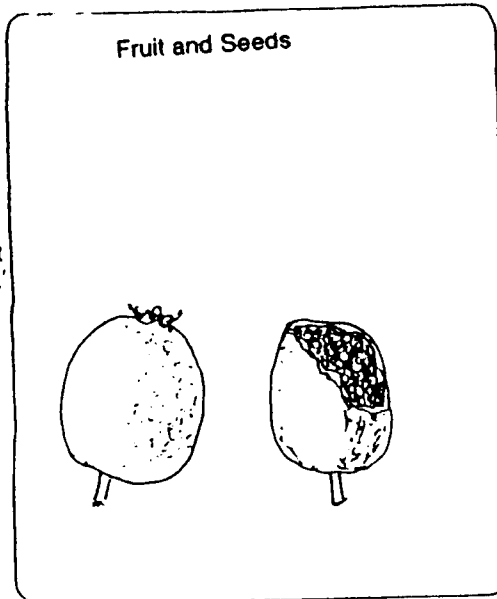
**Availability**  
seasonal

**Persistence**  
high

**Seeds per fruit**  
50 - 100

**Extraction**  
pulp ripe fruit

**Storage**  
6 months  
to 1 year



**Pretreatment:** none      **Expected Germ. Time to Germ.:** not bad: 50-70%      2-3 weeks      **Rate of growth:** fast, can be ready to plant out after 4-5 months

**Syzygium guineese**

**Waterberry**

**Indigenous**

**Propagation:** seedlings, wildlings

**Elevation:** 1-2100 meters

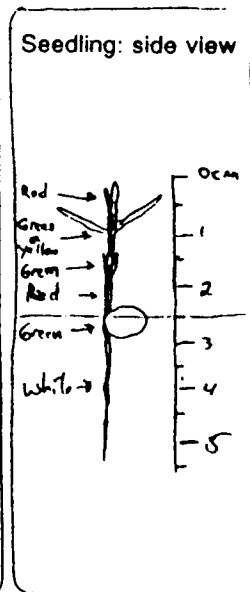
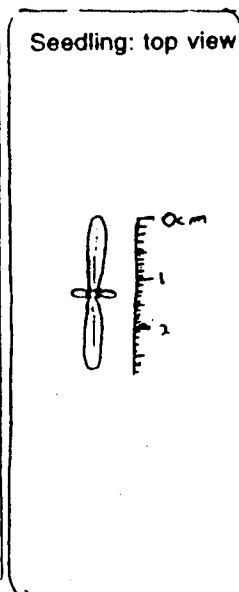
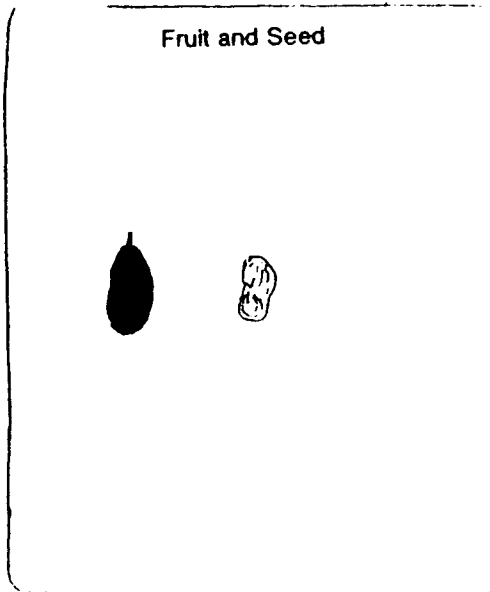
**Availability**  
seasonal

**Persistence**  
high

**Seeds per fruit**  
1

**Extraction**  
not necessary  
just plant fruit

**Storage**  
not possible  
sow fresh



**Pretreatment:** none      **Expected Germ. Time to Germ.:** 50%      6 to 7 weeks      **Rate of growth:** fast, ready to plant out after 4-5 months

**Olea africana**

**Wild Olive**

**Indigenous**

**Propagation:** seedlings(difficult to raise), wildings

**Elevation:** 1,300-3,150- meters

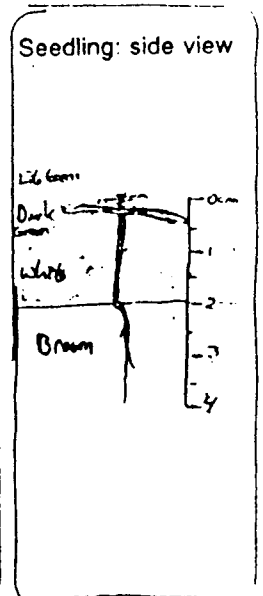
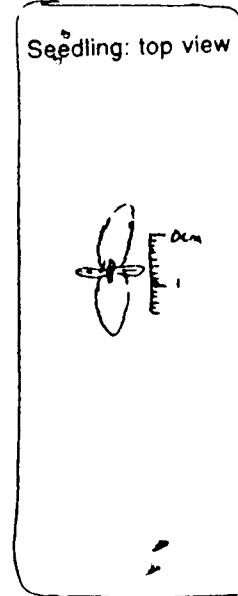
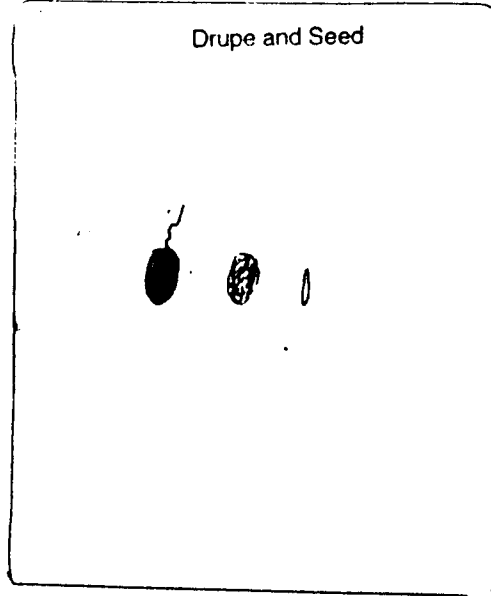
**Availability**  
seasonal

**Persistence**  
high

**Seeds per fruit**  
1

**Extraction**  
depulp with  
wire mesh,  
wash and dry

**Storage**  
1 year



**Pretreatment**  
cracking

**Expected Germ.**  
variable: 20-60%

**Time to Germ.**  
3-7 weeks

**Rate of growth**  
slow- if large trees are  
desired quickly, use wildings,  
these can be also be raised in  
the nursery, and be strong  
enough to plant out even in  
adverse locations after 2-3  
months

**Palmae**

**Phoenix reclinata**

**Wild date palm**

**Indigenous**

**Propagation:** seedlings, suckers

**Elevation:** 1 - 2,400 meters

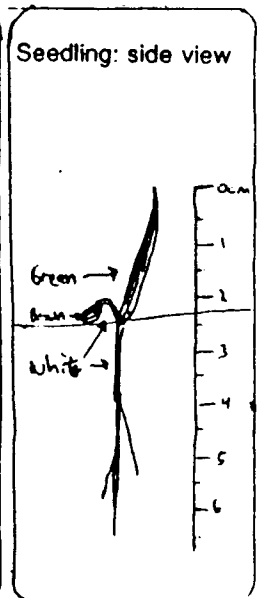
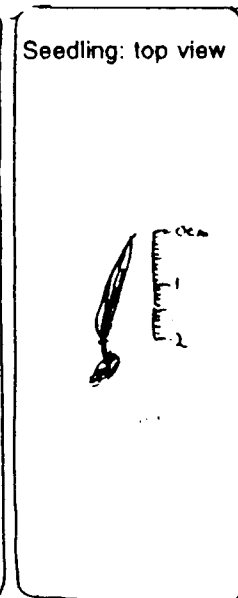
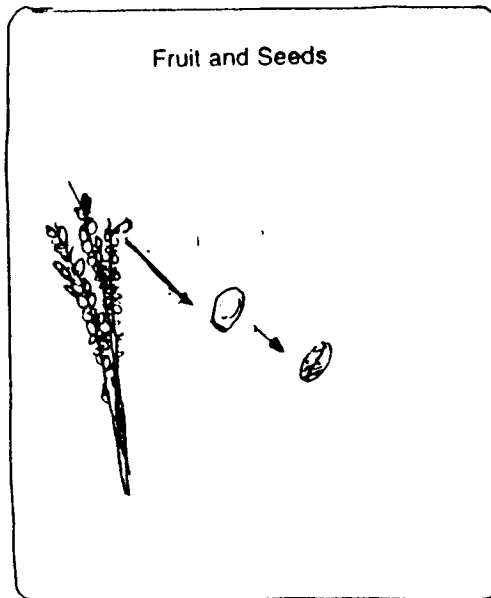
**Availability**  
seasonal

**Persistence**  
moderate

**Seeds per fruit**  
1

**Extraction**  
drying, threshing,  
winnowing

**Storage**  
1 year



**Pretreatment**  
none

**Expected Germ.**  
good: 60-70%

**Time to Germ.**  
4-5 weeks

**Rate of growth**  
slow, but can be planted out  
after 6 months

Erythrina abyssinica

Flame tree

Indigenous

Propagation: seedlings, wildings, direct sowing

Elevation: 0-2,000 meters

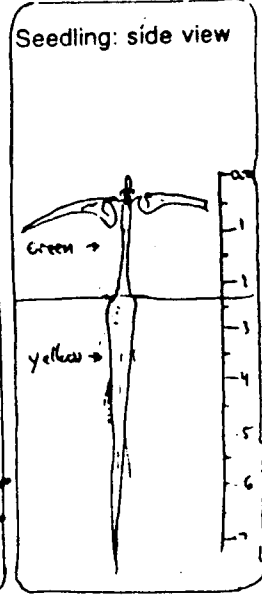
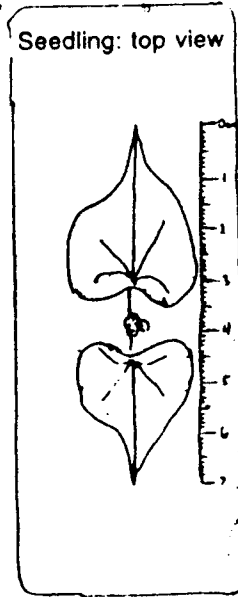
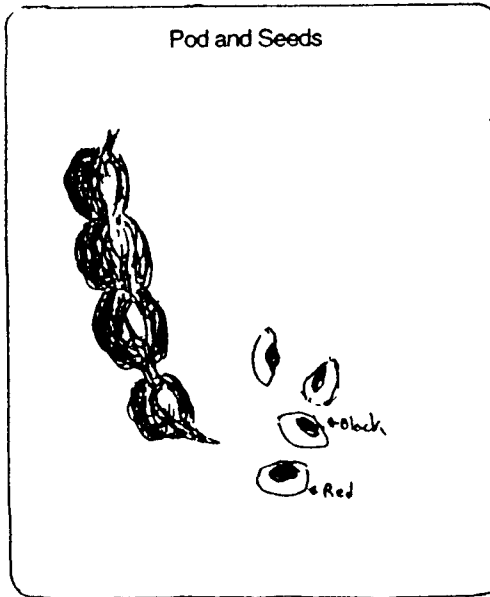
Availability  
seasonal

Persistence  
moderate

Seeds per fruit  
4 - 8

Extraction  
collect dry,  
thresh

Storage  
1-2 years



Pretreatment  
none, though  
nicking can help

Expected Germ.  
good: 50-60%

Time to Germ.  
2-4 weeks

Rate of growth  
moderate, can be ready to  
plant after 3 months, but will  
progress slowly from that  
point forward

Sesbania sesban

Sesbania/River bean

Indigenous

Propagation: wildings, direct sowing

Elevation: 350-1900 meters

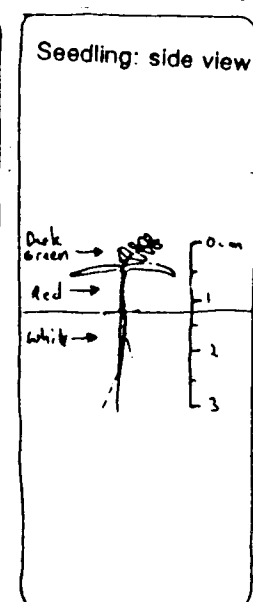
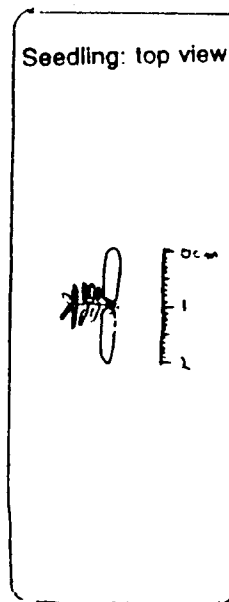
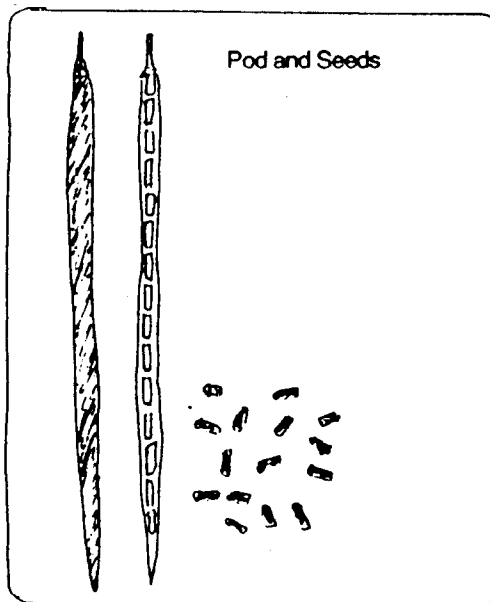
Availability  
Much of the year

Persistence  
moderate

Seeds per fruit  
30+

Extraction  
Drying and  
threshing

Storage  
1 year



Pretreatment  
exposure to hot  
water overnight

Expected Germ.  
60-80%

Time to Germ.  
2-10 days

Rate of growth  
fast growing, use  
direct sowing

Tipuana tipu Tipu tree Exotic: South America

Propagation: seedlings, wildings, direct sowing Elevation: 1,200-2,200 meters

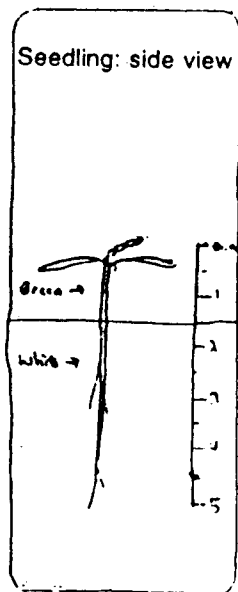
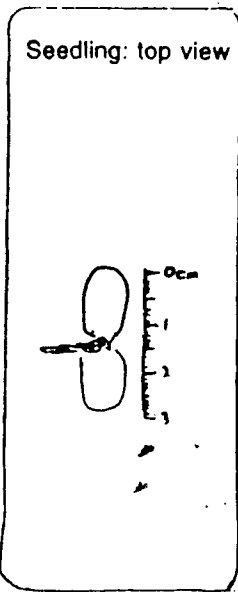
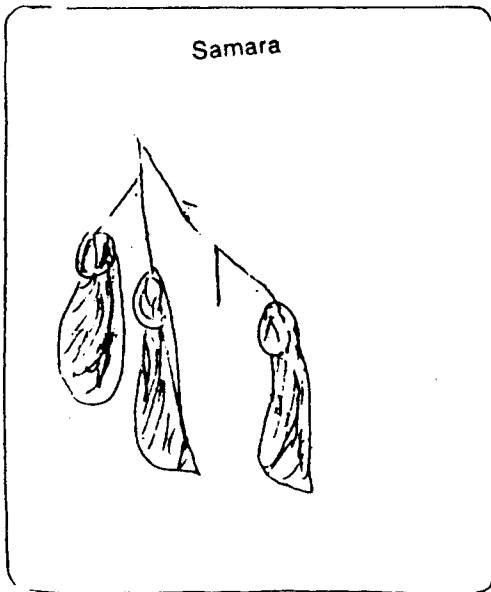
Availability  
much of the year

Persistence  
moderate

Seeds per fruit  
1

Extraction  
de-wing seed to reduce volume

Storage  
3 months



Pretreatment de-wing if it hasn't already been done Expected Germ. very good: 90% Time to Germ. 3-4 weeks Rate of growth moderately fast, can be ready to plant out after 5-6 months

*Pinaceae*

Pinus patula Mexican Weeping pine Exotic: Central America

Propagation: seedlings Elevation: 1,500-2,500 meters

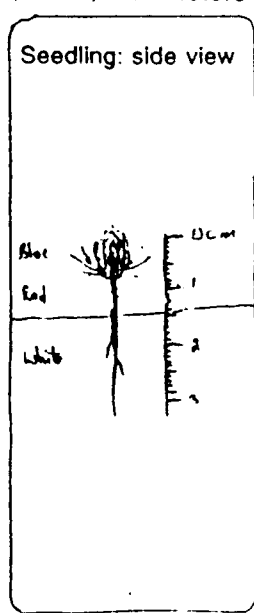
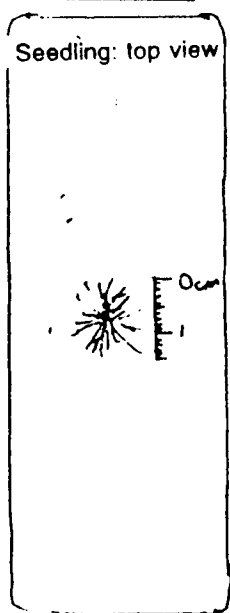
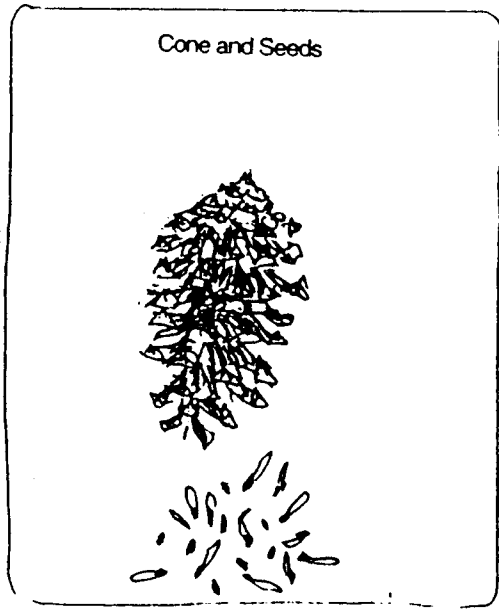
Availability  
seasonal

Persistence  
low

Seeds per fruit  
50+

Extraction  
dry cones until open, shake to release seeds

Storage  
1 year



Pretreatment none Expected Germ. very good: 75-80% Time to Germ. 4-8 weeks Rate of growth fast growing, but slow to start- needs 6-8 months

Note: This tree does best with a symbiotic relationship with mycorrhizal fungi, thus if you can get soil from a plantation with which to inoculate the soil you are using for your germination bed or containers, it will improve the performance of this tree.

Podocarpaceae

30

**Podocarpus falcatus** Podo Indigenous

**Propagation:** seedlings, (small)wildings **Elevation:** 2,100-3,000 meters.

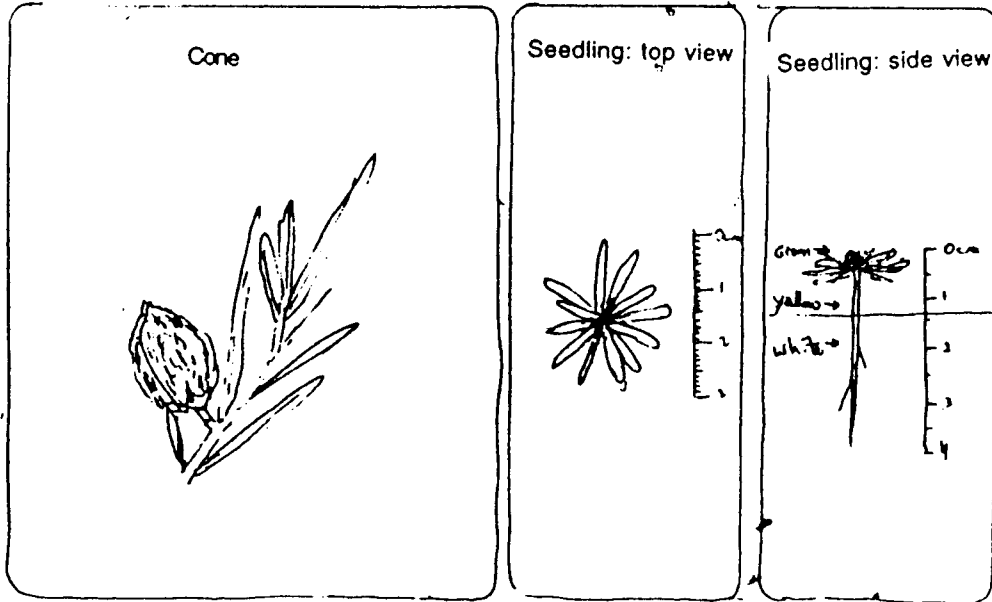
**Availability**  
very intermittent

**Persistence**  
moderate

**Seeds per fruit**  
1

**Extraction**  
depulping with  
wire mesh, washing  
and drying

**Storage**  
1 year



**Pretreatment** cracking **Expected Germ.** poor: 30% **Time to Germ.** 2-4 months **Rate of growth** slow, may want a year in the nursery before planting out

Proteaceae

**Grevillea robusta** Grevillea Exotic: Australia

**Propagation:** seedlings, wildings **Elevation:** 0 -3000 meters

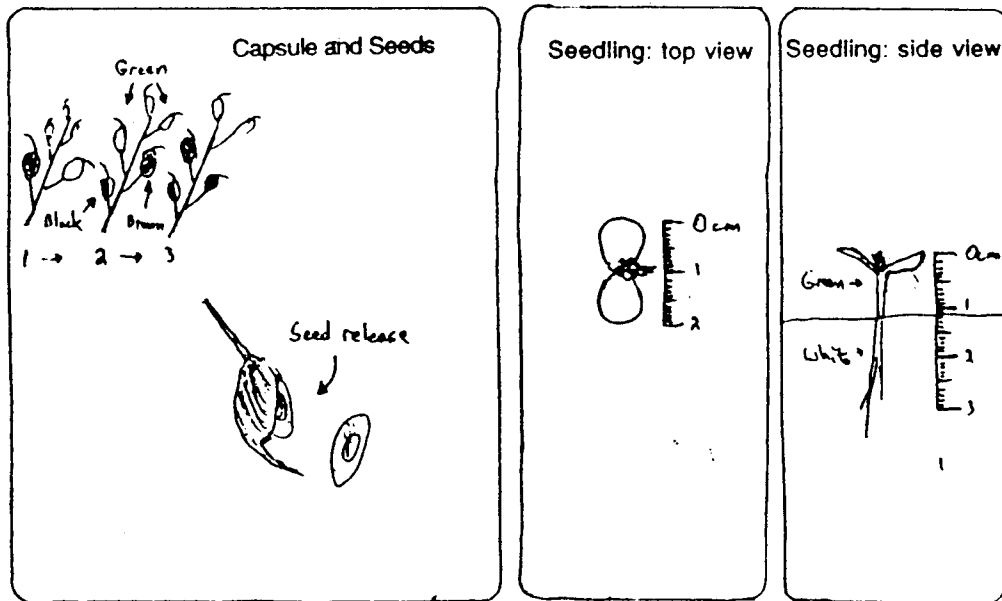
**Availability**  
seasonal

**Persistence**  
moderate

**Seeds per fruit**  
2

**Extraction**  
dry in the sun  
out of the wind,  
-will open and  
release seeds

**Storage**  
3 months



**Pretreatment** none necessary, soaking in cold water for 24 hours can help. **Expected Germ.** variable: 30-90% **Time to Germ.** 2-3 weeks **Rate of growth** fast, can be planted out after 4 months

**Collection notes:** there is a short collection window for any given seed (a few days). However fruits will not all ripen at the same time. Instead they will do so sequentially, changing from green to brown (seed release) to black, examples of all of which may be found on the same branch. Thus seeds may be available for several weeks at a time.

**Eriobotrya japonica** Loquat Exotic: East Asia

**Propagation:** seedlings, wildings, direct sowing **Elevation:** 1,500 -2400 meters

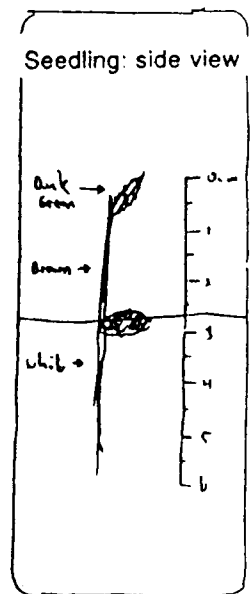
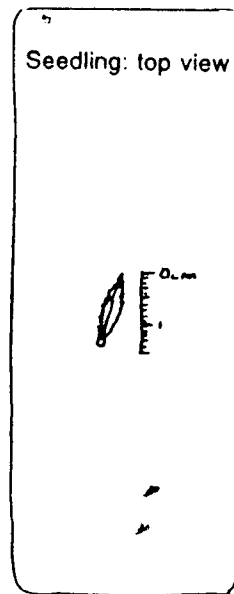
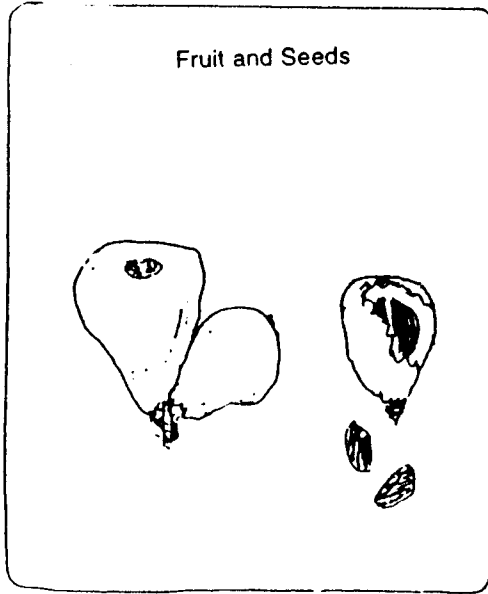
**Availability**  
seasonal

**Persistence**  
high

**Seeds per fruit**

**Extraction**  
pulp (or eat)  
ripe fruit,  
then dry seeds

**Storage**  
1-2 months



**Pretreatment**  
none

**Expected Germ.**  
high: 60-80%

**Time to Germ.**  
3-5 weeks

**Rate of growth**  
fast growing, can be ready to  
plant out after 4-5 months

Rutaceae

**Calodendrum capense** Cape chestnut Indigenous

**Propagation:** seedlings, wildings

**Elevation:** 1,600-2,300 meters

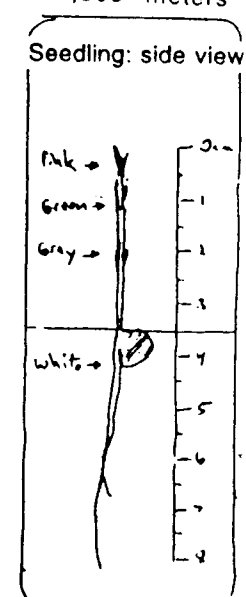
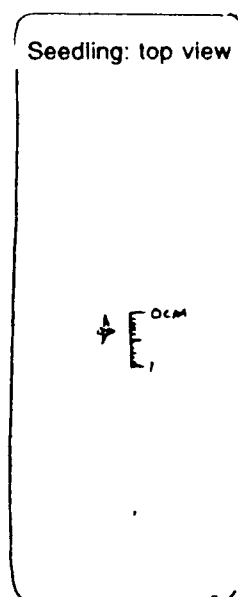
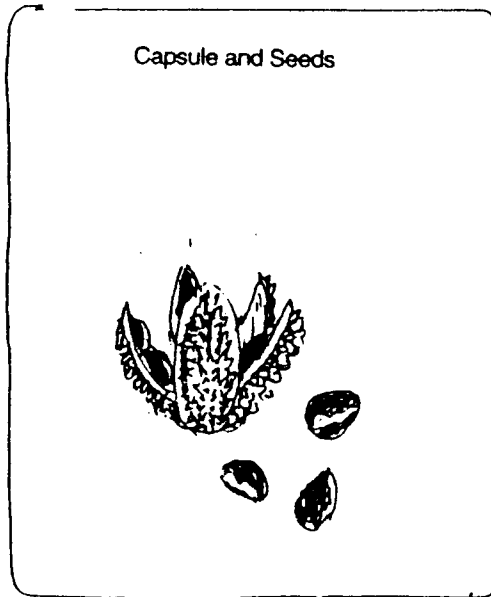
**Availability**  
seasonal

**Persistence**  
moderate

**Seeds per fruit**  
5-10

**Extraction**  
shake loose

**Storage**  
1 year



**Pretreatment**  
float to separate  
viable seeds

**Expected Germ.**  
good: 60-70%

**Time to Germ.**  
3-4 weeks

**Rate of growth**  
rather slow, but because of  
it's big seed, it will be big  
enough to plant out after 3-4  
months

Genus

species

common name

origin

Propagation:

Elevation:

Availability

Persistence

Seeds per fruit

Extraction

Storage

Availability  Persistence  Seeds per fruit  Extraction  Storage			

Pretreatment

Expected Germ.

Time to Germ.

Rate of Growth

Genus

species

common name

origin

Propagation:

Elevation:

Availability

Persistence

Seeds per fruit

Extraction

Storage

Availability  Persistence  Seeds per fruit  Extraction  Storage			

Pretreatment

Expected Germ.

Time to Germ.

Rate of Growth

Genus	species	common name	origin
<u>Propagation:</u>		<u>Elevation:</u>	
<u>Availability</u>			
<u>Persistence</u>			
<u>Seeds per fruit</u>			
<u>Extraction</u>			
<u>Storage</u>			
<u>Pretreatment</u>	<u>Expected Germ.</u>	<u>Time to Germ.</u>	<u>Rate of Growth</u>

Genus	species	common name	origin
<u>Propagation:</u>		<u>Elevation:</u>	
<u>Availability</u>			
<u>Persistence</u>			
<u>Seeds per fruit</u>			
<u>Extraction</u>			
<u>Storage</u>			
<u>Pretreatment</u>	<u>Expected Germ.</u>	<u>Time to Germ.</u>	<u>Rate of Growth</u>

Genus	species	common name	origin	
<u>Propagation:</u>		<u>Elevation:</u>		
<u>Availability</u>				
<u>Persistence</u>				
<u>Seeds per fruit</u>				
<u>Extraction</u>				
<u>Storage</u>				
	<u>Pretreatment</u>	<u>Expected Germ.</u>	<u>Time to Germ.</u>	<u>Rate of Growth</u>

Genus	species	common name	origin	
<u>Propagation:</u>		<u>Elevation:</u>		
<u>Availability</u>				
<u>Persistence</u>				
<u>Seeds per fruit</u>				
<u>Extraction</u>				
<u>Storage</u>				
	<u>Pretreatment</u>	<u>Expected Germ.</u>	<u>Time to Germ.</u>	<u>Rate of Growth</u>

	Genus	species	common name	origin
	<u>Propagation:</u>		<u>Elevation:</u>	
<u>Availability</u>				
<u>Persistence</u>				
<u>Seeds per fruit</u>				
<u>Extraction</u>				
<u>Storage</u>				
	<u>Pretreatment</u>	<u>Expected Germ.</u>	<u>Time to Germ.</u>	<u>Rate of Growth</u>

	Genus	species	common name	origin
	<u>Propagattion:</u>		<u>Elevation:</u>	
<u>Availability</u>				
<u>Persistence</u>				
<u>Seeds per fruit</u>				
<u>Extraction</u>				
<u>Storage</u>				
	<u>Pretreatment</u>	<u>Expected Germ.</u>	<u>Time to Germ.</u>	<u>Rate of Growth</u>

	Genus	species	common name	origin
	<u>Propagation:</u>		<u>Elevation:</u>	
<u>Availability</u>				
<u>Persistence</u>				
<u>Seeds per fruit</u>				
<u>Extraction</u>				
<u>Storage</u>				
	<u>Pretreatment</u>	<u>Expected Germ.</u>	<u>Time to Germ.</u>	<u>Rate of Growth</u>

	Genus	species	common name	origin
	<u>Propagation:</u>		<u>Elevation:</u>	
<u>Availability</u>				
<u>Persistence</u>				
<u>Seeds per fruit</u>				
<u>Extraction</u>				
<u>Storage</u>				
	<u>Pretreatment</u>	<u>Expected Germ.</u>	<u>Time to Germ.</u>	<u>Rate of Growth</u>

## Appendix A: Nurseries

### Purpose:

1. To help trees whose seedlings usually fail in competition, and thus increase the yield of trees from a given set of seeds. This is done by providing an environment free of competition and damage until the trees are ready for planting.
2. To provide optimum growing conditions (water, etc.) and by doing so speed up the rate of growth.

### Advantages of an on farm/school nursery as opposed to buying seedlings:

- health of seedlings
- ease of transportation
- saved expense
- learning experience for students
- demonstration for community
- self sufficiency
- ease of planning/flexibility
- income generation

### To start

Ask yourself:

1. Is it necessary to have a nursery?(direct sowing may be preferable). What types of trees do you want?(based upon personal needs and the community)
2. Numbers of seedlings to grow? what is reasonable for the available water and labor
3. How long? One growing season, or year round?
4. When is labor available?- school holidays, competitions, etc.
5. When will you want to plant out the tree seedlings?
6. How long will it take for the trees to grow in the nursery before they can be planted out?
7. Growing trees by seed, cuttings, or wildings?
8. Where and what time of year can seed be obtained?(collection or purchase)

### Site Selection

1. The area must have a reliable source of water, preferably with an alternate source nearby if the first fails.
2. It must be accessible for transport of materials and trees.
3. Security- prevention of people and livestock, wildlife etc. from entering and disturbing or destroying the seedlings.
4. Protection from extreme wind, sun, and rain.

### Nursery Bed Construction and Use

#### Germination beds:

Why?

1. Poor germination- if germination of the species you want to plant is good then it may not be necessary to plant in a germination bed.

38

2. Insures adequate spacing
3. Prevents labor of filling and watering containers that nothing will germinate in.

*Soil:*

1. Forest soil: good nutrients and structure, which eases infiltration of water (the best to use, if easily available)
2. Mixture: allows use of poor soil with supplements for nutrients (old manure) and structure (sand or clay depending upon the soil). There are many recipes for the mixture. here's one: 4 parts top soil, 2 parts sand, and 1 part manure.

*Bed*

Raised bed: prepare the soil mixture and build a frame of 1 meter by 2 or more meters in length.

Sunken bed: For arid areas. Dig an area of 1 meter by 2 or more meters in length and line the area with a gunia (gunny sack).

Sowing the seeds

1. Seeds may require pretreatment and it depends upon the type of seed. Refer to the species listing to find out.
2. Sow the seeds to a depth equal to the diameter of the seed.
3. Sow in lines so that the seedlings are easier to identify after germination.

*After sowing:*

1. Place a layer of ash over the soil to prevent insects.
2. Mulch until germination, and then remove the mulch and build a shade over the bed. This practice reduces the loss of moisture and discourages weeds.
3. Soak the bed the first time you water. Then water twice a day, and weed once a week.
4. The rate of germination will vary with the species you plant and may take anywhere from one week to two months. Refer to the species listing to find out.
5. While waiting for the seeds to germinate, prepare the containers or beds which you will transfer the seedlings into.

Containers.

This step is the biggest single job in the nursery, it takes a lot of time, so it is good to prepare them early while waiting for germination.

*There are three types:*

1. Containerized Single seedling - can be improvised with tins, plastic tubs, or paper boxes. Plastic tubing is also available commercially.
2. Gang box- box able to be carried to the site for planting. Contains many seedlings.
3. Swaziland bed- frame for soil, seedlings are removed bare rooted for transport and planting (roots must be kept moist between the nursery and the planting site!)

### Which container type to use?

1. Where are the trees going? Far or near? If the seedlings are to be carried far, to different places then the individual containers are best (though the weight of all that soil can be a problem- what is your transportation situation like?). If they are all traveling far, but to the same place (for example Kei apple for live-fencing), then the gang box can also work (especially beneficial as you get by with less soil and less space per seedling.) If they are being planted nearby in large numbers and water is available, then the Swaziland bed should be used. The latter two options are less labor intensive than the individualized containers.

2. Climate of the area- wet or dry? When dry it is best to use the containers. If a wet area, then the Swaziland bed is fine - for on site plantings. If some distance is involved, then the gang box may also be useful as it is easy to transport.

3. Which species of tree? Some trees are not robust enough to be transported as bare-rooted seedlings from a Swaziland bed, so it is best to use containers with these species.

4. Number of seedlings? If many seedlings are needed (e.g. for a live fence), a gang box or Swaziland bed is best as it is less labor intensive.

### Pricking out

1. When? After the third leaf grows on the seedling, and before the roots get too long, which depends on the type of tree.

2. Process: Do quickly so the roots do not dry.
- Water (to loosen soil from roots)
  - prick-out
  - prick-in
  - Water seedling again (to help control shock)

### Maintenance

1. Watering : 2 times a day, morning and evening (one time per day can be sufficient, however tell people 2 so that it happens at least once.)

2. Weeding: once every week

3. Root pruning: one time every month. Cut the lateral and horizontal roots with a sharp panga.

4. Hardening off: One month before planting out, reduce water and increase exposure to sun and wind. This step forces the tree to become stronger in order to withstand the conditions it will face after planting out.

### Nursery Costs

One thing that is very important to realize is that a nursery need not cost anything except labor, which at least in the case of schools is readily available. The components of a nursery as listed above are:

1. seeds
2. soil
3. water
4. containers
5. labor.

Seeds of most trees are freely available, as are soil, water, and containers (rubbish). Their only real cost is the cost of labor to collect them. In some cases this may be a lot of labor, and thus money may be spent to reduce it (for example pumping water instead of carrying it from a far away river, or purchasing rolls of plastic tubing instead of collecting rubbish). However, this is a choice, and should the money not be available, the same end can be achieved by an increase in effort. Even tools are generally available (pangas and jembes),

or easily improvised (Watering Can : See Appendix C) A nursery doesn't have to cost anything, except labor.

## Appendix B: Seed Collection

### Why collect your own seed?

- Local seeds are the best adapted to local conditions
- You can get seed at predictable times
- Save money
- No dependence on others
- Fresh seeds are the strongest, in fact the seeds of some trees cannot be stored at all.

### What to do:

1. Learn about the tree you want from:
  - other people
  - extensionists
  - books
2. Watch for flowering and fruiting
  - see when the seeds are ready
  - test them
3. Keep records so that you will know when seeds will be ready in the future.

### Why test seed?

1. If you collect the seeds before they are mature they won't grow well, if at all.
2. If you wait too long they will get eaten by animals, or blow away in the wind.
3. Thus you should watch and test seeds to get them when they are ready

### Seeds are ready when:

1. They are easy to remove from the tree
2. They change color from green to black, red or brown (it depends upon the kind of tree, some aren't ready even when they change color, so test several ways, ask people, and learn about your tree).
3. They dry- turns brown, weighs less, becomes less flexible, may make a rattling sound if shaken.
4. Fruit is edible- taste it (only if you know it should be edible). If the fruit is ripe then so are the seeds.
5. They pass a cutting test: Remove seeds from the fruit / pod / cone etc., and cut them in half. If they are still soft and very wet, then they are not yet ready. Seeds should be hard and white inside when they are ready.

### Choosing parent trees:

Identify a good mother tree to get seeds from. The offspring will be like the parent, thus the better the tree you collect from, the better the trees you will produce.

- determining quality depends what use you have for the trees you are growing:

#### TIMBER



Straight, tall  
fast growing  
few branches

#### FUELWOOD



Fast growth, high  
wood yield, form  
less important

#### FODDER



High production  
of leaves/pods  
ability to recover  
after cutting

#### FRUIT



Production  
of lots of  
sweet fruit

#### FENCING



Grows fast  
with many  
thorns

**Collection methods:**

Expensive tools are not needed.

**Ground Collection**

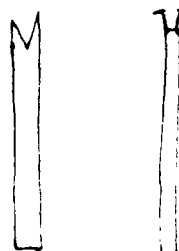
Clear the ground under the tree, or lay tarps / sheets / old newspaper under it. Then shake the tree or beat the branches with sticks to loosen seed, or wait and check the ground sheets daily.

**Weighted Rope**

Throw a rope 20 m long with a 400 gm weight (a padlock works well) over a branch. Catch the weighted end, and pull on both ends to shake the branch or break it off - collect seeds on ground sheets spread below the tree.

**Hooked Branch**

Used to catch the end of a branch to pull it down to where the seeds can be picked, or to shake the branch and make seeds fall to a ground sheet below.

**Wedged Stick**

Used to break the stem which attaches the fruit to the tree. You can also use a pole with two nails driven into the end. Let seeds fall to a ground sheet below.

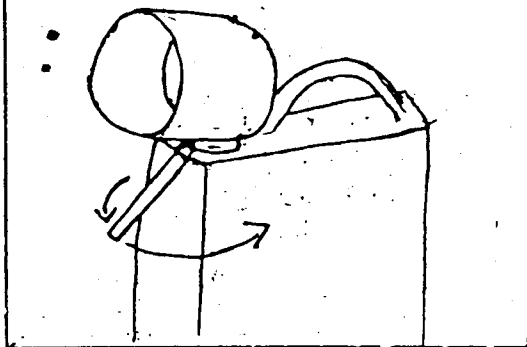
**Climbing and Cutting**

Climb into the crown of the tree with a saw or panga, and cut off the seed bearing branches. Let seeds fall to ground sheets below.

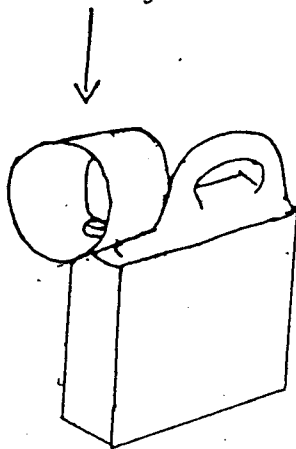
## Appendix C: Watering Can (Improved)

Finding a means of watering a nursery quickly and easily is a universal problem. Commercially available watering cans come in two varieties, metal and plastic. Both are expensive. Metal ones break easily and often. Plastic ones are imported and rarely available in rural areas. The answer, of course, is to make your own, and here is one successful design, that can be made in 5 to 10 minutes with locally available materials.

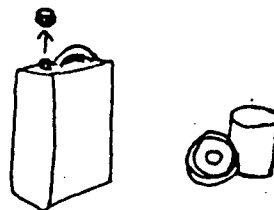
1] Place the tub on the threaded neck of the jerry can and use the pen to mark the size of the opening.



3] Fit the tub over the neck of the jerry can. Cut more plastic from the tub if necessary to make it fit. However, cut as little as possible so as to ensure a tight fit and prevent leakage.



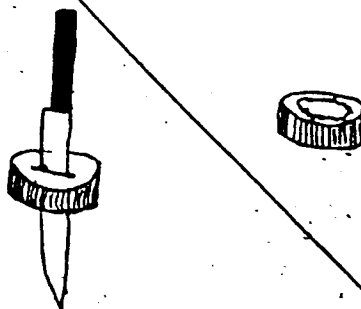
A] The materials needed are 1 plastic jerry can, with cap (5 L is best) and 1 plastic tub with replaceable lid (500 g cooking fat is best). The tools you will use are a marking pen, a knife, and a needle.



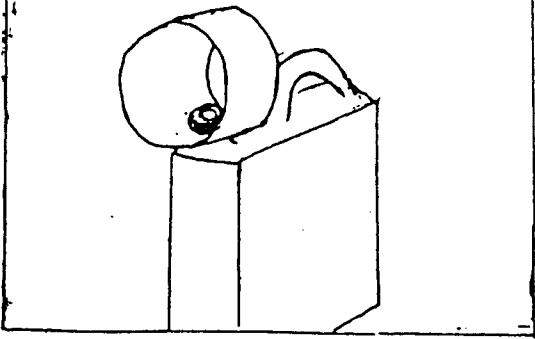
2] Cut out and discard the plastic disk from within the circle you have drawn.



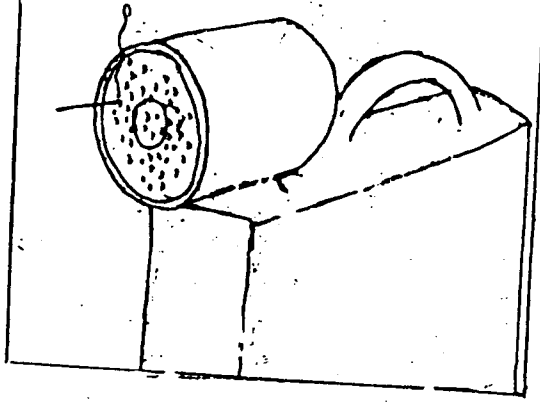
4] Pierce the cap, and carve out a large hole to allow water to pass quickly.



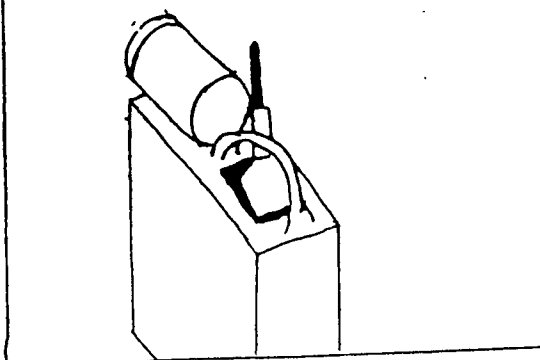
5) Screw the cap down to hold the tub in place.



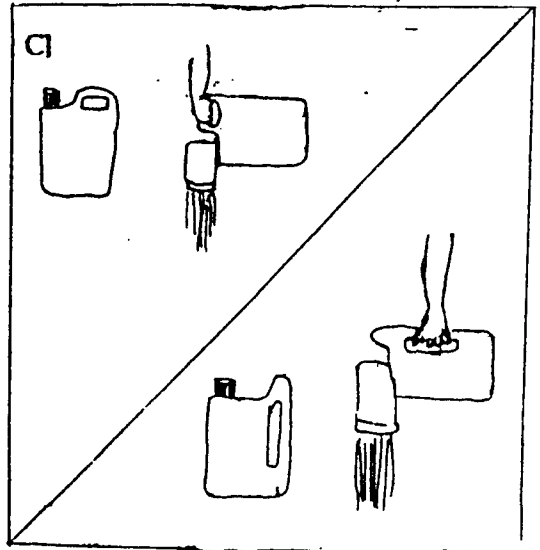
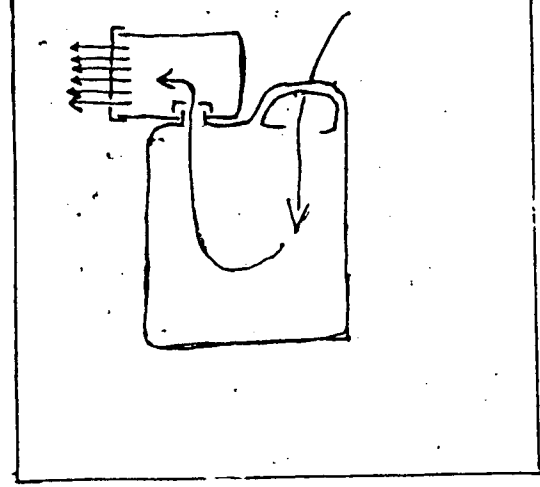
6) Replace the tub lid, and pierce it repeatedly with a hot needle to make holes for the water to pass. Many small holes will do better than a few large ragged ones.



7) Cut out a square of plastic underneath the handle to make the watering can easy to fill.



B) Flow of water through the finished can.



C) Top: The most commonly available kind of jerry can. The ergonomics are poor, causing the user's wrist to get tired quickly.

Bottom: A better jerry can to use if it can be found in your area. It is much easier to use because of the design of the handle.