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SEED GUIDE

(Second Edition)
for

TIVA NURSERY

JULY, 1996

GABRIEL MUTUA
[Nursery Officer]

KATSUTOSHI SUZUKI
[Nursery Expert]

SEED GUIDE

FOR

TIVA NURSERY

(SECOND EDITION)

1988-1995

BY:

G. K. Mutua
(*Nursery officer*)

K. Suzuki
(*Japanese expert*)

FOREWORD

The need to have available specific informations on promising species has necessitated the formulation of this guide.

This is a third in a series that has been written by Tiva Tree Nursery section aimed at improving nursery management and planned seedling production technics presently in use at elementary levels e.g community groups, schools, individual farmers and technical assistant in arid and semi arid areas.

The guide has covered most aspects of seed i.e. seed phenology, collection, seed sources, processing, storage, pre-treatments and sowing that may be used by seed users. The informations has been gathered from accumulated records and experience from research results in Tiva nursery and else where.

The information may be applied in Kitui District and other related areas with similar climatic and soil conditions.

G.K. MUTUA
TIVA NURSERY OFFICER (SFTP)

ACKNOWLEDGMENTS

Our appreciation are extended various individuals who have tirelessly contributed to the success of this revised guide.

Special gratitude goes to Mr. Kiema Kimweli (Head seed collector), Stanslaus Mbingu (Head foreman) and their colleagues who have provided various informations on seed sources, seed phenology collection and extraction techniques.

Appreciation also goes to Mr. Titus Nyamai who have highly assisted on seed pre-treatments, seed testing and seed weights.

We also record our gratitude to senior technical staff of the Social Forestry Training Project (SFTP) Kitui for their technical advice and moral support.

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The repeatedly typing/retyping of the writings with full dedication by Catherine Kang'alikya has been given special thanks.

TABLE OF CONTENTS

ACKNOWLEDGMENTS

FOREWORD

1.0 INTRODUCTION

Tiva Tree Nursery is a sub-section of the Pilot Forest Scheme. The distance from Kitui Social Forestry Training Centre is about 20 kilometres. It is situated in Kwavonza location, Yatta division of Kitui District. This is a semi arid area receiving an annual rainfall of between 400-700 mm. The short rains comes in April while long rains falls in November. The soils are sandy loam. It is within the 1° 50' latitude and 37° 30' longitude. The altitude is about 1000m above sea level. The average daily maximum temperature is 30°C, average daily minimum 16°C and average daily mean of 22°C. The Kitui District agroclimatic zone ranges between III-3, IV-2, VI-2 and VI-1. The nursery undertakes the following activities.

(1) Seed collection for seedling production plan.
(2) Raise seedlings for reforestation in Trial plantation and distribution to farmers
(3) Carry out species trials for arid and semi arid lands
(4) Carry out herbal solution trials for termites control
(5) Carry out seedling production and tending for seedlings techniques that are biologically sound, socially acceptable, and economically suitable for ASAL.

The successes of afforestation projects in ASALs depends on the quality of seeds hence quality of seedlings. It is therefore very necessary to put daily observation in writing so that in future a very conclusive phenological documentation can be made as far as seed sources and provenance are concerned. It is therefore necessary to have a progressive seed guide. We therefore hope that this guide with information from within Kitui and its outskirts will be of great help in forestry activities through out Kitui District and other Districts with similar conditions.

2.0 SEED PHENOLOGY

2.1 Introduction

Good quality seedlings raised in the nursery depends on good quality of selected seeds. The quality of good seeds comes from good quality parent trees, timing of various stages of seed development i.e. budding, flowering, fruiting and seed maturity. This should be the key point to a good seed collector.

2.2 Leaf shedding period

Most of the tree species shed their leaves during the dry period, some shed their leaves during the rainy season and some shed their leaves between the rainy season and the dry season and vise versa. Some do not shed leaves at all during the year. It is therefore easy to study flowering development period for trees which shed leaves. A list has been appended of a combination of trees which shed leaves and those that do not shed leaves (App. I).

Appendix I

FLOWER AND LEAF BEHAVIORAL PATTERNS

No.	TREE NAME	FLOWER	LEAVES			
		color	Dry season color	Leaf fall season	No fall season	always green
1	Acacia abyssinica	white	yellow	12~5	6~11	
2	albida	white	yellow	11-1	2-10	
3	gerrardii	white	yellow	8-10	11-7	(green)
4	holosericea	yellow				green
5	mellifera	white	yellow	5~10	11~4	
6	nilotica	yellow	yellow	5~10	11~4	
7	polyacantha	white	yellow	5~10	11~4	
8	pendula	-	-	-	-	
9	senegal	white	yellow	5~10	11~4	
10	seyal	yellow	yellow	5-10	11~4	
11	sieberiana	white	yellow	5-10	11~4	
12	tortilis	white	yellow	5~10	11~4	
13	xanthophloea	Yellow				green
14	Acrocarpus fraxinifolius	yellow	yellow	8~10	11~7	
15	Adansonia digitata (Baobab)	white	yellow	5~9	10~4	
16	Albizia amara	red	yellow	4~10	11~5	
17	anthelmintica	white	yellow	5~9	10~4	
18	lebbeck	yellow				
19	Azadirachta indica	white				green
20	Balanites aegyptiaca	"				green
21	Berchemia discolor	"	yellow	8~12	1~7	
22	Bombax rhodognaphalon	"	yellow	3~7	8~2	
23	Caesalpinia decapetala	yellow	yellow	6~11	12~5	
24	Callitris robusta	white				green
25	Cassia siamea	yellow				green
26	" spectabilis	yellow	yellow	6~11	12~5	
27	Casuarina equisetifolia	red				green
28	Cordia ovalis	white	yellow	12~4	5~11	
29	Croton megalocarpus	white	yellow	12~5	6~11	
30	Dalbergia melanoxylon	white	yellow	12~6	7~11	
31	Delonix regia	red	yellow	12~5	6~11	
32	Dichrostachys cinerea	white	yellow	12~5	6~11	
33	Dovyalis caffra	white				green
34	Gmelina arborea	yellow	yellow	12~5	6~11	
35	Grevillea robusta	yellow				green

36	Jacaranda mimosifolia	purple	yellow	4~10	11~3	
37	Leucaena leucocephala	white	yellow	5~10	11~4	
38	Melia azedarach	white	yellow	5~10	11~4	
39	Melia volkensii	white	yellow	5~9	10~4	
40	Parkinsonia aculeata	yellow	yellow	5~10	11~4	
41	Piliostigma thonningii	white				green
42	Prosopis juliflora	yellow	yellow	5~10	11~4	
43	Sesbania grandiflora	white	yellow	4~10	11~5	
44	sesban	white	yellow	5~10	4~12	
45	Syzygium codatum	purple				green
46	Syzygium cuminii	purple				green
47	guajava	white				green
48	Tamarindus indica	Yellow	Yellow	7~9	10~6	green
49	Terminalia brownii	white	yellow	5~9	10~4	
50	mentaly	yellow	yellow	4~9	10~3	
51	prunioides	white	yellow	5~9	10~4	
52	Zizyphus mauritiana	white	yellow	3~9	10~4	
53	Eucalyptus camaldulensis	white				green
54	Erythrina abyssinica	red	yellow	5~10	11~4	
55	Kigelia abyssinica	white	yellow	3~9	10~2	
56	Euc. tereticornis	white				green
57	Markhamia lutea	yellow	yellow	7~10	11~6	
58	Euc. maculata	white				green
59	Ficus benjamina					green
60	Delonix elata	red	yellow	7~8	9~6	

2.3 Flowering and Fruiting

All trees that produce seed pass a juvenile stage before they start flowering and fruiting. The juvenile stage duration varies from species to species. The duration and variance depends on soil conditions and fertility, climatical conditions e.g. amount of rainfall, rainfall distribution, length of rainfall period, environmental factors such as exposure to sunlight, i.e. adequate sunlight, moisture and high temperature accelerate photosynthesis rate hence the accumulation of carbohydrates thence high growth rate. High growth rate influence flower budding and flower development.

Flower budding may start, or starts long before the flower is observed. Climatical conditions determines the abundance of flower production. Some species require heavy rainfall to flower, others require average rainfall to flower while others require little rainfall. The above factors are beneficial to some species while they are injurious to others. The above three factors also determine the amount of fruit development hence the harvest. This varies with species and intervals. That is why some species have heavy fruiting intervals of between one to five years or so.

The flowering and fruiting patterns varies with species and provenance's. Some flowers when they are leafless while others when they are in full leaf. The flowering fruiting and maturity may slightly change from year to year season to season or a number of years. Appendix II indicate approximate season when certain tree species have flower, fruit maturity period for harvest.

2.4 Seed maturity

Collection should only be done to ripe fruits, pods, cones, capsules or nuts. Some fruits, pods, cones, capsules and nuts open and disperse their seeds immediately when they ripen up. The species which disperse their seeds immediately after maturity should be collected before the dispersal. The maturity is indicated by change of colour e.g. from green to brown, yellow, purple, red e.t.c. or texture. Fleshy fruits change their taste from acid and astringent to sweet. The fruits can be opened to observe the texture of the seeds.

The ripe determined capsules cones and nuts can slowly be cut without cutting the seed and observe the seed coat colour which is normally dark coloured and have a firm flesh. Un ripe or immature seeds have whitish seed coats and soft or milky contents. Some species retain mature seeds in the tree for a longer period.

(1) Some of the species which open and disperse their seeds immediately after ripening. *Leucaena leucephala, Markhamia lutea, Jacaranda mimosifolia, Grevillea robusta, Casuarina equisetifolia, Acacia seyal, Acacia senegal, Albizia holosericea, Acacia abyssinica, Acacia mellifera, Delonix elata.*

(2) Some species which retain their seeds for a longer period after ripening: *Acacia nilotica, Acacia polyacantha, Acacia tortilis, Acrocarpus flaxinifolius, Bombax rhodognaphalon, Callitris robusta, Euc. maculata, Euc. camaldulensis, Euc. tereticornis.*

(3) Some species which do not disperse their seeds: *Melia volkensii, Piliostigma thorningii, Schnus molle, Terminalia species, Delonix regia, Dalbergia melanoxylon, Dovyalis caffra, Croton megalocarpus.*

Experience to fruit ripening characteristic is the best guide to seed collection. Appendix II indicates the approximate period for seed maturity.

3.0 SEED COLLECTION AND HANDLING

3.1 Seed sources

The Kenyan population is increasing rapidly. The increase in population leads to increased demand for seeds hence the need for increased seed sources. The seed source should have parent trees of good form, vigour growth, free from diseases and have sufficient (many) representative population. Natural wood lands may not meet all these requirements. The seed source is referred to as a provenance.

Newly developing areas may also not meet the above provenance requirements. Some of the seed sources within Kitui District and other sources are as tabled.

No.	Species name	Collection place	Farmers, name (Kitui)
1.	Acacia polyacantha	Kaveta, Kalundu, Matinyani, Wikililye	Samuel Mulandi
2.	Tamarindus indica	Zombe, Mbitini Mutitu, Yatta, South Nyanza, Siaya, Kibwezi	Mr. John of Zombe
3.	Acacia nilotica	Tiva, Kaveta, Zombe, Kabati, Miambani, Mutonguni	Mr. Mbiwa
4.	Croton megalocarpus	Ilooi, Isaangwa, Kaveta, Syongla, Matinyani, Kisumu	Mr. John Kaea(Kaveta)
5.	Cassia siamea	K.T.C, Kitui T/ship, Kabati, Mbitini, Zombe, Invuu.	
6.	Cassia spectabilis	Kitui town, Machakos town,	
7.	Jacaranda mimosifolia	BLI, St. angelas, St. C. Lwanga,	
8.	Balanites aegyptiaca	Tiva, Kavisuni, Yatta, Mutomo, Kwavonza, Machakos	
9.	Albizia amara	Kwavonza, Yatta, Maliku, Mbitini	Mutunga Mulang'a
10.	Albizia anthemintica	Tiva, Kwavonza, Yatta	
11.	Melia azadirach	Tulia, Isaangwa, Matuu	Kitema Miutia (Isaangwa)
12.	Erythrina abyssinica	Ithenzeni, Kalundu	Mr. Kilonzo Mbiti
13.	Terminalia brownii	Kwavonza, Kathivo, Yatta, H/bay, Kisumu, Kibwezi, Turkana	
14.	Terminalia prunoides	Zombe, Mutomo	
15.	Terminalia spinosa	Voi, Garrisa, Zombe, Tana river	
16.	Acacia senegal	Kisasi, kwavonza, Yatta, Zombe, Kabati	
17.	Acrocarpus fraxinifolius	Kitui T/ship, Ilooi, Kaveta	Mr. Kimai Ngesu, Mr. Mutinda
18.	Spathodea nilotica	BAT, Kitui, Kitale, Nakuru, Kisumu, Kibwezi, Machakos	

19.	Azadirachta indica	Zombe, Inyuu, Voi, T/taveta, Kibwezi, Kilifi, Mwatate	
20.	Acacia mellifera	Tiva, Ikutha, Ikanga, Zombe	
21.	Acacia gerrardii	Tiva, Yatta, Kibwezi	
22.	Terminalia mentaly	Kaveta, Mulango, Kibwezi, Kisumu, Kabati	Mr. Titus Mbuthi (Kibwezi)
23.	Grevillea robusta	Kaveta, Kabati, Katulani	Mr. Maingi Maliti, Rosa Muema
24.	Delonix regia	Riverside motel	Dr. Mulinge
25.	Dovyalis caffra	Mutune, Kabati, Machakos	David Mwandia
26.	Vitex Doniana	Isaangwa	Mr. Mutingu Mwendwa

NB: For more sources see Appendix II and III

Appendix II (a)

No.	Species name	Seed source	Flowering period	Seed maturity
1.	A. brevispica	Tiva (Kwavonza) Ikutha, Mutomo	Jan - Feb.	Jun - Oct.
2.	A. hiderbrandtii	Yatta		Sept.-Oct.
3.	A. mellifera	Kwavonza, Ikutha, Ikanga, Zombe, Matinyani, Kabati, Kaveta, Ilooi	Mar.- Apr.	Aug. - Sept.
4.	A. nilotica	Tiva, Kaveta, Zombe, Ilooi, Isaangwa, Mutonguni, Kabati	Jan. - Mar.	July - Sept.
5.	A. polyacantha	Kaveta, Kalundu, Ilooi, Isaangwa, Matinyani, Wikililye	Oct - Dec. Jan - Feb.	June - July
6.	A. senegal	Yatta B_2 Kwavonza, Zombe, Kabati	Jan - Feb.	June - Sept.
7.	A. seyal	Mutonguni, Ilooi, Tiva, Kaveta	Feb - March Sept. - Nov.	June - Aug.
8.	A. tortilis	Tiva, Kwavonza, Kabati, Zombe, Ilooi, Isaangwa	Jan - Mar.	Aug. - Sept.
9.	Acrocarpus fraxinifolius	Kitui town, Kaveta, Ilooi, Isaangwa	Aug - Sept.	Feb. - July
10.	Adansonia digitata	Kitui South and East	Oct. - Nov.	Mar, Jul - Aug.
11.	Albizia amara	Yatta, Maliku, Mbitini, Kwavonza	March	June - Oct.
12.	Azadirachta indica	Zombe, Inyuu	April - Sept.	July - Sept.
13.	Berchamia discolor	Kawongo, Kavisuni	Oct.	April -May
14.	Balanites aegyptiaca	Mutomo, Zombe, Yatta, Kavisuni, Kwavonza, Tiva	Oct. - Nov.	Mar. - Aug.
15.	Bombax rhodognaphalon	Isaangwa, Kitui town	July - Aug.	Jan - Oct.
16.	Caesalpinia decapitulata	Tiva	Jan	Apr. - Oct.

19.	Azadirachta indica	Zombe, Inyuu, Voi, T/taveta, Kibwezi, Kilifi, Mwatate	
20.	Acacia mellifera	Tiva, Ikutha, Ikanga, Zombe	
21.	Acacia gerrardii	Tiva, Yatta, Kibwezi	
22.	Terminalia mentaly	Kaveta, Mulango, Kibwezi, Kisumu, Kabati	Mr. Titus Mbuthi (Kibwezi)
23.	Grevillea robusta	Kaveta, Kabati, Katulani	Mr. Maingi Maliti, Rosa Muema
24.	Delonix regia	Riverside motel	Dr. Mulinge
25.	Dovyalis caffra	Mutune, Kabati, Machakos	David Mwandia
26.	Vitex Doniana	Isaangwa	Mr. Mutingu Mwendwa

NB: For more sources see Appendix II and III

Appendix II (a)

No.	Species name	Seed source	Flowering period	Seed maturity
1.	A. brevispica	Tiva (Kwavonza) Ikutha, Mutomo	Jan - Feb.	Jun - Oct.
2.	A. hiderbrandtii	Yatta		Sept.-Oct.
3.	A. mellifera	Kwavonza, Ikutha, Ikanga, Zombe, Matinyani, Kabati, Kaveta, Ilooi	Mar.- Apr.	Aug. - Sept.
4.	A. nilotica	Tiva, Kaveta, Zombe, Ilooi, Isaangwa, Mutonguni, Kabati	Jan. - Mar.	July - Sept.
5.	A. polyacantha	Kaveta, Kalundu, Ilooi, Isaangwa, Matinyani, Wikililye	Oct - Dec. Jan - Feb.	June - July
6.	A. senegal	Yatta B_2 Kwavonza, Zombe, Kabati	Jan - Feb.	June - Sept.
7.	A. seyal	Mutonguni, Ilooi, Tiva, Kaveta	Feb - March Sept. - Nov.	June - Aug.
8.	A. tortilis	Tiva, Kwavonza, Kabati, Zombe, Ilooi, Isaangwa	Jan - Mar.	Aug. - Sept.
9.	Acrocarpus fraxinifolius	Kitui town, Kaveta, Ilooi, Isaangwa	Aug - Sept.	Feb. - July
10.	Adansonia digitata	Kitui South and East	Oct. - Nov.	Mar, Jul - Aug.
11.	Albizia amara	Yatta, Maliku, Mbitini, Kwavonza	March	June - Oct.
12.	Azadirachta indica	Zombe, Inyuu	April - Sept.	July - Sept.
13.	Berchamia discolor	Kawongo, Kavisuni	Oct.	April -May
14.	Balanites aegyptiaca	Mutomo, Zombe, Yatta, Kavisuni, Kwavonza, Tiva	Oct. - Nov.	Mar. - Aug.
15.	Bombax rhodognaphalon	Isaangwa, Kitui town	July - Aug.	Jan - Oct.
16.	Caesalpinia decapitulata	Tiva	Jan	Apr. - Oct.

17.	Callitris robusta	Kabonge forest, Ilooi	June	Sept - Jan
18.	Casuarina equisetifolia	Kitui agroforestry plantation at BLI, Museve (John Mutinda's) home, Ithookwe	Mar - May	Apr - July
19.	Cordia Ovalis	Kwavonza, Yatta	June - Sept.	Jan - April
20.	Croton macrostachyus	Matinyani, Kalundu, KTC, Syongila	Jan - May	Sept - Oct.
21.	Croton megalocarpus	Kaveta, Syongila, Ilooi, Matinyani, Kalundu	Dec - Jan Sep. 95 (Mar. 95 arboted	Mar. - April
22.	Delonix elata	Yatta, Kavisuni	Apr. - June	Aug - Oct.
23.	Delonix regia	Kalundu, Tiva, St. Lwanga	July - Dec. Nov. Jan	May - Aug.
24.	Dobera glabra	Zombe	March	Oct- Nov.
25.	Dovyalis caffra	Mulango G. School, Syongila junction(Mzee Juma's home) Mutonguni, Kyawea forest, Migwani	Aug - Oct	Dec - Feb
26.	Dalbergia melanoxylon	Tiva, Kwavonza, Yatta, Mutitu, Mutomo (UAE) Yatta proper	Oct - Dec	Mar - June
27.	Eucalyptus paniculata	Kahawa Sec. Sch, Matinyani, Kabonge, Kitui town	September	Mar - April, Aug.
28.	Cassia siamea	KTC, Mbitini, Mutitu, Kabati, Zombe, Inyuu, Syongila	Jan - May	March - Oct.
29.	Cassia spectabilis	Machakos, Tiva, Kwavonza, Mbitini, Kabati, Matinyani, Syongila	July - Sept.	Mar - Aug.
30.	Grevillea robusta	Ithiani, Kabati, Kitui Central (Kililye) Kyangwithya (Museve) Mutune, Kaveta, Syongila	Sept. Dec.	Feb - April
31.	Fagara chybea	Kwavonza (Tiva forest)		Dec - Feb
32.	Jacaranda mimosifolia	Matinyani, Kitui town, BLI, Tiva, Kitui H. Sch., St. Angelas	Aug. - Nov.	June - Sept.
33.	Melia Volkensii	Katse, Yatta, Kavisuni, Kwavonza	July - Oct.	May - Oct.
34.	Melia azadirach	Isaangwa, Tiva, Kaveta, Kabati, Kitui High School	Sept - Jan	Mar - June
35.	Merchamia lutea	Tiva site	Jan - Feb	May - June
36.	Lawsonia inermis	Kitui high school	Jan	May - July
37.	Newtonia hilderbrandtii	Tiva, Yatta	May	Sept. - Oct.
38.	Parkinsonia aculeata	Tiva site	Jan - Dec.	Jan - Dec.
39.	Prosopis juliflora	Tiva site, Katangi, Kyua goat project	Jan - Dec. Aug.	Jan - Dec. Dec - Mar.

17.	Callitris robusta	Kabonge forest, Ilooi	June	Sept - Jan
18.	Casuarina equisetifolia	Kitui agroforestry plantation at BLI, Museve (John Mutinda's) home, Ithookwe	Mar - May	Apr - July
19.	Cordia Ovalis	Kwavonza, Yatta	June - Sept.	Jan - April
20.	Croton macrostachyus	Matinyani, Kalundu, KTC, Syongila	Jan - May	Sept - Oct.
21.	Croton megalocarpus	Kaveta, Syongila, Ilooi, Matinyani, Kalundu	Dec - Jan Sep. 95 (Mar. 95 arboted	Mar. - April
22.	Delonix elata	Yatta, Kavisuni	Apr. - June	Aug - Oct.
23.	Delonix regia	Kalundu, Tiva, St. Lwanga	July - Dec. Nov. Jan	May - Aug.
24.	Dobera glabra	Zombe	March	Oct- Nov.
25.	Dovyalis caffra	Mulango G. School, Syongila junction(Mzee Juma's home) Mutonguni, Kyawea forest, Migwani	Aug - Oct	Dec - Feb
26.	Dalbergia melanoxylon	Tiva, Kwavonza, Yatta, Mutitu, Mutomo (UAE) Yatta proper	Oct - Dec	Mar - June
27.	Eucalyptus paniculata	Kahawa Sec. Sch, Matinyani, Kabonge, Kitui town	September	Mar - April, Aug.
28.	Cassia siamea	KTC, Mbitini, Mutitu, Kabati, Zombe, Inyuu, Syongila	Jan - May	March - Oct.
29.	Cassia spectabilis	Machakos, Tiva, Kwavonza, Mbitini, Kabati, Matinyani, Syongila	July - Sept.	Mar - Aug.
30.	Grevillea robusta	Ithiani, Kabati, Kitui Central (Kililye) Kyangwithya (Museve) Mutune, Kaveta, Syongila	Sept. Dec.	Feb - April
31.	Fagara chybea	Kwavonza (Tiva forest)		Dec - Feb
32.	Jacaranda mimosifolia	Matinyani, Kitui town, BLI, Tiva, Kitui H. Sch., St. Angelas	Aug. - Nov.	June - Sept.
33.	Melia Volkensii	Katse, Yatta, Kavisuni, Kwavonza	July - Oct.	May - Oct.
34.	Melia azadirach	Isaangwa, Tiva, Kaveta, Kabati, Kitui High School	Sept - Jan	Mar - June
35.	Merchamia lutea	Tiva site	Jan - Feb	May - June
36.	Lawsonia inermis	Kitui high school	Jan	May - July
37.	Newtonia hilderbrandtii	Tiva, Yatta	May	Sept. - Oct.
38.	Parkinsonia aculeata	Tiva site	Jan - Dec.	Jan - Dec.
39.	Prosopis juliflora	Tiva site, Katangi, Kyua goat project	Jan - Dec. Aug.	Jan - Dec. Dec - Mar.

40.	P. chilensis	Tiva site, Zombe	May - Oct.	July - Dec.
41.	Araucaria cunningamiana	Kabonge forest (Kitui central)	Jan - Mar.	July - Aug.
42.	Thevetia peruviana	Kitui town, Kaveta	Jan - July.	April
43.	Salvadora persica	Zombe	July	Oct.
44.	Grewia bicolor	Kavisuni		May - June
45.	Tamarindus indica	Yatta, Ithookwe, Zombe, Miambani, Mutitu forest, Mbitini	Sept. - Jan - Feb.	Aug - Sept.
46.	Terminalia brownii	Kitui Central (Mutonguni) Mulango, Kitui South, East, Yatta, Zombe	Jan - Mar	Jun - Sept.
47.	Terminalia spinosa	Kitui East (Zombe) Kitui South (Mutomo)	Mar - April	Aug. -Sept.
48.	Terminalia prunioides	Kitui East (Zombe) Kitui South (Mutomo)	Jan - April	May - Aug.
49.	Pyracantha equisetifolia	Kitui Central (Kaveta, Museve)	Oct.	Jan - Jul
50.	Tecoma stans	Isaangwa, Tiva KTC	May - Aug- Sept.	Oct- Nov.
51.	Mangifera indica	Kitui central, Zombe	Sept.	Dec - Feb.
52.	Terminalia mentaly	Kaveta, Zombe, Mutomo, Voi	Sept.	Mar - Apri.
53.	Zizyphus mauritiana	Wikililye, Kaveta	May	Sept.
54.	Zyzyphus codatum	Kitui central, Kaveta, Museve	Oct.	Jun - July
55.	Zyziphus abyssinica	Kitui central	Oct.	May - June
56.	Schinus molle	Isaangwa, Kabati, Katumani (Machakos)	Aug - Nov. (Jan - Dec)	Jan - Mar. (Jan - Dec)
57.	Stynchinos spinosa	Kitui, tiva	Jan - Feb	Sept. - June
58.	Vitex doniana	Kitui South and East	Dec.	Apr. - Aug
59.	Cordia sinensis	Zombe		Oct.
60.	Faurea saligna	Chuluni (Kyuluni)	Feb - April	Sept - Oct.
61.	Acacia depranolobium	Zombe	Nov.	
62.	Bombax rhodognaphalon	Isaangwa		Oct.
63.	Piliostigma thonningii	Ithookwe, Wikililye, Isaangwa	Oct. - Nov.	Mar- Aug- Oct.
64.	Acacia gerrardii	Tiva, Kakumuti	March	September
65.	Acacia holosericea	BLI, KTC, Kaveta, Tiva	February	May - July
66.	Acacia xanthopholea	Kaveta, Naivasha, Rongai, Kibwezi		
67.	Albizia anthelmintica	Yatta B_2,	August	Sept. - Oct
68.	Euc. camaldulensis	Tiva, Kaveta	Sept.	Aug.
69.	Euc. maculata	Kitui town	Sept.	Aug.
70.	Euc. tereticornis	Migwani, Chuluni	Sept.	Aug.
71.	Euc. paniculata	Mulutu	Sept.	Aug.
72.	Erythrina abyssinica	Kalundu	Nov.	Feb.
73.	Gmelina arborea	KTC, Isaangwa	October	Feb.
74.	Kigelia africana	Kitui East, Central	Feb.	September
75.	Lawsonia inermis	KHS, St. Iwanga,	Jan.	July
76.	Leucaena leucocephala	KTC, Isaangwa, Tiva, Mulutu	Dec.	Feb-April
77.	Tecoma stans	KTC, Tiva, Kalungu	May	Nov.

Cont'd

No.	SPECIES	MONTH 1	2	3	4	5	6	7	8	9	10	11
50	Salvadora persica							○	●		☆	
51	Schimus molle	☆								○		
52	Sesbania grandiflora				○				●			
53	sesban					○					●	
54	Spathodea nilotica		○			●				☆		
									○	●	☆	
55	Tamarindus indica	○							●		☆	
56	Tecoma stans					○				●		
57	Terminalia brownnii	☆							○			
58	mentalis		☆							○		
59	prunioides	○				●	☆					
60	spinosa		○		●		☆					
61	Thevetia peruviana	○		●	☆							
62	Ziziphus mauritiana					○			●	☆		
63	Mangifera indica		☆							○		

: indigenous tree

Appendix 2 (b)

Table 2. (b)

○ :Flower
● :Fruit
☆ :Seed disposal

Time of flowering. fruit. seed disposal in Kitui

No.	SPECIES	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
1	Acacia abyssinica		○		●		☆						
2	albida								☆				
3	gerrardii			○	—	—	●	—	—	☆			
4	holoicilica		○	—	●	—	—	☆					
5	hypophylla												
6	mellifera			○	—	—	●	—	—	☆			
7	nilotica		○	—	—	●	—	☆					
8	polyacantha	○	—	—	●	—	—	☆					
9	pendula												
10	salicina												
11	senegal					○	—	●	—	☆			
12	tortilis						○	—	●	—	☆		
13	xanthophloea												
14	Acrocarpus flaxinifolius			○	—	●	—	—	☆				
15	Albizia amara		○	—	—	●	—	☆					
16	anthelmintica								○	—	●	—	☆
17	Azadirachta indica				○	—	●	—	—	☆			
18	Bahaunea thnorngii							○	—	—	●	—	—
19	Balanites aegyptiaca	—	●	—	☆							○	—
20	Bombax rhodognaphalon					○	—	—	—	—	●	—	—
21	Caesalpinia decapetala	○	—	●	—	—	☆						
22	Callitiriss robsta	—	☆				○	—	—	●	—	—	—
23	Cassia siamea	○	—	—	—	●	—	—	—	☆			
24	spectabilis	○	—	—	●	—	—	—	☆				
25	Casuarina equisetifolia									○	—	●	—
26	Croton megalocarpus	—	—	●	—	☆					○	—	—
27	Dalbergia melanoxylon	—	●	—	—	☆						○	—
28	Delonix regia	○	—	—	—	—	●	—	—	☆			
29	Dovyalis caffra	—	●	—	☆				○	—	—	—	—
30	Eucalyptus camaldulensis	—	—	—	—	—	—	—	—	☆	—	○	—
31	maculata	—	—	—	—	—	—	—	—	☆	—	○	—
32	paniculata	—	—	—	—	—	—	—	—	☆	—	○	—
33	tereticornis	—	—	—	—	—	—	—	—	☆	—	○	—
34	Ficus capenses												
35	Gmelina arborea	—	●	—	☆							○	—
36	Grevillea robusta	○	—	●	—	☆							
37	Jacaranda mimosifolia	—	—	—	—	●	—	—	—	☆			
38	Kigelia africana		○	—	—	—	●	—	—	—	☆		
39	Machaerium tipu												
40	Maesopsis eminii												
41	Lawsonia inermis	○	—	—	—	●	—	—	☆				
42	Leucaena leucocephala	○	—	—	—	—	●	—	—	☆			
43	Melia azedarach	○	—	—	●	—	☆						
44	volkensii	—	—	●	—	—	—	—	—	☆		○	—
45	Newtonia hildebrandtii					○	—	—	●	—	—	☆	
46	Parkinsonia aculeata	—	☆							○	—	—	●
47	Phoenix reclinata												
48	Prosopis juliflora	—	—	●	—	☆				○	—	—	—

: indigenous tree

STAND AND MOTHER TREE

NO.	SPECIES NAME	PLACE OF collection	Height	Diameter	FARMERS NAME
1	Acacia polyacantha	Kaveta	20	56	Samuel mulandi
2	Azadirachta indica	Yatta	8.00	7.5	Kamau Mutia, Mutia Kamai
3	Tamarindus indica	Zombe Mbitini	22	5	Mr. John of Zombe
4	Acacia nilotica	Kaveta	8	3	Mr. Mbiwa
5	Croton megalocarpus	Ilooi	15	4	Mr. John Kaea
6	Cassia siamea	Kabati , Mbitini	20	5	Mbitini P.School,Kabati market
7	Cassia spectabilis	Kitui Township	15	4	Kitui Township
8	Jacaranda mimosifolia	B.L.I	20	6	B.L.I kitui
9	Balanites aegyptiaca	JICA Tiva	22	5	Tiva pilot site (JICA)
10	Albizia amara	Kwavonza	17	6	Mutunga Mulanga
11	Melia azadirach	Tulia Isaangwa	20	3	Tulia P.shool ,Kitema Mutia(Isaangwa)
12	Erythrina abyssinica	Ithenzeni	17	4	Mr Kilonzo mbiti
13	Terminalia brownii	Kathivo Kwavonza	30	6	Kathivo centre
14	Albizia anthelminitica	Tiva	15	5	Tiva pilot site (JICA)
15	Acacia senegal	Kisasi	30	5	Kisasi area
16	Acrocarpus fraxinifolius	ILooi , Kaveta	60	10	Mr.kimai ngesu, Mr.Mutinda
17	Spathodea nilotica	B.A.T Kitui	14	5	B.A.T Kitui
18	Azadirachta indica	Voi	15	4	Voi Town ship
19	Acacia mellifera	Tiva	20	6	Tiva pilot site (JICA)
20	Terminalia mantaly	Mulango Kibwezi	24	6	Kefri kibwezi (Mr.Titus mbathi)
21	Grevillea robusta	Kaveta	25	5	Mr.Maingi maliti
22	Delonix regia	River side motel	20	6	Dr.Mulige
25	Dovyalis caffra	Mutune	9	1	David mwandia
26	Vitex doniana	Isaangwa	19	5	Mr.Mutingu mwendwa
27	Gmelina arborea	Isaangwa	18	4	Mr.Musele nzuva
28	Zysigium cuminii	Kaveta	22	6	Mr.Kwiya mulinge
29	Cordia ovalis	Tiva site	8	3	Tiva pilot site (JICA)
30	Tecoma stans	ILooi	8	3	Mr. John kaea
31	Sesbania sesban	K.T.C	6	1	K.T.C

Appendix III

STAND AND MOTHER TREE

NO.	SPECIES NAME	PLACE OF collection	Height	Diameter	FARMERS NAME
1	Acacia polyacantha	Kaveta	20	56	Samuel mulandi
2	Azadirachta indica	Yatta	8.00	7.5	Kamau Mutia, Mutia Kamai
3	Tamarindus indica	Zombe Mbitini	22	5	Mr. John of Zombe
4	Acacia nilotica	Kaveta	8	3	Mr. Mbiwa
5	Croton megalocarpus	Ilooi	15	4	Mr. John Kaea
6	Cassia siamea	Kabati , Mbitini	20	5	Mbitini P.School,Kabati market
7	Cassia spectabilis	Kitui Township	15	4	Kitui Township
8	Jacaranda mimosifolia	B.L.I	20	6	B.L.I kitui
9	Balanites aegyptiaca	JICA Tiva	22	5	Tiva pilot site (JICA)
10	Albizia amara	Kwavonza	17	6	Mutunga Mulanga
11	Melia azadirach	Tulia Isaangwa	20	3	Tulia P.shool ,Kitema Mutia(Isaangwa)
12	Erythrina abyssinica	Ithenzeni	17	4	Mr Kilonzo mbiti
13	Terminalia brownii	Kathivo Kwavonza	30	6	Kathivo centre
14	Albizia anthelminitica	Tiva	15	5	Tiva pilot site (JICA)
15	Acacia senegal	Kisasi	30	5	Kisasi area
16	Acrocarpus fraxinifolius	ILooi , Kaveta	60	10	Mr.kimai ngesu, Mr.Mutinda
17	Spathodea nilotica	B.A.T Kitui	14	5	B.A.T Kitui
18	Azadirachta indica	Voi	15	4	Voi Town ship
19	Acacia mellifera	Tiva	20	6	Tiva pilot site (JICA)
20	Terminalia mantaly	Mulango Kibwezi	24	6	Kefri kibwezi (Mr.Titus mbathi)
21	Grevillea robusta	Kaveta	25	5	Mr.Maingi maliti
22	Delonix regia	River side motel	20	6	Dr.Mulige
25	Dovyalis caffra	Mutune	9	1	David mwandia
26	Vitex doniana	Isaangwa	19	5	Mr.Mutingu mwendwa
27	Gmelina arborea	Isaangwa	18	4	Mr.Musele nzuva
28	Zysigium cuminii	Kaveta	22	6	Mr.Kwiya mulinge
29	Cordia ovalis	Tiva site	8	3	Tiva pilot site (JICA)
30	Tecoma stans	ILooi	8	3	Mr. John kaea
31	Sesbania sesban	K.T.C	6	1	K.T.C

32	Boscia angastifolia	Ngiluni	8	4	Ngiluni P.school
33	Parkinsonia aculeata	Tiva	5	2	Tiva site
34	Delonix elata	Zombe	20	8	Zombe market
35	Terminalia prunioides	Zombe	10	2	Zombe market
36	Leucaena leucocephala	Kaveta	9	3	Mr.kivindyo mulinge
37	Acacia tortilis	Tiva site	20	10	Tiva pilot site (JICA)
38	Acacia gerrardii	Tiva river	50	15	Tiva river
39	Terminalia spinosa	Zombe	30	5	Zombe market
40	Adansonia digitata	zombe	70	40	Zombe
41	Kigelia africana	ILooi	30	15	Mr.Sandi mutua
42	Eucalyptus paniculata	Isaangwa	60	8	Mr.Kamende musiu
43	Ficus natalensis	Kalundu market	40	7	Kalundu market
44	Melia volkensii	Kavisuni pr.s	50	9	Kavisuni primary school
45	Cassuarina equisetifolia	Ithookwe	70	5	Mr.Mulandi
46	Dalbergia melanoxylon	Kwavonza	15	3	Kwavonza
47	Berchemia discolor	Kavisuni	18	38.0	Kavisuni market
48	Berchemia discolor	Yatta	16	31.4	Kavwongo market
49	Azadirachta indica	Matuu(ndalani)	7.5	7	Thomas Nganda
50	Azadirachta indica	Kilifi	13.5	25	Kilifi plantation
51	Euc. camaldulensis	Ngiini Pri. Sch.	12.8	15	Ngiini Pri. School
52	Acacia holosericea	Isaangwa	7.5	10.5	Wamwene
53	Dalbergia melanoxylon	Nzangathi	9.0	28.7	Joyce Mutua
54	Melia volkensii	Kavisuni	11.0	12.0	Mutinda
55	Delonix regia	Mbitini	15	18	Tito Kilaa (Mr.) near Mbitini market
56	Dovyalis caffra	Mutonguni (Tulia Mkt.)			Fass Muinde
57	Dovyalis caffra	Mutune			Mr. Ndaa
58	Dovyalis caffra	Tulia market			Mr. Justus Muinde
59	Grevillea robusta	Kakumuti	15.0	9	Mrs. Rosa Muema Mbuvi
60	Terminalia mentalis	Kakumuti	11.0	6	" " " "
61	Dovyalis caffra	Ilooi			Mr. Mbuve c/o Ngala Mwendwa

3.2 Preparation for seed collection

Fruit maturity determines the time when preparation should start. Maturity survey should be done well ahead of time. During the survey the economic value should be assessed. The economic value is determined by the required number of seedlings and the value of the required seedlings. The accessibility to the seed should guide the amount of seeds required siting the type of equipments that will used.

The quality and quantity of the seeds in the seed source should be well surveyed. Where equipments are to be used the equipment should be prepared or maintained so that no loss of collected seeds should be met.

3.3 Harvesting

Seed harvesting is gathering of fruits in a seed container ready for transport to the seed pool. Manualised gathering is monthly used in seed collecting areas. There are two main methods of seed harvesting:

(1) Collecting from the crown
(2) Collecting from the ground

(1) Crown collection

This should be applied to the species which fruits mature and do not fall to the ground. It should also apply to the species whose seeds when they fall to the ground are difficulty to pick. The third category of species should be the ones when they ripen the pods open and the seeds are dispersed very far by the wind. The seeds can be detached from the tree using hands, by shaking using hooks or it can be knocked from the tree. Also small branches with seeds can be cut using shears. Climbing trees for crown collection, trees without thorns are recommended but those with thorns may also be climbed where protective covering are available. When doing crown collection two things should be available i.e. either a collecting bag and a net sheeting or tarpaulin and a big bag for mass gathering.

The net sheeting or tarpaulin should be spread on a clear ground before harvesting starts. Ladders are most convenient for climbing into the crown. Climbing spars, full body harness and safety ropes may also be used where available.

Small scale harvesters can use locally available materials e.g. wooden hooks or shears which are locally made from Jua Kali artisans. Jua Kali shears are sufficient for school nurseries, homestead nurseries and group nurseries. Where Jua Kali shears are not available wooden hooks cut from withies are sufficient. After harvesting two labels indicating the species provenance and date of collection should be made on the spot. One should be put inside the gathering bag and the other should be tied to the hem of the bag.

Where seeds will stay for one night in transits between the store the bags should be loosely parked and if the space is available should be spread on t he floor. The above should mainly be done to fleshy fruits or green seeds. Some of the species where crown collection is possible are: *Acacia polyacantha, Tamarindus indica, Acacia nilotica, Cassia siamea, Cassia spectabilis, Jacaranda mimosifolia. Albizia amara, Albizia anthelmintica, Erythrina abyssinica, Terminalia brownii, Terminalia prunioides, Terminalia spinosa, Acacia senegal, Acrocarpus fraxinifolius, Azadirachta indica, Acacia mellifera* etc.

(2) **Ground Collection**

This mainly applies to big seeded species which fall to the ground when ripe and are not destroyed by the insects or other pests. The seeds should be observed for the flesh ones otherwise one may mistake for those that fell during the last season. Checking by cutting should be done before collection starts to avoid collecting unviable ones. The main advantage of ground collection is that a big team can work at the same time, no equipments are needed and any age group can be trained on the spot and start off.

Ground collection can include species which pass throughout the elementary canal of livestock and birds without getting damaged. Some of the species are either extracted by birds whereby the bird uses the juice and drops off the seed e.g. *Cordia ovalis, Azadirachta indica* and *Berchemia discolor.* An example of those that pass through the elementary canal of livestock without damage are: *Melia volkensii* and *Balanites aegyptiaca.*

Some of the species which are ideal for ground collection are: *Croton megalocaprus, Melia volkensii, Balanites aegyptiaca, Terminalia mentaly, Terminalia brownii.*

3.4 Processing

Immediately after collection seeds should be separated from unwanted materials. The unwanted material includes: Green and dry leaves, all kinds of branches and all undesired seeds. This should be done at the collection site or before the fruits are weighed. This will help transport only the required material and obtain clean seeds free of broken dry debris. It also helps in decreasing some insects which might be embedded in the debris and might attack the fruits before other processes starts. It also reduces fungus that might be in the dry matter and be transferred to the seeds.

3.5 Seed extraction

The method of removing seeds from their enclosure for immediate use or storage is termed as seed extraction. The removal of pericap involcure wings or any other unrequired materials highly reduces the weight and the unnecessary bulk. During the extraction processes various methods are used to remove the seed from its enclosure.

(1) **Solar power drying** - this is used to dry dihiscent fruits. The fruit are spread in the open sun either on a fine wire mesh tarpaulin, polythene sheeting or net sheeting so long the spread will retain the seeds when required to be put in another smaller container.

The **dehiscent** seeds need to be severally shaken as they proceed on reducing the moisture so that seeds can be released from the capsules or pods. some of the species which require sun drying are: *Cassia siamea, Eucalyptus spp, Casuarina equisetifolia, Callitris robusta, Acacia mearnsii, Acrocarpus flaxinifolius, Grevillea robusta, Markhamia lutea, Leucaena leucocephala* and *Moringa oleifera.*

In sun drying where seeds can be brown by the wind such as light winged seeds e.g. *G. robusta* light sheet covering should be applied. Thin layers should be used to allow uniform penetration of sun heat and easy manual shaking. The **in dehiscent** species may be dried in the sun and be beaten in a sack for pods removal e.g. most *Acacia* spp. Some are sun dried and nuts cracked between hard surface e.g. *Croton megalocarpus.* Some are sun dried pods removed and others contents removed in between water e.g. *Bombax rhodognaphalon.* Some fleshy species are crushed in a mortar and seed separated by use of large quantities of water e.g. *Dovyalis caffra, Psidium guajava* before sun drying. Tentative methods are illustrated in appendix IV and Fig. 3.5.1 to 3.5.10.

Figs. 3.1 - 3.10 **Shows different seed extraction techniques**

Fig. 3.1 *Terminalia brownii:* Method of extraction using scissors which is called nipping.

Fig. 3.2 *Croton Megalocarpus:* Method of extraction using two stones one on the ground and the other on hand.

Fig. 3.3 *Cassia spectabilis*: Method of extraction using a knife to remove out the seeds.

Fig. 3.4 *Jacaranda mimosifolia*: Method of extraction using a knife to remove out the seeds.

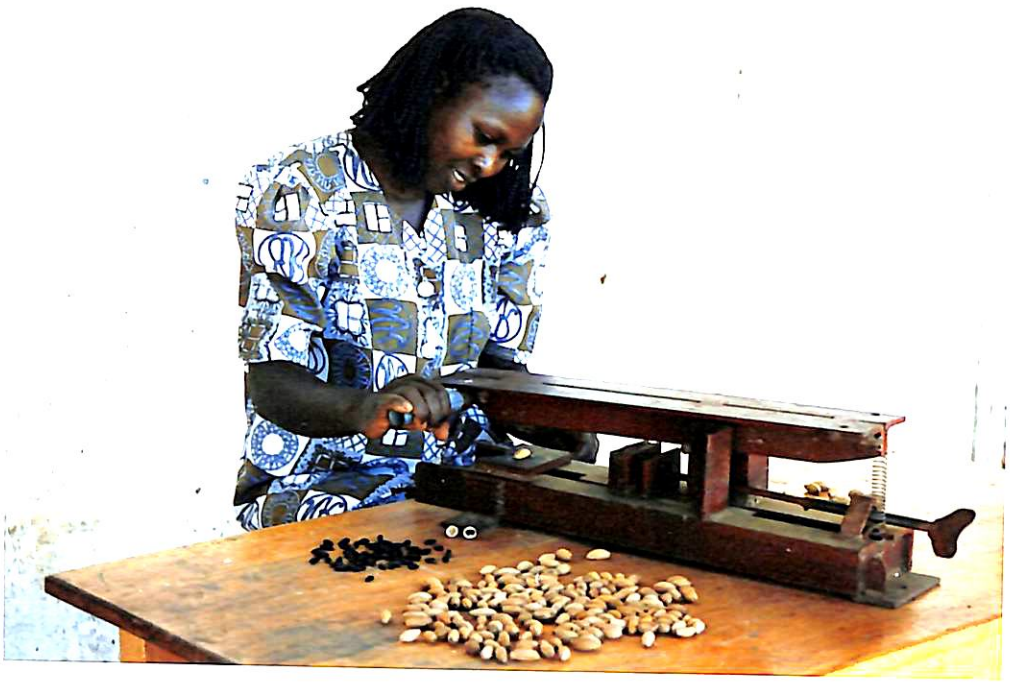


Fig. 3.5 *Melia volkensii*: Method of extraction using a machine (nut crackers) to crack the hard cover of the nut to get the seed.

Fig. 3.2 *Prosopis juliflora*: Method of extraction using iron sheet and putting the seed into the hole and covering it with dry grass to attract termites come and eat the pods leaving the seeds.

Fig. 3.7 *Eucalyptus spp.* Method of extraction using a stick to beat the seeds so as to shake seeds from capsules.

Fig. 3.8 *Sesbania grandflora* Method of extraction using a winnower inorder to separate clean seeds and the pods.

Fig. 3.9 *Acacia gerrardii* Crown collection using net spread under a tree and looping shears to shake branches so that the pods can fall on the net.

Fig. 3.10 *Acacia nilotica* Method of extraction using a mortar and pestle to remove the pods.

SEED EXTRACTION

1.	*Acacia abyssinica* *Acacia albida* *Acacia holosericea* *Acacia mellifera* *Acacia polyacantha* *Acacia senegal* *Acacia xanthopholea* *Albizia anthelmintica* *Albizia amara* *Albizia lebbeck* *Cassia siamea*	Ripe mature pods are collected sun drying is done. The duration depends on species and the collection period. Dried pods are put in the sack. The big parts of pods are removed by hand. Small parts of the pods are removed using a winnower. Any remaining parts should be picked by hand to obtain the cleanest seeds.
2.	*Acacia nilotica* *Acacia tortilis*	Ripe mature pods are collected sun dried. Duration depends on the amount of moisture in the pods (it may range from 1-4 days). The pods are put in a motor pounded and the seeds are separated from the chaff using a winnower. Any remaining parts of pods stalk and bad seeds should be picked by hand.
3.	*Caesalpinea decapetala* *Lawsonia inermis*	Fruits are collected sun dried and seeds removed by hand.
4.	*Acacia gerrardii* *Acrocarpus flaxinifolius* *Leucaeana leucocephala* *Parkinsonia aculeata* *Sesbania sesban*	The ripe pods are sun dried sufficiently according to species; put in a bag and bitten with a stick. The chaff is separated using a winnower.
5.	*Tecoma stans* *Spathodea nilotica* *Jacaranda mimosifolia* *Grevillea robusta* *Callitris robusta* *Eucalyptus spp.* *Casuariana equisetifolia*	Capsules or pods are collected. Sun dried according to species until pods/capsules open. Vigorous shaking is done. The pods are separated from the seeds using the hands. Sun drying should be under light cover.
6.	*Bauhinia thonningii*	The pods are collected properly sun dried put in a mortar and pounded. The chaff is separated from the seeds using a winnower. Most of the pods dry properly in the tree before collection.
7.	*Bombax rhodognaphalon*	Pods are collected dried in the sun until the mixture like cotton wool and seeds start to appear. Cotton wool and seeds are put in water. The seeds are separated from cotton wool by hand. The seeds are then sun dried from 2 to 3 days before storage.
8.	*Tamarindus indica*	Pods are collected. The fragile outer covering is removed by hand. The seeds are put in a drum of water then depulped and seeds sun dried for 3 days.

9.	*Balanites aegyptiaca* *Melia volkensii*	Nuts are collected then pounded in a mortar using pestle. The nuts are separated from the pulp using water. Nuts are sun dried for 3 - 4 days. The nuts can also be collected from goats sheds. The nuts are chewed and vomited by goats.
10.	*Delonix regia* *Kigelia africana*	After fruit collection, they are then put in water for 1-3 days. A knife is used to release the seeds. The seeds are sun dried for one to two days.
11.	*Gmelina arborea*	The collected fruits are put in water for about 4 days before depulping. Sufficiently ripe fruits can be depulped without putting in water but the mixture is washed to separate seeds from the pulp. The seeds are dried for 2 days.
12.	*Dovyalis caffra* *Maesopsis eminii* *Phoenix reclinata* *Psidium guajava*	The fruits are collected and put in water for about 3 days . The fruits are pounded either in a drum or mortar. Water is used to separate seeds from the pulp. Seeds are sun dried and resquized to remove the remaining material and a winnower is used to separate the seeds from the unwanted material.
13.	*Azadirachta indica*	After collection the sin, the pulp and the seed are separated in water easily. The seeds are sun dried for two days. The dry collected fruits should be soaked in water before cleaning.
14.	*Dalbergia melanoxylon*	The pods are collected. Pods are separated from the leaves and other debris by hand. No more cleaning is required as the seeds are very light and difficulty to separate with the pods.
15.	*Newtonia hilderbrandtii*	The pods are collected, then thoroughly dried in the sun. They are either stirred or slightly beaten in a bag. Pods open to release the seeds.
16.	*Macharium tipu* *Melia azaderach*	The fruits are collected and put in water for 4 days. They are cleaned using hands. Seeds are sun dried for 2-3 days.
17.	*Sesbania grandiflora*	The collected pods are sun dried. The pods open and are beaten in a bag to remove seeds. A winnower is used to separate the chaff from the seeds.
18.	*Terminalia cattapa*	After fruit collection a knife is used to cut every side of the fruit to remove the covering inorder to release the seeds.
19.	*Terminalia brownii* *Terminalia spinosa*. *Terminalia pruinoides*	After fruit collection scateur shears or a pair of scissors are used to remove the wing like appendages.

20.	*Adenium obesum* *Croton megalocarpus*	After fruit collection, it is sun dried for 2 to 4 days. The seeds are removed from the nut by using two hard surfaces to crack the nut.
21.	*Prosopis juliflora*	For immediate use after collection pods are soaked in water for one day. The seeds are removed from the pod using a knife. For bulky use the pods are put on an iron sheet and covered with some soil. Dry grass is put on top of the soil then some water is added to attract termites. Termites consume the pods but not the pods. Seeds are separated from the soil by sieving. This process may take upto three months.
22.	*Trema ariantalis*	After pods collection, they are put in the bag and beaten with a stick to open up the pods. The seeds are sun dried.
23.	*Cassia spectabilis*	After pods collection a knife is used to slit the pod open and release the seeds. The seeds are sun dried.
24.	*Terminalia mentaly*	Seeds readily germinate without further extraction. Sun drying is a good process of the only extraction.
25.	*Thevetia peruviana*	After collection of the fruit, the skin and the little pulp can be removed using a mortar. The nut is crushed between two hard surfaces to release the seed. The seed can be dried for 2 days if the nut was still green.
26.	*Zyziphus mauritiana*	After collection the fruits are put in water and the nut separated from the fleshy using hands the nut is then sun dried.
27.	*Carica papaya*	After collection the fruit is slit open with a knife and the seeds removed. The seeds are sun dried for 2 days.
28.	*Berchemia discolor*	After collection the fruits are pounded in a mortar with a pestle. The seeds are separated from the pulp using water and sand because seeds are gummy. They are sun dried for 3 days.
29.	*Cordia ovalis*	The fruit is squeezed between dry sand to remove the seed from the pulp. The seeds are then washed and sun dried for 2 days.
30.	*Schinus molle*	The fruits are sun dried for about 3 days. The seeds are rubbed with the hand to remove the thin skin. A winnower is used to separate the seed from the chaff.

3.6 Seed Storage

The main reason for storing seeds is to have regular production of seedlings whenever they are required. The storage conditions should ensure that the viability of seeds are retained. The storage period may range from 1 day to many years depending on the species. Some species e.g. *Carica papaya, Dovyalis caffra* and *Azadirachta indica* loose viability within a short time. Their storage should be short lived. Preferably they should be sown within two months from the time of collection.

Few species have seeds throughout the year e.g. *Parkinsonia aculeata* so their is less need of storage unless the seeds are required in bulk. Some species have a pattern of producing seeds that is they may produce seeds after every two or four years. There is great need for such species to be stored to have regular production of seedlings. Most species in Kitui and other arid and semi arid areas can be stored at room temperature for along period of time so long as they are sufficiently dried, protected from insects and rodents attacks and are loosely stacked. Such species include *Acacia spp, Albizia species, Eucalyptus spp, Terminalia spp.* and *Cupressucae spp.* Acacia spp. Albizia spp. and *Tamarindus indica* need chemical application to protect them from rodents and insect attacks. Some species are highly attacked by rodents e.g. *Melia volkensii* so they require immediate chemical application for protection.

All types of seeds are hygroseopic i.e. they pick up moisture from the air when their moisture contents are below that of the air. This mostly happens during the rainy periods. To prevent such conditions to occur hence respiration and metabolic activities the seeds should be sufficiently dried and stored in moisture proof containers that is containers that will not allow moisture exchange in air media. This will prolong the storage period where seed viability is of great importance. Air light containers such as sealed polythene bags jars and tins are preferred. These will not suffocate the seeds because they will allow the exchange of carbon dioxide and oxygen in between the seeds at required amounts.

The containers should contain properly well recorded labels which includes date of collection, provenance, date of extraction, purity and the weight at packing time. This eases the dispatch or repackaging records. The storage methods and facilities can be affordable by farmers, schools or any other connected installations in arid and semi arid areas. Where cold storage is affordable many species can be stored for long periods of time after high tech drying methods are applied to different species hence storage temperature.

4.0 PRE-GERMINATION TREATMENTS

Dormancy is the period seed stays before it starts germinating.

4.1 Introduction

Dormancy has led many seed users to start thinking of ways they can act on the seeds so that it can meet their needs in form of seedling production. When some seeds are subjected to favourable conditions i.e. moisture and temperature they readily germinate. Some seeds do not give sufficient germination, do not germinate or take long to germinate even if they are exposed to favourable conditions.

Dormancy is common in dryland species. To overcome this, mechanical pretreatment and soaking at different water temperatures have been tried and proved successful especially at Tiva nursery. The Project have adopted simple pretreatment methods that can be used at elementary levels that have been tried at Tiva. The pretreatments that are going to be discussed in the following chapter are Tiva trials mainly the ones that have been found successful. The pretreatment chapters have been reproduced.

4.2 Pre-treatment methods

4.2.1 Nipping

Nipping is the pretreatment involving cutting the seed coat to allow moisture to enter the inside of the seed. This treatment can be done with a nail clipper, fine pliers, knives or needles. A small scar at one end of the seed where the seed is attached to the pod indicate where nipping should be done. Care should be taken when nipping so as not to injure the radical. Nipping should be carried to the under listed species: *Acacia albida, A. brevispica, A. mellifera, A. nilotica, A. polyacantha, A. senegal, A, tortilis, A. xanthopholea, Acrocarpus flaxinifolius, Albizia gummifera, Albizia cariaria, Bauhinia thorningii, Cassia siamea, C. spectabilis, Leucaena leucocephala* and *Melia volkensii.* Nipping soaking and slitting is convenient with *M. volkensii.* Pretreatment by hot wire. The pre treatment requires much labour but the final products pays.

4.2.2 Soaking in boiling water

This is the most frequent used technique. The seeds are immersed in boiling water 4-10 times their volume. The heat source is immediately removed to avoid cooking the seeds. The seeds are left in water to cool gradually for 12-24 hrs. The technique can give erratic results. The optimum soaking time varies with species. This technique mostly favours Acacia species. Hot water soften the seed coat increasing water permeability speed. The following species are applicable to the above pre treatment: *Acacia senegal, Acacia polyacantha, Acacia mearnsii, Acacia melanoxylon, Acacia abyssinica, Delonix*

4.2.3 Soaking in hot water

Low temperatures has less chances of damaging the seeds by cooking them. Soaking the seeds in hot water within a temperature range of between 60°C - 90°C is as effective as soaking in boiling water (100°C). This method is applicable to the hard coated seeds e.g. *Acacia gerrardii, Acacia mearnsii, Acacia mellifera, A. xanthopholea, Cassia siamea, C. spectabilis, D. regia, L. leucocephala, Prosopis juliflora, Tamarindus indica* and *Callitris robusta.* The temperature depends on species.

4.2.4 Soaking in warm/cold water

Some seeds tend to develop seed coat impermeability as they over mature or due to prolonged storage. Soaking of seeds in cold water or warm water within the temperature range of 40°C or below helps to increase permeability and accelerate germination. The under listed species may be pretreated with cold or warm water. *Newtonia hilderbrandtii, Tipuana tipu, Zizyphus mauritiana* and *Schnus molle.*

4.2.5 Fresh seeds only

Some species loose their viability within a very short period. Their seeds should be sown immediately after extraction so as to obtain best germination results. These species include: *Araucaria angustifolia, Azadirachta indica, Dovyalis caffra, Kigelia africana, Salvadora persica* and *Warbugia ugandensis.*

4.2.6 No pretreatment required

Some seeds readily germinate without any pretreatment. Such species include: *Casuarina equistifolia, Croton megalocarpus, Dalbergia melanoxylon, Eucalyptus spp, Grevillea robusta, Jacaranda mimosifolia, Melia azadirach, Markhamia lutea.* Table 4.2.6.1 illustrate some pretreatment techniques that were carried to various species in Tiva nursery between 1988 and 1991. Table 4.2.6.2 illustrate change of temperature as time increases from the heat source in relation to the amount of water. The sauce pan was rested on a bad conductor of heat (Wooden desk).

Fig 4.2.6.3 illustrate table 4.2.6.2 in graphic form.

Table 4.2.6.1 (1988 - 1991)

YEAR	SPECIES	PRETREATMENT	TEMP.°C	GERM. %
88	Acacia abyssinica	boiling 15 min.	80	78
89	Acacia abyssinica	boiling 15 min.	80	78
90	Acacia abyssinica	boiling 15 min.	80	78
91	Acacia abyssinica	boiling 15 min.	80	98
88	Faitherbia albida	boiling 1 min.	80	44
89	Faitherbia albida	boiling 3 min.	80	39
90	Faitherbia albida	nipping and boiling 15 min.	80	52
91	Acacia auriculiformis	boiling 15 min.	80	76
89	Acacia gerrardii	soaking 12 hrs.	-	75
90	Acacia gerrardii	none	-	13
91	Acacia gerrardii	soaking 12 hrs.	-	76
89	Acacia holosericea	boiling 2 min.	80	86
90	Acacia holosericea	boiling 7 min.	-	86
91	Acacia holosericea	boiling 2 min.	80	86
90	Acacia hypophylla	boiling 3 min.	80	52
89	Acacia mearnsii	boiling 7 min.	80	69
91	Acacia mellifera	hot water till cool		74
88	Acacia nilotica	boiling 3 min.		8
89	Acacia nilotica	nipping		50
90	Acacia nilotica	nipping		62
91	Acacia nilotica	nipping hot water till cool		86
88	Acacia polyacantha	boiling 20 min.	80	77
89	Acacia polyacantha	boiling leave in water till cool	80	77
90	Acacia polyacantha	boiling 20 min.	80	78
91	Acacia polyacantha	Hot water till cool		74
90	Acacia pendula	boiling 1 min.		51
91	Acacia pendula	boiling 3 min.	80	50
90	Acacia saligna	boiling 3 min.	80	50
91	Acacia senegal	soaking 12 hrs.		82
91	Acacia stenophylla	boiling 3 min.		51
88	Acacia tortilis	nipping		73
89	Acacia tortilis	nipping		
90	Acacia tortilis	nipping		
91	Acacia tortilis	nipping pour boiling water overseed leave to soak 24hrs.		72
91	Acacia xanthopholea	boiling 3 min	80	63
88	Acrocarpus flaxinifolius	boiling 2 min		4
89	Acrocarpus flaxinifolius	nipping		60
90	Acrocarpus flaxinifolius	nipping		60
91	Acrocarpus flaxinifolius	nipping and soaking		44
91	Albizia amara	soaking 12 hrs.		18
91	Albizia anthelmintica	soaking 12 hrs.		91
88	Azadirachta indica	boiling 5 min.	60	42
89	Azadirachta indica	none	-	95

90	Azadirachta indica	boiling 5 min.	60	13
91	Azadirachta indica	none	-	97
91	Azanza garckeana	none		49
90	B. aegyptiaca	none or soaking 24 hrs.		55
89	Bombax rhodognaphalon	none or boiling 2 min.	80	57
90	Bombax rhodognaphalon	none		65
88	Caesalpinia decapetala	boiling 2 min.		75
	Caesalpinia decapetala	boiling 20 min.	60	75
89	Caesalpinia decapetala	boiling 3 min.	60	75
90	Caesalpinia decapetala	boiling 2 min.		75
91	Caesalpinia decapetala	boiling 3 min.	60	85
90	Callitris robusta	none		18
88	Cassia siamea	boiling 20 min.	60	92
89	Cassia siamea	boiling 20 min.	60	92
90	Cassia siamea	boiling 20 min.	60	95
91	Cassia siamea	boiling or leave in water till cool	60	88
88	Cassia spectabilis	boiling 10 min.	80	68
89	Cassia spectabilis	boiling 10 min.	80	68
90	Cassia spectabilis	boiling 10 min.	80	85
91	Cassia spectabilis	boiling 10 min.	80	70
89	Casuarina equisetifolia	none		90
90	Casuarina equisetifolia	none		92
91	Cordia ovalis	none		89
89	Croton megalocarpus	none		99
90	Croton megalocarpus	none		89
91	Croton megalocarpus	none		89
91	Dalbergia melanoxylon	none		90
91	Delonix regia	boiling 3 min.		69
90	Dovyalis caffra	none		49
91	Dovyalis caffra	none		86
90	Erythrina abyssinica	none		23
89	Euc. camaldulensis	none		90
91	Euc. camaldulensis	none		99
91	Euc. citriodora	none		89
91	Ficus natalensis	none or soak 24 hrs.		40
91	Grevillea robusta	none or soak 24 hrs.		88
89	Jacaranda mimosifolia	none		69
91	Jacaranda mimosifolia	none		88
90	Kigelia africana	none		39
91	Kigelia africana	none		36
91	Lawsonia inermis	none		84
89	Leucaena leucocephala	boiling 15 min.	60	96
90	Leucaena leucocephala	boiling 15 min.	60	94
91	Leucaena leucocephala	boiling 15 min.	60	89
90	Melia azaderach	none		49
91	Melia azaderach	none		97
89	Melia volkensii	nipping		27
90	Melia volkensii	nipping and cut out		56
91	Melia volkensii	nipping		28

91	Moringa stenopetala	none		69
90	Newtonia hilderbrandtii	none		52
88	Parkinsonia aculeata	boil 3 min.	80	86
89	Parkinsonia aculeata	boil 3 min.	80	86
90	Parkinsonia aculeata	boil 10 min.	80	85
91	Parkinsonia aculeata	boil 2 min	60	76
89	Phoenix reclinata	boil 15 min.	60	18
90	Piliostigma thonningii	soak hot water		11
88	Prosopis juliflora	boil 20 min.	80	84
89	Prosopis juliflora	boil 15 min.	80	84
90	Prosopis juliflora	boil 10 min.	80	84
91	Prosopis juliflora	boil 15 min.	80	55
88	Sesbania grandflora	boil 15 hrs.	60	59
89	Sesbania grandflora	soak 12 hrs		74
90	Sesbania grandflora	soak 12 hrs		62
91	Sesbania grandflora	soak 12 hrs		80
89	Sesbania sesban	none		86
90	Sesbania sesban	boil 20 min.	60	90
91	Sesbania sesban	none		89
90	Schinus molle	boil 5 min.	60	14
91	Schinus molle	none	-	98
91	Spathodea nilotica	none		21
88	Tamarindus indica	boiling 3 min.		98
89	Tamarindus indica	boiling 3 min.	60	95
90	Tamarindus indica	boiling 3 min.	80	80
91	Tamarindus indica	boiling 3 min.	60	96
91	Tecoma stans	none		97
89	Terminalia brownii	nipping		39
91	Terminalia brownii	scarification		34
88	Terminalia cattapa	boiling 2 min.		48
89	Terminalia cattapa	boiling 3 min.	60	98
90	Terminalia cattapa	none or soaking in water		61
88	Terminalia mentaly	boil 3 min.	60	49
89	Terminalia mentaly	boil 15 min.	80	49
90	Terminalia mentaly	boil 15 min.	80	45
91	Terminalia mentaly	boil 15 min.	80	57
89	Terminalia prunoides	nipping		5
90	Terminalia prunoides	nipping		63
91	Terminalia prunoides	scarification		23
88	Terminalia spinosa	boil 3 min.	80	13
89	Terminalia spinosa	boil 3 min.	80	13
90	Terminalia spinosa	nipping		41
91	Terminalia spinosa	scarification remove wings		13
91	Thevetia peruviana	none		91
91	Tipuana tipu	remove wings hot water		23
91	Trichilia roka	none		15
91	Zizyphus mauritiana	soak in water cracknut		10
91	Zyzigium cuminii	none		97

SEED GERMINATION PRETREATMENT 1992

YEAR	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
1992	Acacia gerrardii	Soaking in cold water overnight		65
1992	Acacia holoicilica	Boiling water for 7 min.	80	92
1992	Acacia polyacantha	Boiling water till cool	80	85
1992	Acacia nilotica	Knipping with hot wire		78
1992	Acacia senegal	Soaking in cold water overnight		75
1992	Acacia tortilis	Knipping with hot wire		80
1992	Acacia mearnsii	Boiling water foor 7 min.	80	65
1992	Acacia aulacocarpa	Boiling water for 7 min.	80	55
1992	Acacia crassicarpa	Boiling water for 7 min.	80	62
1992	Acacia xanthophloea	Boiling water for 20 min.	60	60
1992	Albizia anthelmintica	Soaking in cold water		84
1992	Azadirachta indica	No treatment		75
1992	Balanites aegyptiaca	No treatment		60
1992	Callitris robusta	No treatment		45
1992	Casuarina aquisetifolia	No treatment		50
1992	Cassia siamea	Boiling water for 20 min.	60	92
1992	Cassia spectabilis	Boil for 15 min.	60	95
1992	Cordia ovalis	No treatment		70
1992	Croton megalocarpus	No treatment		65
1992	Dalberia melanoxylon	No treatment		57
1992	Eucalyptus camaldulensis	No treatment		60
1992	Eucalyptus globlus	No treatment		50
1992	Eucalyptus grandis	No treatment		52
1992	Eucalyptus nitens	No treatment		61
1992	Eucalyptus tereticornis	No treatment		65
1992	Eucalyptus paniculata	No treatment		70
1992	Eucalyptus pellita	No treatment		64
1992	Gmelina arborea	No treatment		71
1992	Grevillea robusta	No treatment		52
1992	Jacaranda mimosifolia	No treatment		62
1992	Lawsonia inermis	No treatment		56
1992	Melia volkensii	Knipping then soak in cold water overnight		45
1992	Prosopis juliflora	Boiling water 15 min.	80	92
1992	Tamarindus indica	Boiling water for 3min	60	70
1992	Terminalia brownii	Knipping then soak in cold water overnight		45
1992	Terminalia pruinoides	Knipping then soak in cold water over night		60
1992	Terminalia spinosa	Knipping then soak in cold water overnight		55

SEED GERMINATION PRE-TREATMENT 1993
Kenyan species

YEAR	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
1993	Acacia gerrardii	Soak in cold water overnight		80
1993	Acacia melifera	Soak in cold water overnight		72
1993	Acacia nilotica	Knipping with hot wire		75
1993	Acacia polyacantha	Boiling water then left in the same water overnight	80	86
1993	Acacia tortilis	Boiling water for 20 min.	80	70
1993	Acacia xanthophloea	Boiling water for 15min.	60	72
1993	Albizia anthelmintica	Soaking in cold water for 12 hrs.		87
1993	Azadirachta indica	Direct sowing without any treaatment		87
1993	Balanites aegyptiaca	Direct sowing without any treaatment		72
1993	Cassia siamea	Boiling in hot water for 20 min.	60	95
1993	Cassia spectabilis	Boiling water for 15 min.	60	80
1993	Croton megalocarpus	Direct sowing without any treaatment		75
1993	Dalbergia melanoxylon	Direct sowing without any treaatment		60
1993	Delonix regia	Boiling water for 2 minutes	80	70
1993	Eucalyptus camaldulensis	Direct sowing without any treaatment		75
1993	Grevillea robusta	Direct sowing without any treaatment		60
1993	Melia volkensii	Knipping soaking in cold water overnight		50
1993	Prosopis juliflora	Boiling water for 15 minutes	80	98
1993	Tamarindus indica	Boiling in hot water for 3 minutes	60	78
1993	Terminalia brownii	Knipping then soaking in cold water overnight		30
1993	Terminalia mentalis	Boiling water for 15 min.	60	55
1993	Tipuana tipu	Soaking in cold water overnight		45

Australian species (1993)

Batch no.	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
16976	Acacia aulacocarpa	Boiling water for 7 min.	80	65
17553	Acacia auriculiformis	Boiling water for 7 min.	80	60
17869	Acacia crassicarpa	Boiling water for 7 min.	80	55
17634	Acacia cincinnata	Boiling water for 7 min.	80	52
16389	Acacia holosericea	Boiling water for 7 min.	80	70
18091	Acacia leptocarpa	Boiling water 7 min.	80	70
12966	Eucalyptus alba	No treatment		52
13997	Eucalyptus brassiana	No treatment		70
18304	Eucalyptus camaldulensis	No treatment		62
18242	Eucalyptus camaldulensis	No treatment		67
17633	Eucalyptus camaldulensis	No treatment		64
13628	Eucalytus citriodora	No treatment		61
14850	Eucalyptus citriodora	No treatment		57
18230	Eucalyptus citriodora	No treatment		56
14107	Eucalyptus crebra	No treatment		54
15686	Eucalyptus cullenii	No treatment		50
14864	Eucalyptus exserta	No treatment		57
17864	Eucalyptus tereticornis	No treatment		51
16348	Eucalyptus tereticornis	No treatment		50
16347	Eucalyptus tereticornis	No treatment		57
16729	Acacia auriculiformis	Boiling water for 7 min.	80	62
18059	Acacia auriculiformis	Boiling water for 7 min.	80	65

SEED GERMINATION PRE-TREATMENT 1993
Kenyan species

YEAR	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
1993	Acacia gerrardii	Soak in cold water overnight		80
1993	Acacia melifera	Soak in cold water overnight		72
1993	Acacia nilotica	Knipping with hot wire		75
1993	Acacia polyacantha	Boiling water then left in the same water overnight	80	86
1993	Acacia tortilis	Boiling water for 20 min.	80	70
1993	Acacia xanthophloea	Boiling water for 15min.	60	72
1993	Albizia anthelmintica	Soaking in cold water for 12 hrs.		87
1993	Azadirachta indica	Direct sowing without any treaatment		87
1993	Balanites aegyptiaca	Direct sowing without any treaatment		72
1993	Cassia siamea	Boiling in hot water for 20 min.	60	95
1993	Cassia spectabilis	Boiling water for 15 min.	60	80
1993	Croton megalocarpus	Direct sowing without any treaatment		75
1993	Dalbergia melanoxylon	Direct sowing without any treaatment		60
1993	Delonix regia	Boiling water for 2 minutes	80	70
1993	Eucalyptus camaldulensis	Direct sowing without any treaatment		75
1993	Grevillea robusta	Direct sowing without any treaatment		60
1993	Melia volkensii	Knipping soaking in cold water overnight		50
1993	Prosopis juliflora	Boiling water for 15 minutes	80	98
1993	Tamarindus indica	Boiling in hot water for 3 minutes	60	78
1993	Terminalia brownii	Knipping then soaking in cold water overnight		30
1993	Terminalia mentalis	Boiling water for 15 min.	60	55
1993	Tipuana tipu	Soaking in cold water overnight		45

Australian species (1993)

Batch no.	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
16976	Acacia aulacocarpa	Boiling water for 7 min.	80	65
17553	Acacia auriculiformis	Boiling water for 7 min.	80	60
17869	Acacia crassicarpa	Boiling water for 7 min.	80	55
17634	Acacia cincinnata	Boiling water for 7 min.	80	52
16389	Acacia holosericea	Boiling water for 7 min.	80	70
18091	Acacia leptocarpa	Boiling water 7 min.	80	70
12966	Eucalyptus alba	No treatment		52
13997	Eucalyptus brassiana	No treatment		70
18304	Eucalyptus camaldulensis	No treatment		62
18242	Eucalyptus camaldulensis	No treatment		67
17633	Eucalyptus camaldulensis	No treatment		64
13628	Eucalytus citriodora	No treatment		61
14850	Eucalyptus citriodora	No treatment		57
18230	Eucalyptus citriodora	No treatment		56
14107	Eucalyptus crebra	No treatment		54
15686	Eucalyptus cullenii	No treatment		50
14864	Eucalyptus exserta	No treatment		57
17864	Eucalyptus tereticornis	No treatment		51
16348	Eucalyptus tereticornis	No treatment		50
16347	Eucalyptus tereticornis	No treatment		57
16729	Acacia auriculiformis	Boiling water for 7 min.	80	62
18059	Acacia auriculiformis	Boiling water for 7 min.	80	65

Kenyan species (1994)

Species	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
1994	Acacia gerrardii	Knipping then soaking in cold water overnight		98
1994	Acacia mellifera	Soaking in cold water overnight		70
1994	Acacia nilotica	Knipping with hot wire		75
1994	Acacia polyacantha	Boiling water till cool	80	82
1994	Acacia senegal	Soaking in cold water 12 hrs.		70
1994	Albizia anthelmintica	Soaking in cold water 12 hrs		90
1994	Azadirachta indica	No treatment		80
1994	Cassia siamea	Boiling water for 20 min.	60	92
1994	Cassia spectabilis	Boiling water for 15 min.	60	70
1994	Cassuarina equisetifolia	No treatment		60
1994	Croton megalocarpus	No treatment		70
1994	Dalbergia melanoxylon	No treatment		60
1994	Dovyalis caffra	No treatment		80
1994	Grevillea robusta	No treatment		62
1994	Jacaranda mimosifolia	No treatment		64
1994	Mellia volensii	No treatment		65
1994	Prosopis juliflora	Boiling water for 15 min.	80	90
1994	Tamarindus indica	Boil for 3 min.	60	68
1994	Terminalia brownii	Knipping then soaking in cold water overnight		60

Australian species (1994)

Batch no.	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
18515	Acacia cowleana	Boiling water for 7 min.	80	54
18524	Acacia cowleana	Boiling water for 7 min.	80	55
17604	Acacia crassicarpa	Boiling water for 7 min.	80	45
17871	Acacia crassicarpa	Boiling water for 7 min.	80	46
17852	Acacia mangium	Boiling water for 7 min.	80	48
17868	Acacia mangium	Boiling water for 7 min.	80	54
18265	Acacia mangium	Boiling water for 7 min.	80	56
17936	Acacia mearnsii	Boiling water for 7 min.	80	57
17949	Acacia mearnsii	Boiling water for 7 min.	80	62
	Eucalyptus camaldulensis	No treatment		60
13165	Eucalyptus pellita	No treatment		62
17874	Eucalyptus pellita	No treatment		54
17854	Eucalyptus pellita	No treatment		52
18197	Eucalyptus pellita	No treatment		56
18199	Eucalyptus pellita	No treatment		50
15370	Eucalytpus tereticornis	No treatment		48
16349	Eucalytpus tereticornis	No treatment		45
18094	Eucalyptus urophylla	No treatment		40
18096	Eucalyptus urophylla	No treatment		45
18106	Grevillea robusta	No treatment		60
18107	Grevillea robusta	No treatment		62
	Adansonia digitata	Knipping then soak in cold water overnight		70
	Delonix regia	Boiling water for 2 min.	80	70

Kenyan species (1994)

Species	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
1994	Acacia gerrardii	Knipping then soaking in cold water overnight		98
1994	Acacia mellifera	Soaking in cold water overnight		70
1994	Acacia nilotica	Knipping with hot wire		75
1994	Acacia polyacantha	Boiling water till cool	80	82
1994	Acacia senegal	Soaking in cold water 12 hrs.		70
1994	Albizia anthelmintica	Soaking in cold water 12 hrs		90
1994	Azadirachta indica	No treatment		80
1994	Cassia siamea	Boiling water for 20 min.	60	92
1994	Cassia spectabilis	Boiling water for 15 min.	60	70
1994	Cassuarina equisetifolia	No treatment		60
1994	Croton megalocarpus	No treatment		70
1994	Dalbergia melanoxylon	No treatment		60
1994	Dovyalis caffra	No treatment		80
1994	Grevillea robusta	No treatment		62
1994	Jacaranda mimosifolia	No treatment		64
1994	Mellia volensii	No treatment		65
1994	Prosopis juliflora	Boiling water for 15 min.	80	90
1994	Tamarindus indica	Boil for 3 min.	60	68
1994	Terminalia brownii	Knipping then soaking in cold water overnight		60

Australian species (1994)

Batch no.	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
18515	Acacia cowleana	Boiling water for 7 min.	80	54
18524	Acacia cowleana	Boiling water for 7 min.	80	55
17604	Acacia crassicarpa	Boiling water for 7 min.	80	45
17871	Acacia crassicarpa	Boiling water for 7 min.	80	46
17852	Acacia mangium	Boiling water for 7 min.	80	48
17868	Acacia mangium	Boiling water for 7 min.	80	54
18265	Acacia mangium	Boiling water for 7 min.	80	56
17936	Acacia mearnsii	Boiling water for 7 min.	80	57
17949	Acacia mearnsii	Boiling water for 7 min.	80	62
	Eucalyptus camaldulensis	No treatment		60
13165	Eucalyptus pellita	No treatment		62
17874	Eucalyptus pellita	No treatment		54
17854	Eucalyptus pellita	No treatment		52
18197	Eucalyptus pellita	No treatment		56
18199	Eucalyptus pellita	No treatment		50
15370	Eucalytpus tereticornis	No treatment		48
16349	Eucalytpus tereticornis	No treatment		45
18094	Eucalyptus urophylla	No treatment		40
18096	Eucalyptus urophylla	No treatment		45
18106	Grevillea robusta	No treatment		60
18107	Grevillea robusta	No treatment		62
	Adansonia digitata	Knipping then soak in cold water overnight		70
	Delonix regia	Boiling water for 2 min.	80	70

Kenyan species (1995)

Species	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
1995	Acacia gerrardii	Knipping then soaking in cold overnight		95
1995	Acacia holoicilica	Boiling for 7 min.	80	86
1995	Acacia mellifera	Soaking in cold water overnight		67
1995	Acacia nilotica	Knipping then soaking in cold		82
1995		water overnight		
1995	Acacia polyacantha	Boiling water till cool	80	90
1995	Acacia senegal	Soak in cold water overnight		65
1995	Acacia tortilis	Knipping then soaking in cold water overnight		85
1995	Albizia anthelmintica	Soaking in cold water for 12 hrs.		92
1995	Albizia lebbeck	Knipping then soaking in cold water overnight		72
1995	Azadirachta indica	No treatment		90
1995	Balanites aegyptica	No treatment		65
1995	Berchemia discolor	Soaking in cold water 24 hrs.		70
1995	Cassia siamea	Boiling water for 20 min.	60	90
1995	Cassia spectabilis	Boiling water for 15 min.	60	78
1995	Casuarina equisetifolia	No treatment		64
1995	Cordia ovalis	Soaking in cold water overnight		10
1995	Croton megalocarpus	No treatment		60
1995	Dalbergia melanoxylon	No treatment		52
1995	Delonix regia	Boiling water for 2 min.	80	74
1995	Dovyalis caffra	No treatment		92
1995	Eucalyptus camaldulensis	No treatment		65
1995	Faidherbia albida	Knipping then soaking in cold water overnight		72
1995	Grevillea robusta	No treatment		64
1995	Jacaranda mimosifolia	No treatment		50
1995	Melia volkensii	Knipping then soak in cold water overnight		40
1995	Leucaena leucocephala	Boiling water for 15 min.	60	80
1995	Prosopis juliflora	Boiling water for 15 min.		92
1995	Termarindus indica	Boiling water for 3 mon.	60	72
1995	Terminalia brownii	Knipping then soak in cold water overnight		20
1995	Terminalia mentalis	Knipping, soaking in cold water overnight		70
1995	Makharmia lutea	No treatment		60

AUSTRALIAN SPECIES

Batch NO.	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
18785	Eucalyptus camaldulensis	No treatment		71
17618	Grevillea robusta	No treatment		72
18441	Acacia holoisericea	Boiling for 7 min.	80	65
17737	Acacia holoisericea	Boiling for 7 min.	80	70

Kenyan species (1995)

Species	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
1995	Acacia gerrardii	Knipping then soaking in cold overnight		95
1995	Acacia holoicilica	Boiling for 7 min.	80	86
1995	Acacia mellifera	Soaking in cold water overnight		67
1995 1995	Acacia nilotica	Knipping then soaking in cold water overnight		82
1995	Acacia polyacantha	Boiling water till cool	80	90
1995	Acacia senegal	Soak in cold water overnight		65
1995	Acacia tortilis	Knipping then soaking in cold water overnight		85
1995	Albizia anthelmintica	Soaking in cold water for 12 hrs.		92
1995	Albizia lebbeck	Knipping then soaking in cold water overnight		72
1995	Azadirachta indica	No treatment		90
1995	Balanites aegyptica	No treatment		65
1995	Berchermia discolor	Soaking in cold water 24 hrs.		70
1995	Cassia siamea	Boiling water for 20 min.	60	90
1995	Cassia spectabilis	Boiling water for 15 min.	60	78
1995	Casuarina equisetifolia	No treatment		64
1995	Cordia ovalis	Soaking in cold water overnight		10
1995	Croton megalocarpus	No treatment		60
1995	Dalbergia melanoxylon	No treatment		52
1995	Delonix regia	Boiling water for 2 min.	80	74
1995	Dovyalis caffra	No treatment		92
1995	Eucalyptus camaldulensis	No treatment		65
1995	Faidherbia albida	Knipping then soaking in cold water overnight		72
1995	Grevillea robusta	No treatment		64
1995	Jacaranda mimosifolia	No treatment		50
1995	Melia volkensii	Knipping then soak in cold water overnight		40
1995	Leucaena leucocephala	Boiling water for 15 min.	60	80
1995	Prosopis juliflora	Boiling water for 15 min.		92
1995	Termarindus indica	Boiling water for 3 mon.	60	72
1995	Terminalia brownii	Knipping then soak in cold water overnight		20
1995	Terminalia mentalis	Knipping, soaking in cold water overnight		70
1995	Makharmia lutea	No treatment		60

AUSTRALIAN SPECIES

Batch NO.	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
18785	Eucalyptus camaldulensis	No treatment		71
17618	Grevillea robusta	No treatment		72
18441	Acacia holoisericea	Boiling for 7 min.	80	65
17737	Acacia holoisericea	Boiling for 7 min.	80	70

Kenyan species (1996)

Species	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
1996	Acacia gerrardii	Knipping then soaking in cold water overnight		90
1996	Acacia holoisericea	Boiling water for 7 min	80	84
1996	Acacia mellifera	Soaking in cold water for 12 hrs.		80
1996	Acacia nilotica	Knipping then soak in cold water overnight		92
1996	Acacia polyacantha	Boiling water then left to cool overnight		93
1996	Acacia senegal	Soaking in cold water overnight		72
1996	Acacia tortilis	Knipping the soak in cold water		90
1996	Albizia anthelmintica	Soaking in cold water overnight		78
1996	Albizia anthelmintica	Soaking in cold water overnight		78
1996	Albizia lebbeck	Knipping then soaking in cold water overnight		70
1996	Azadirachta indica	No treatement		92
1996	Balanites aegyptiaca	No treatment		71
1996	Berchemia discolor	Soaking in cold water for 48 hours		80
1996	Carica papaya	No treatment		58
1996	Cassia siamea	Boiling water for 20 min.	60	86
1996	Cassia spectabilis	Boiling water for 15 min.	60	82
1996	Casuarina equisetifolia	No treatment		52
1996	Cordia ovalis	No treatment		2
1996	Croton megalocarpus	No treatment		50
1996	Dalbergia melanoxylon	No treatment		54
1996	Delonix regia	hot water for 2 min.	80	68
1996	Dovyalis caffra	No treatment		86
1996	Eucalyptus camaldulensis	No treatment		62
1996	Faitherbia albida	Knipping then soaking in cold water overnight		76
1996	Grevillea robusta	No treatment		58
1996	Jacaranda mimosifolia	No treatment		52
1996	Leucaena leucocephala	Boiling for 13 min.	60	85
1996	Melia volkensii	Knipping then soaking in cold water overnight		45
1996	Moringa oleifera	No treatment		70
1996	Psidium guajava	No treatment		85
1996	Prosopis juliflora	Boiling water	80	88
1996	Schinus molle	No treatment		3
1996	Tamarindus indica	Boiling water for 3 min.	60	74
1996	Terminalia brownii	Knipping then soak in cold water overnight		10
1996	Terminalia mentalis	Knipping then soak in cold water overnight		72
1996	Terminalia pruinioides	Knipping then soak in cold water overnight		56

AUSTRALIAN SPECIES

Batch NO.	SPECIES	PRE-TREATMENT	TEMP.°C	GERM. %
18785	Eucalyptus camaldulensis	No treatment		80
18828	Acacia holosericea	Boil for 7 min.	80	80
15821	Acacia melanoxylon	Boil for 7 min.	80	60

Table 4.2.6.2

Change of temperature in water with time unit °C

TIME	WATER CAPACITY (LITRES)			
(min)	1.5	2.0	2.5	3.0
0	95	95	95	95
2	82	85	87	89
4	76	80	84	85
6	70	76	79	81
8	66	72	75	79
10	62	69	72	76
12	60	66	69	73
14	57	64	67	71
16	54.5	62	64	69
18	53	60	62	67
20	51	58	60	65
22	49	57	59	64
24	47.5	55	57	62
26	46	54	56	61
28	45	52	54	60
30	44	51	53	58
32	42.5	50	52	57
34	42	49	51	56
36	41	48	50	55
38	40	47	49	54
40	39	46	48	53
42	38.5	45.5	47	52
44	37.5	44.5	46	51
46	37	44	45	50
48	36.5	43	44.5	49.5
50	36	42.5	44	49

The air temperature at the time of recording was between 22-24°C. The sauce pan used had a capacity of 3.3 litres.

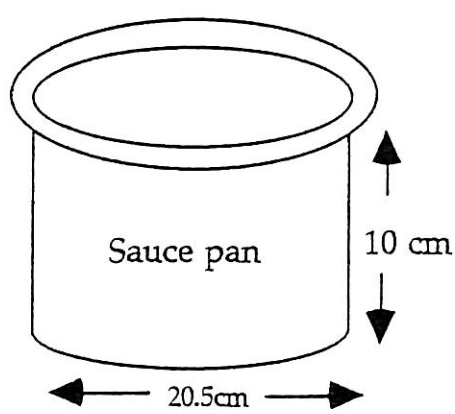
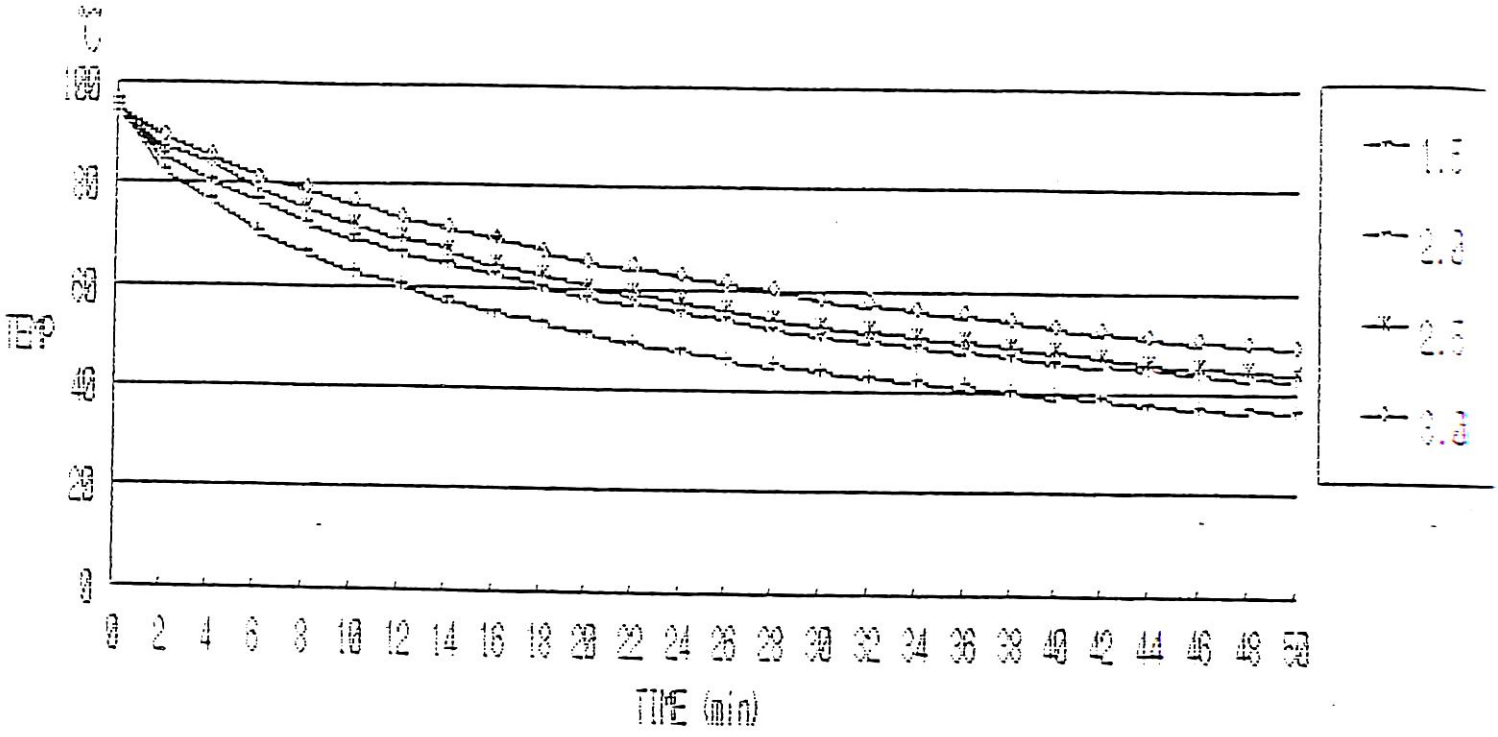


Fig. 4.2.6.3 Change of water temperature with time



4.3.0 MELIA VOLKENSII (Special case)

4.3.1 Introduction

Arid and semi-arid lands of Kenya cover upto 80% of the country's land surface. These areas support upto 20% of the population and more than 50% of livestock.

The present trend of population movement is directed towards the low potential areas that are environmentally fragile. Cases of burning, clearing and degradation of vegetation as a result of demand for human settlement and overgrazing are common features on the landscape. This is causing alot of concern to those bestowed with the responsibility of environmental conservation and national planing.

It is in record that in most of the dry areas especially in Kitui, alot of effort has been directed towards afforestation and re-afforestation by the Government and numerous Non-Governmental organizations.

Despite the magnitude of work and funds directed towards that end, little is seen in terms of survival after planting. The poor survival rates have been attributed to **1.** Drought **2.** Termites **3.** Animal destruction **4.** Lack of know-how (poor species selection) **5.** Poor soils etc.

It has been realized that despite the failures, a few trees have been noted to do well in dry areas. One of the key species that has high potential for survival and a multiplicity of uses is *Melia volkensii.*

The species belongs to Meliaceae family. It is potentially a useful tree growing in semi-arid areas of Kenya. It occurs as an emergent in the *Acacia, commiphora,* deciduous bushlands and sometimes fringing seasonal water courses on rock outcrops (ICRAF, 1992). Ecologically, the species is widely distributed at altitudes ranging from 350-1675m in lower semi-arid Savanna Districts such as Kitui, Machakos, Samburu, Taita and Voi. It does well under an average annual rainfall of 450-900mm and temperature range of 22-30°C.

The species grows to 15m, the bark has pronounced vertical fissures. It grows fast, coppices well and shedding the leaves during the dry season to provide mulch (Teel, 1984).

The species produces high quality timber resembling that of African mahogany which is durable and easy to work (Dale and Greenway, 1961). Despite the foresaid however, the species has not been planted in plantations or in many areas. This is because the seeds do not easily germinate despite numerous trials. Notable to say here is that work done by Social Forestry Training project Kitui has given some hope.

4.3.2 1992 Trials

4.3.2.1 Yatta provenance trial

Seed from the above provenance were subjected to four treatments.

1. Knipping and slitting
2. Knipping alone
3. Soaking in warm water (60°C)
4. Control.

The seeds were sown in pure sand and the germination boxes were covered with polythene sheet. Watering was done twice daily. The table below give as a breakdown of the results.

Pre-treatment	Knipping and slitting	Knipping alone	Soak 60°C	Control
Covered with polythene	64%	4%	3%	0%
Open boxes	0%	0%	0%	0%

4.3.2.2 Different provenance trials

The seeds of *Melia volkensii* from Kibwezi, Kavisuni and Yatta were subjected to two main treatments:

1. Knipping, slitting and soaking in cold water for 12 hours.
2. Soaking in 60°C till cool.

The table below gives the results.

	Pre-treatment	Knipping, slitting soak in cold water	Soak in 60°C till cool
Provenance	Kibwezi Kavisuni Yatta	34% 74% 39%	3% Average

4.3.3 Discussion

It is clear from the above results that seeds of *Melia volkensii* subjected to different treatments give different results. The best results were given by knipping followed by slitting (64%).

Germination results of the same species from different provenances were varied, though the seeds were subjected to similar conditions. This may mean that other conditions may be attributed to the varied results. It is not possible at this point to state the cause of this disparity though it is suspected that physical/edaphic conditions prevailing at the seed source or seed maturity may have profoundly influenced the results.

4.3.4 1995 trials

The seeds from Kavisuni, Yatta and Tiva sites were subjected to five treatments:

A. Knipping
B. Slitting
D. Knipping, slitting and soaking
E. Control

The table below gives the results in germination percentage.

	PROVENANCE			
Pre-treatment	Kavisuni	Yatta	Tiva	Average %
A	18	43	12	24.3
B	33.5	54.5	54	47.3
C	5	8.5	9	7.5
D	41.5	60.5	56.5	52.8
E	1	0.5	2.5	1.3
Total	99	167	134	

4.3.4.1 Discussion

It is clear from the table above that seeds subjected to different treatments give different results. Pre-treatment D (knipping, slitting and soaking) had the highest percentage germination (52.8). The least (1.3%) was given by E (control). It is therefore clear that atleast the seeds of *Melia volkensii* require some preparation as to break dormancy. This may be in the form of knipping or slitting with a combination giving the highest germination percentage so far recorded.

From the table above, it is also clear that seeds from different sources gave different results. Yatta was noted to have the highest overall germination. An explanation given in the 1992 trials may be satisfactory for this case.

5.0 SEED WEIGHT

5.1 Introduction

More information has to be sought in connection with the seeds as the population of seed users increases. The information to be supplied has to be oriented on better nursery management. This has to combine areas where equipments are available and where they are not available. The information will help nursery manager to plan their requirements soon after seed collection.

5.2 Weight of collected fruits and production of extracted seeds

The weight of collected fruits should be taken soon after collection. This can be done using local available balances like the ones used for weighing farm produce materials. This will help the nursery manager determine and calculate the extracted material.

The weight of the unextracted material depends mainly on (1) Localities the fruits has been collected (2) The vigour of parent tree growth (3) The time (period) the fruits has been collected (4) The time the fruits has stayed in the parent tree after ripening. (An appendix will be provided at the end of chapter)

5.3 Weight of 1000 seeds

This will help the manager determine the weight he/she requires or has used in case weighing machines are not available. The weight of the seeds depends on provenances the correction period and the size of the seeds per parent tree. An appendix will be provided at the end of chapter.

5.4 Weight of one seed

Some species have got big seeds that can be weighed separately. It is very necessary for nursery managers to know the weight of single seeds because some species are sown in small quantities. How, small the quantify is, it is vital as concerns the environmental improvement. The weight of single seeds depends on individual parent trees, provenances, vigour of growth of each parent tree and the collection period. An appendix has been provided at the end of the chapter.

5.5 No. of seeds per kg.

The number of seeds per kilogramme depends on provenances, parent trees vigor of growth and the collection period. A nursery manager should be very well informed of his/her requirements in terms of kilos but the number of kilos required per one plan will be guided by the number of seeds per kilo and the total number of seedlings required by the plan of a particular year.

An average estimate of the number of seeds per kilo which have been determined in a number of years have been provided at the end of the chapter.

NO.	SPECIES	TIVA ESTIMATES		1 KG.	OTHER ESTIMATES	sources	TIVA QTY.	TIVA REQUIRE
		1988 .	1989	1992		REF		
1	*Acaciagerrardii*	6500	9563	8547	1000-15000	{2}		
2	*Acacia holosericea*			71429	70000	{2}		
3	*Acacia mellifera*		15751	18519	20000	{2}		
4	*Acacia nilotica*	6760	7955	7063	7500	{1}		
					7000-11000	{2}		
5	*Acacia polyacantha*	15240	5324	16129	14000-16000	{2}		
6	*Acacia senegal*		8406	8696	18000	{1}		
					8000-11000	{2}		
7	*Acacia tortilis*	15620	18055	11628	15000-20000	{1}		
					12000-31000	{2}		
8	*Albizia anthelmintica*	8400						
9	*Albizia amara*			10101				
10	*Albizia lebbeck*			8403	8000-10000	{1}		
					10000-14000	{2}		
11	*Azadirachta indica*				16000-17000	{1}		
					5000	{2}		
12	*Balanites aegyptiaca*		355	294	500-1500	{1}		
					1000	{2}		
13	*Berchermia discolor*							
14	*Cassia siamea*	36240	35414	45455	35000-40000	{1}		
					38000	{2}		
15	*Cassia spectabilis*	32240	35461	32258	39000	{2}		
16	*Cordia ovalis*			6098	2500-4500	{2}		
17	*Croton megalocarpus*	2100	2178	1825				
18	*Dalbergia melanoxylon*				16000	{1}		
					6000-16000	{2}		
19	*Dovyalis caffra*				27000-47000	{2}		
20	*Eucalyptus camaldulensis*		2163162		200000-1000000	{1}		
					100000-2100000	{2}		
21	*Grevillea robusta*				70000-113000	{2}		
22	*Faitherbia albida*	3200	7852	-	11500	{1}		
					7500-10000	{2}		
23	*Jacaranda mimosifolia*		72610	83333	63000-80000	{2}		
24	*Leucaena leucocephala*		17800	20400	20000	{1}		
					13000-34000	{2}		
25	*Markhamia lutea*				75000	{2}		
26	*Melia volkensii*	5000}'95						
		4900}						
27	*Prosopis juliflora*			40870	8000-15000	{1}		
					30000-35000	{2}		

An average estimate of the number of seeds per kilo which have been determined in a number of years have been provided at the end of the chapter.

NO.	SPECIES	TIVA ESTIMATES		1 KG.	OTHER ESTIMATES	sources	TIVA QTY.	TIVA REQUIRE
		1988 -	1989	1992		REF		
1	*Acaciagerrardii*	6500	9563	8547	1000-15000	{2}		
2	*Acacia holosericea*			71429	70000	{2}		
3	*Acacia mellifera*		15751	18519	20000	{2}		
4	*Acacia nilotica*	6760	7955	7063	7500	{1}		
					7000-11000	{2}		
5	*Acacia polyacantha*	15240	5324	16129	14000-16000	{2}		
6	*Acacia senegal*		8406	8696	18000	{1}		
					8000-11000	{2}		
7	*Acacia tortilis*	15620	18055	11628	15000-20000	{1}		
					12000-31000	{2}		
8	*Albizia anthelmintica*	8400						
9	*Albizia amara*			10101				
10	*Albizia lebbeck*			8403	8000-10000	{1}		
					10000-14000	{2}		
11	*Azadirachtaindica*				16000-17000	{1}		
					5000	{2}		
12	*Balanites aegyptiaca*		355	294	500-1500	{1}		
					1000	{2}		
13	*Berchermia discolor*							
14	*Cassia siamea*	36240	35414	45455	35000-40000	{1}		
					38000	{2}		
15	*Cassia spectabilis*	32240	35461	32258	39000	{2}		
16	*Cordia ovalis*			6098	2500-4500	{2}		
17	*Croton megalocarpus*	2100	2178	1825				
18	*Dalbergia melanoxylon*				16000	{1}		
					6000-16000	{2}		
19	*Dovyalis caffra*				27000-47000	{2}		
20	*Eucalyptus camaldulensis*		2163162		200000-1000000	{1}		
					100000-2100000	{2}		
21	*Grevillea robusta*				70000-113000	{2}		
22	*Faitherbiaalbida*	3200	7852	-	11500	{1}		
					7500-10000	{2}		
23	*Jacaranda mimosifolia*		72610	83333	63000-80000	{2}		
24	*Leucaena leucocephala*		17800	20400	20000	{1}		
					13000-34000	{2}		
25	*Markhamia lutea*				75000	{2}		
26	*Melia volkensii*	5000}'95						
		4900}						
27	*Prosopis juliflora*			40870	8000-15000	{1}		
					30000-35000	{2}		

28	*Tamarindus indica*	1200	1575	1575	2000-2500	{1}		
					1400	{2}		
29	*Terminalia brownii*	1800	3188	1399	3000	{2}		
30	*Terminalia mentalis*		2034					
31	*Parkisonia aculeata*	11120	13104	12500	12000	{1}		
					11000-15000	{2}		
32	*Delonix regia*	2600	22105	2793	2000	{2}		
33	*Acrocarpus fraxinifolius*	25400	24220	34483	24000-29000	{2}		
34	*Bombax rhodognafalon*							
35	*Piliostigma thorningii*	7520	7546	7299	8500	{1}		
					7300	{2}		
36	*Acacia seyal*			26667	22600	{1}		
					20000	{2}		
37	*Acacia xanthopholea*	23060	26212	31613	24000-30000	{1}		
38	*Callitries robusta*	95000	123457	100000				
39	*Calliandra calothyrsus*				19000	{2}		
40	*Casuarina cunninganiana*				1400000-1600000	{2}		
41	*Casuarina equistifolia*	269600	860215	400000	600000-1400000	{1}		
					600000-900000	{2}		
42	*Melia azadirach*	2180	2710	1634	500-300	{2}		
43	*Moringa oleifera*			4673	4000-5000	{2}		

(1) Trees and shrubs of sahel
(2) A selection of useful trees of Kenya

1995 SEED INFORMATION INDEX FOR CHAP. 5.0

No.	SPECIES	TIVA EST. seeds/kg.	OTHER EST. seeds/kg.	UNEXTRACTED Kg.	EXTRACTED Kg.	EXT. unext.	WT. OF 1000 seeds
1	*Acacia gerrardii*	6500					
2	*Acacia holosericea*	71400	70000	30.2	1.3	0.039	18.16gm
3	*Acacia mellifera*	15000-18500	17000-2000	19.5	0.300	0.016	10.31gm
4	*Acacia nilotica*	6500-7900	7000-11000	61.0	15.020	0.250	132gm
5	*Acacia polyacantha*	5000-16000	14000-16000	48.9			60gm
6	*Acacia senegal*	8400-8700	8000-18000	25.2			124gm
7	*Acacia seyal*	22000		0.5	0.400	0.8	22.64gm
8	*Acacia tortilis*	15600-18000	12000-31000	86.3	13.900	0.16	55gm
9	*Albizia anthelmintica*	8400		11.0	2.570	0.23	127gm
10	*Albizia lebbeck*						
11	*Albizia amara*	10100		9.1	2.200	0.77	80gm
12	*Azadirachta indica*	5000		39.6			
13	*Balanites aegyptiaca*	290-350	500-1500	36.0			4.580kg.
14	*Berchemia discolor*		2400	10.3			336 gm
15	*Carica papaya*						
16	*Cassia siamea*	35400-45400	35000-4000	118.4	13.47	0.11	31gm
17	*Cassia spectabilis*	32000-35000	39000	35.5	2.660	0.08	28.21gm
18	*Casuarina equisetifolia*	269600		17.5			2.68gm
19	*Cordia ovalis*	6000		9.7			148
20	*Croton megalocarpus*	1800-2100	1000	32.0	19.250	0.59	367gm
21	*Dalbergia melanoxylon*	16000	6000-16000	45.0	7.320	0.16	
22	*Delonix elata*						178gm
23	*Delonix regia*	2100-2700	2000	194.8	12.896	0.07	520gm
24	*Dovyalis caffra*	27000		23.0	2.900	0.13	42gm
25	*Eucalyptus camaldulensis*	100000		18.0			
26	*Eucalyptus maculata*	100000		100	0.317	0.03	
27	*Eucalytus t ereticornis*	100000		34.0			
28	*Faitherbia a lbida*		75000				
29	*Grevillea robusta*	70000		83.0	7.00	0.08	17.09gm
30	*Gmelina arborea*	1400		12.5	0.925	0.07	590gm
31	*Jacaranda mimosifolia*	72600-83300	63000-80000	97.5	1.770	0.02	13gm
32	*Leucaena l eucocephala*	17800		8.5	3.600	0.40	58gm
33	*Melia azadirach*	2000		99.5			595gm
34	*Melia volkensii*	1900-5000		3.0	0.144	0.048	250gm
35	*Moringa oleifera*						
36	*Psidium guajava*						
37	*Prosopis juliflora*	40800	8000-35000	75.0	2.460	0.03	29.19gm
38	*Schinus molle*		7000	0.125	0.125		35gm
39	*Tamarindus indica*	1200-1500	1400-2500	247.4	24.360	0.09	625gm
40	*Terminalia brownii*	1400-1800	3200	111.9			445gm
41	*Terminalia mentaly*	2000		13.0			106gm
42	*Terminalia prunoides*			50.5			88gms
43	*Acacia melanoxylon*						10.31gm
44	*Markhamia lutea*		75000-76000	1.0			
45	*Acrocarpus fraxinifolius*	24000-34000	24000-29000	36.0	3.900	0.11	34.87gm
46	*Parkinsonia aculeata*	12000		10.5			54.9gm
47	*Callitris robusta*	95000		37.0	3.140	0.08	12.74gm

Table 5.1

Weight of 1000 seeds & number of seeds per kg. & ratio of clean seeds

No.	SPECIES	88'	89'		92'		co lected se d/ clea se
		No. of seeds/Kg	Weight of 1000 seeds	No. of seeds/Kg	Weight of 1000 seeds	No. of seeds/Kg	
	Adenium obesum				554	1.529	
1	Acacia abyssinica		72.5	13.936	67	14.925	
2	albida	32.000	127.4	7.852			
3	cadaba				142	7.042	
4	gerrardii	6.500	104.6	9.563	117	8.547	2.
5	mellifera		63.5	15.751	54	18.519	2.
6	holoicillica				14	71.429	7.
7	nilotica	6.760	125.7	7.955	142	7.063	3.
8	polyacantha	15.240	80.5	5.324	62	16.129	2.
9	senegal		119.0	8.406	115	8.696	1.
10	seyal				38	26.667	
11	tortilis	15.620	55.3	18.055	86	11.628	3.
12	xanthophloea	23.060	38.2	26.212	32	31.613	
13	Acrocarpus fraxinifolius	25.400	41.3	24.220	29	34.483	3.
14	Albizia amara				99	10.101	75.
15	anthelmintica	8.400					1.
16	lebbeck				119	8.403	
17	Azadirachta indica						1.
18	Azanza garckeana				209	4.785	
19	Bahaunea thorngii		145.8	6.806	128	7.813	
20	Balanites aegyptiaca		3247.2	355	3.404	294	1.
21	Caesalpinia decapetala	3.420	263.1	3.960	275	3.636	2.
22	Callitriss robusta	95.000	8.1	123.457	10	100.000	
23	Cassia siamea	36.240	28.3	35.414	22	45.455	7.
24	spectabilis	32.240	28.2	35.461	31	32.258	4.
25	Casuarina equisetifolia	269.600	1.2	860.215	3	400.000	18.
26	Cordia ovalis				164	6.098	
27	Croton macrostachyus				52	19.231	
28	megalocarpus	2.100	459.3	2.178	548	1.825	6.
29	Dalbergia melanoxylon						1.
30	Delonix regia	2.600	475.0	2.105	358	2.793	7.
31	Diospyros abyssinica				124	8.065	
32	Dodonaea viscosa				9	111.111	
33	Dovyalis caffra						3.
34	Eucalyptus camaldulensis		0.5	2.162.162			
35	maculata						16.
36	paniculata						22.
37	tereticornis						5.
38	Ficus natalensis						
39	Gmelina arborea						
40	Grevillea robusta	48.400	8.9	122.676			10.
41	Jacaranda mimosifolia		1.3	72.610	12	83.333	14.
42	Kigelia africana						19.
43	Lawsonia inermis		312.0		22	45.000	4.
44	Leucaena leucocephala		66.5	17.800	49	20.400	2.
45	Maesopsis eminii				823	1.215	1.
46	Macharium tipu				596	1.678	1.
47	Melia azedarach	2.180	369.0	2.710	612	1.634	1.
48	volkensii				2.980	336	3.
49	Moringa oleifera				214	4.673	
50	Newtonia hildebranditii	4.340			149	6.711	1.
51	Parkinsonia aculeata	11.120	76.3	13.104	80	12.500	2.
52	Phoenix reclinata				258	3.876	
53	Piliostigma thonningii	7.520	132.5	7.546	137	7.299	

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Weight of 1000 seeds & number of seeds per kg. & ratio of clean seeds

No.	SPECIES	88'	89'		92'		co lected se d/ cle se
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5	mellifera		63.5	15.751	54	18.519	2.
6	holoicillica				14	71.429	7.
7	nilotica	6.760	125.7	7.955	142	7.063	3.
8	polyacantha	15.240	80.5	5.324	62	16.129	2.
9	senegal		119.0	8.406	115	8.696	1.
10	seyal				38	26.667	
11	tortilis	15.620	55.3	18.055	86	11.628	3.
12	xanthophloea	23.060	38.2	26.212	32	31.613	
13	Acrocarpus flaxinifolius	25.400	41.3	24.220	29	34.483	3.
14	Albizia amara				99	10.101	75.
15	anthelmintica	8.400					1.
16	lebbeck				119	8.403	
17	Azadirachta indica						1.
18	Azanza garckeana				209	4.785	
19	Bahaunea thorngii		145.8	6.806	128	7.813	
20	Balanites aegyptiaca		3247.2	355	3.404	294	1.
21	Caesalpinia decapetala	3.420	263.1	3.960	275	3.636	2.
22	Callitriss robusta	95.000	8.1	123.457	10	100.000	
23	Cassia siamea	36.240	28.3	35.414	22	45.455	7.
24	spectabilis	32.240	28.2	35.461	31	32.258	4.
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26	Cordia ovalis				164	6.098	
27	Croton macrostachyus				52	19.231	
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33	Dovyalis caffra						3.
34	Eucalyptus camaldulensis		0.5	2.162.162			
35	maculata						16.
36	paniculata						22.
37	tereticornis						5.
38	Ficus natalensis						
39	Gmelina arborea						
40	Grevillea robusta	48.400	8.9	122.676			10.
41	Jacaranda mimosifolia		1.5	72.610	12	83.333	14.
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45	Maesopsis eminii				823	1.215	1.
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Table 5.1

Weight of 1000 seeds & number of seeds per kg. & ratio of clean seeds

No.	SPECIES	88'	89'		92'		collected seed/clean
		No. of seeds/Kg	Weight of 1000 seeds	No. of seeds/Kg	Weight of 1000 seeds	No. of seeds/Kg	
	Adenium obesum				654	1.529	
1	Acacia abyssinica		72.5	13.936	67	14.925	
2	albida	32.000	127.4	7.852			
3	cadaba				142	7.042	
4	gerrardii	6.500	104.6	9.563	117	8.547	2.
5	mellifera		63.5	15.751	54	18.519	2.
6	holoicillica				14	71.429	7.
7	nilotica	6.760	125.7	7.955	142	7.063	3.
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13	Acrocarpus flaxinifolius	25.400	41.3	24.220	29	34.483	8.
14	Albizia amara				99	10.101	75.
15	anthelmintica	8.400					1.
16	lebbeck				119	8.403	
17	Azadirachta indica						1.
18	Azanza garckeana				209	4.785	
19	Bahaunea thorngii		146.8	6.806	128	7.813	
20	Balanites aegyptiaca		3247.2	355	3.404	294	1.
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Cont'd

No.	SPECIES	88'	89'		92'		collected seed/clean seed
		No. of seeds/Kg	Weight of 1000 seeds	No. of seeds/Kg	Weight of 1000 seeds	No. of seeds/Kg	
54	Prosopis juliflora				24	40.870	10.1
55	Sesbania grandiflora	16.760	49.7	20.141			8.0
56	sesban	69.000	9.5	105.125	11	89.091	2.3
57	Schinus molle	7.940	30.9	32.262			1.5
58	Soathodea nilotica				8	125.000	
59	Tamarindus indica	1.200	634.8	1.575	635	1.575	
60	Tecoma stans		6.3	157.791	7	142.857	5.7
61	Terminalia brownnii	1.800	313.6	3.188	715	1.399	1.0
62	mentalis		491.7	2.034			1.0
63	prunioides	3.080	125.3	7.510	165	6.061	1.0
64	spinosa	10.480	36.7	27.239			1.0
65	Thevetia peruviana						4.3
66	Trema orientalis				5	200.000	
67	Vitex doniana				1.228	814	
68	Ziziphus mauritiana				111	9.000	18.0

1995 WEIGHT OF ONE SEED (EXTRACTED) FOR CHAPTER 5.O

No.	Species	Wt (gm)
1.	*Acacia nilotica*	0.02
2.	*Acacia polyacantha*	0.01
3.	*Acacia senegal*	0.02
4.	*Acacia tortilis*	0.01
5.	*Albizia anthelmintica*	0.02
6.	*Albizia amara*	0.02
7.	*Balanites aegyptiaca*	4.9
8.	*Berchermia discolor*	0.03
9.	*Leucaena leucocephala*	0.01
10.	*Tamarindus indica*	0.09
11.	*Bombax rhodoghaphalon*	0.01
12.	*Cassia siamea*	0.03
13.	*Cordia ovalis*	0.01
14.	*Croton megalocarpus*	1.1
15.	*Delonix elata*	0.03
16.	*Delonix regia*	0.07
17.	*Melina arborea*	0.08
18.	*Melia volkensii*	0.03
19.	*Melia azadirach*	0.03
20.	*Phoenix reclinata*	0.05
21.	*Schinus molle*	0.01
22.	*Terminalia brownii*	0.7
23.	*Terminalia purniodes*	
24.	*Terminalia spinosa*	
25	*Dovyalis caffra*	0.01

6.0 PROPAGATION

6.1 Seed sowing time and schedule

It is very important to study the sowing time of different species so as to reach plantable size between 30-50cm. The planting time should be known in different parts of Kenya. In Kitui one of ASAL areas the planting time is early November but in some occasion planting time is late October (e.g. 1995) The study information for planting time should be delivered from nursery seedling growth year after year. In 1995 the study was carried three months ahead of planting time until the last day before planting. The study was combined with that of other years as indicated in table 6.1.1.

1995 WEIGHT OF ONE SEED (EXTRACTED) FOR CHAPTER 5.O

No.	Species	Wt (gm)
1.	*Acacia nilotica*	0.02
2.	*Acacia polyacantha*	0.01
3.	*Acacia senegal*	0.02
4.	*Acacia tortilis*	0.01
5.	*Albizia anthelmintica*	0.02
6.	*Albizia amara*	0.02
7.	*Balanites aegyptiaca*	4.9
8.	*Berchermia discolor*	0.03
9.	*Leucaena leucocephala*	0.01
10.	*Tamarindus indica*	0.09
11.	*Bombax rhodoghaphalon*	0.01
12.	*Cassia siamea*	0.03
13.	*Cordia ovalis*	0.01
14.	*Croton megalocarpus*	1.1
15.	*Delonix elata*	0.03
16.	*Delonix regia*	0.07
17.	*Melina arborea*	0.08
18.	*Melia volkensii*	0.03
19.	*Melia azadirach*	0.03
20.	*Phoenix reclinata*	0.05
21.	*Schinus molle*	0.01
22.	*Terminalia brownii*	0.7
23.	*Terminalia purniodes*	
24.	*Terminalia spinosa*	
25	*Dovyalis caffra*	0.01

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Table 6.1.1. Appropriate Seed Sowing Time 1989-90-91-95 indices 1989-1990 0-1991• - 1995 X

NO	SPECIES	JAN.	FEB.	MAR	APR.	MAY.	JUN.	JUL.	AUG.	SEPT	OCT.	NOV.	DEC.
1	Acacia abyssinica					•		O					
2	Acacia albida				O	X							
3	Acacia gerrardii		O		X	•							
4	Acacia holosericea	O			X	X							
5	Acacia hypophylla			O									
6	Acacia juliflora		O										
7	Acacia mellifera		X										
8	Acacia nilotica		• X		O								
9	Acacia plectocarpa					O							
10	Acacia polyacantha	X			• O X								
11	Acacia pendula		O	O									O
12	Acacia salicina			O	O								
13	Acacia senegal		X			O							
14	Acacia tortilis	O X											
15	Acacia xanthopholea				O								
16	Acrocarpus flaxinifolius		O										
17	Albizia amara												O
18	Albizia anthelmintica		X			•		O					
19	Albizia lebbeck			X									
20	Azadirachta indica		X					•					O
21	Bauhinia thonningii												O
22	Balanites aegyptiaca	O	X										
23	Bombax rhodognaphalon												
24	Caesalpinia decapetala												
25	Callitris robusta												
26	Cassia siamea	X		O	•								
27	Cassia spectabilis	O	•	X									
28	Casuarina equistifolia				O								
29	Croton megalocarpus	X			•			O					
30	Cupressus pyramidalis							O					
31	Dalbergia melanoxylon		X									•	
32	Delonix regia		O										
33	Dovyalis caffra		X			O							
34	Eucalyptus camaldulensis			•	X	X	O						
35	Eucalyptus brevifolia			O									
36	Eucalyptus maculata												
37	Eucalyptus paniculata					O							
38	Eucalyptus tereticornis						O						
39	Ficus capensis												

40	Gmelina arborea	O			•								
41	Grevillea robusta		O			X			•				
42	Jacaranda mimosifolia			X		X							
43	Kigelia africana												
44	Macharium tipu												
45	Lawsonia inermis												
46	Leucaena leucocephala			O	X								
47	Melia azaderach		O										
48	Maesopsis eminii												
49	Melia volkensii		X		O			X					
50	Markhamia lutea		X										
51	Newtonia hilderbrandtii						O						
52	Parkonsonia aculeata			O		•							
53	Phoenix reclinata												
54	Prosopis juliflora	•	X		O X								
55	Sesbania grandiflora				O								
56	Sesbania sesban							O					
57	Tamarindus indica	• X	O		X								
58	Tangazate							O					
59	Tecoma stans												
60	Terminalia brownii				X								O
61	Terminalia cattapa			O									
62	Terminalia mentalis			X O						•			
63	Terminalia prunoides									•		O	
64	Terminalia spinosa			O									
65	Schinus molle						O						
66	Ziziphus mauritania												
67	Cordia ovalis			X									
68	Moringa oleifera					X							
69	Acacia seyal		X										

6.2 Seed Germination Average Days

The average days that different species take to germinate depends on provenances and the storage period. Some species germinate readily if sown after collection but when stored for some time the period may change..

The study has been compiled from the records held from 1988-1991 and 1995. The observations made during the period was as under:

(1) During the period 1988-1991 the average days was taken by summing up the number of seeds that germinate per day and dividing the same by the number of days the seeds take to complete germination. See table 6.2 appended.

(2) During the year 1995 the observations were taken from a different angle. The survey started from the day the first lot in a seed box started showing up to the time the last lot germinated (showing on top of the germination media).

NB: The word lot here means the number of seeds that has germinated and are worthy pricking out. Some provenances gives very poor germination that are not worthy while the survey. The germination average days are shown in index 6.2.1.

1995 Seed germination days Tiva Nursery 1995 index 6.2.1

		MONTH SOWN												
NO.	SPECIES	1	2	3	4	5	6	7	8	9	10	11	12	
1	Faitherbia albida					4								4
2	Acacia gerrardii		4	5	3		3							3-5
3	Acacia holosericea				4+5	6								4-6
4	Acacia mellifera		3+4											3-4
5	Acacia nilotica		4		5									4-5
6	Acacia polyacantha	9	3+4		3+4		4							3-9
7	Acacia senegal													
8	Acacia tortilis		3+4											3-4
9	Albizia anthelmintica		3+4			4								3-4
10	Albizia lebbeck			7	4									4-7
11	Azadirachta indica		8	10			13		17	15				8-17
12	Balanites aegyptiaca													
13	Berchermia discolor			0	9	9	9							9
14	Cassia siamea	10		5	6		5							5-10
15	Cassia spectabilis			3			7							3-7
16	Cordia ovalis			13	16									13-16
17	Croton megalocarpus	11	8	13										8-13
18	Dalbergia melonoxylon	6+7	8+9	8	9	7								6-9
19	Dovyalis caffra			10		15								10-15
20	Eucalyptus camaldulensis					6	6							6
21	Grevillea robusta			14	19	15								14-19
22	Jacaranda mimosifolia			8+9	8+7+10	9	9+13							7-13
23	Leucaena leucocephala													
24	Markhamia lutea						5							5
25	Melia volkensii	0	14	11	0		8	7	6	8				6-14
26	Prosopis juliflora		4	4	6		5							4-6
27	Tamarindus indica	10	7,8	6		11+13								6-13
28	Terminalia brownii				4-6	7,9	12+8							4-12
29	Terminalia mentaly			12										12

1995 Seed germination days Tiva Nursery 1995 index 6.2.1

		MONTH SOWN												
NO.	SPECIES	1	2	3	4	5	6	7	8	9	10	11	12	
1	Faitherbia albida					4								4
2	Acacia gerrardii		4	5	3		3							3-5
3	Acacia holosericea				4+5	6								4-6
4	Acacia mellifera		3+4											3-4
5	Acacia nilotica		4		5									4-5
6	Acacia polyacantha	9	3+4		3+4		4							3-9
7	Acacia senegal													
8	Acacia tortilis		3+4											3-4
9	Albizia anthelmintica		3+4			4								3-4
10	Albizia lebbeck			7	4									4-7
11	Azadirachta indica		8	10			13		17	15				8-17
12	Balanites aegyptiaca													
13	Berchemia discolor			0	9	9	9							9
14	Cassia siamea	10		5	6		5							5-10
15	Cassia spectabilis			3			7							3-7
16	Cordia ovalis			13	16									13-16
17	Croton megalocarpus	11	8	13										8-13
18	Dalbergia melonoxylon	6+7	8+9	8	9	7								6-9
19	Dovyalis caffra			10		15								10-15
20	Eucalyptus camaldulensis					6	6							6
21	Grevillea robusta			14	19	15								14-19
22	Jacaranda mimosifolia			8+9	8+7+10	9	9+13							7-13
23	Leucaena leucocephala													
24	Markhamia lutea						5							5
25	Melia volkensii	0	14	11	0		8	7	6	8				6-14
26	Prosopis juliflora		4	4	6		5							4-6
27	Tamarindus indica	10	7,8	6		11+13								6-13
28	Terminalia brownii				4-6	7,9	12+8							4-12
29	Terminalia mentaly			12										12

Table 6.2.2

AVERAGE GERMINATION DAYS IN TIVA NURSERY (1988-91)

No.	S P E C I E S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	AVERAGE
1	Aberia caffra																	
2	Acacia abyssinica	4	3	3	6	5	3	3										4
3	albida	4	3	4	4													4
4	auriculiformis																	
5	cabagei																	
6	gerrardii	4	6	4	2	4	4											4
7	holocicilica	7	4	4	6	3	3											5
8	hupoonylla	3	2	7														4
9	juliflora	9	4															7
10	nilotica	5	4	11	10	7	10	9	6	6	6	3	3	3				6
11	polyacantha	5	3	4	5	4	2	5	7	7	3	3	4	4	6	3		4
12	pendula	4	4	6	2													5
13	plectocarpa	11																11
14	pruinocarpa	7																7
15	salicina	12	9															11
16	senegal																	
17	stenocarpa																	
18	tortilis	5	4	5	9	3	7	5	4	5	7							6
19	torulosa	9																9
20	tunida	13																13
21	xanthophloea	3																3
22	Acrocarpus fraxinifolius	5	7	4	4	11	7	6	7									6
23	Albizia amara	14	6															10
24	anthelmintica	6																6
25	Azadirachta indica	26	13	16	14	6	13											15
26	Banaunea thorngii																	
27	Bombax rhodognaphalon	5	6															6
28	Balanites aegyptiaca	12																12
29	Boscia angustifolia																	
30	Caesalpinia cacalaiata																	
31	decapetala	8	12	11	10	11	10	7										9
32	Callitris robusta																	
33	Carrica papaya																	
34	Cassia siamea	4	6	7	6	7	7	7	8	8	7	8	7	7	7	3	6	6
35	spectabilis	5	6	2	3	10	7	9	8	7	8	5	4	5	4	7	4	5
36	Casuarina equisetifolia	8	4	2	10	8	6	7										5
37	Croton megalocarpus	8	3	10	11	13	6	10	14	15	13	8	11	12	17	12	11	11
38	Cupressus lusitanica																	
39	pyramidalis	23																23
40	Dalbergia melanoxylon	5	3	3	6													4
41	Delonix regia	12	12	15	11													13
42	Dovyalis caffra	11	11	9	9	14												11
43	Eucalyptus camaldulensis	4	3	4	3	5	5	6										4
44	citriodora																	
45	brevifolia	4																
46	paniculata	3	6	5	5													5
47	teroticornis	3	6	3	4	3												5
48	Ficus natalensis																	
49	Gmelina arborea	17	25	23	13													22
50	Grevillea robusta	15	12	11	11	12												12
51	Jacaranda mimosifolia	18																18
52	Kigelia africana																	
53	Lawsonia inermis	6																6
54	Leucaena leucocephala	5	4	6														5
55	Maeharium tipu																	
56	Mangifera indica																	
57	Melia azedarach	32	36	24	23													29
58	volkensii	9	8	7	6	10	15	7	7	3								9
59	Moringa stenopetala																	
60	Newtonia hildebrandtii	19	9															14
61	Parkinsonia aculeata	4	3	4	3	2	3											4
62	Piliostigma thonningii																	
63	Prosopis juliflora	4	6	3	3	8	3	2	2	7								4
64	Psidium guajava																	
65	Sesbania grandiflora	6	3	4	6	6	2											4

Cont'd

No.	SPECIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	AVERAGE
66	Sesbania sesban	4	4	5	5	3												4
67	Sonimus polio	8	12	26	18													14
68	Soethodea pilotica																	
69	Tamarindus indica	10	15	5	2	7	14	11	12	10	7	5	10	5	7			9
70	Tecoma stans	8																8
71	Terminalia brownii	22	18	15	17													18
72	" cattaa	21	23	31	33													27
73	" mentalis	11	27	24	41	18	24	18	12									21
74	" prunioides	22	12	18	6	10												14
75	" spinosa	21	10	11	20	14												15
76	Thevetia peruviana																	

Cont'd

No.	SPECIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	AVERAGE
66	Sesbania sesban	4	4	5	5	2												4
67	Sonimus polle	8	12	26	10													14
68	Spathodea nilotica																	
69	Tamarindus indica	10	15	5	2	7	14	11	12	10	7	5	10	5	7			9
70	Tecoma stans	8																8
71	Terminalia brownii	22	18	15	17													18
72	" catisoa	21	23	31	33													27
73	" mentalis	11	27	24	41	18	24	18	12									21
74	" prunioides	22	12	18	5	18												14
75	" spinosa	21	10	11	20	14												15
76	Thevetia peruviana																	

7.0 SEED SPECIES IDENTIFICATION

It is very necessary to identify some species by the sight of seeds. The necessity is caused by seeds which parent trees are not available and the seeds are required for sowing so the seeds are to be acquired from elsewhere.

The seeds may be confused during the dispatch especially if the seeds are not packed in transparent containers or if the professionals are assisted by less qualified staff. To make the identification easier seed photos numbers 1-53 has been attached for consultation if there is any doubt.

8.0 REFERENCES

Seed guide for Tiva nursery 1992

Trees and shrubs of sahel

A selection of useful trees of Kenya

A pocket dictionary of trees & shrubs of Kenya

APPENDIX 1

C H E C K L I S T

No.	SPECIES	PHENOLOGY	EXTRACTION	PRETREATMENT	WEIGHT	DAYS OF GERMINATION	PHOTO
1	Adenium obesum		x		x		x
2	Acacia abyssinica		x	x	x	x	x
3	albida		x	x	x	x	
4	auriculiformis			x			
5	cadaba				x		x
6	gerrardii	x	x	x	x	x	x
7	holoicilica	x	x	x	x	x	x
8	hypophylla			x		x	
9	juliflora					x	
10	nearnsii			x			
11	nellifera	x	x	x	x		x
12	nilotica	x	x	x	x	x	x
13	polyacantha	x	x	x	x	x	x
14	pendula			x		x	
15	plectocarpa					x	
16	pruinocarpa					x	
17	salicina			x		x	
18	senegal	x	x	x	x		x
19	stenocarpa			x			
20	seyal				x		x
21	tortilis	x	x	x	x	x	x
22	torulosa					x	
23	tunida					x	
24	xanthophloea		x	x	x	x	x
25	Acrocarpus fraxinifolius	x	x	x	x	x	x
26	Albizia amara	x	x	x	x	x	x
27	anthelmintica	x	x	x	x	x	
28	lebbeck				x		x
29	Azadiracata indica	x	x	x		x	
30	Azanza garckeana			x	x		x
31	Banaunea thorngii	x	x		x		x
32	Bombax rhodognaphalon	x	x	x		x	
33	Balanites aegyptiaca	x	x	x	x	x	x
34	Boscia angustifolia						
35	Caesalpinia decaptiata						
36	decapetala	x	x	x	x	x	x
37	Callitris rhousta	x	x	x	x		x
38	Carrica papaya						
39	Cassia siamea	x	x	x	x	x	x
40	spectabilis	x	x	x	x	x	x
41	Casuarina equisetifolia	x	x	x	x	x	x
42	Cordia ovalis			x	x		x
43	Croton macrostachyus				x		x
44	megalocarpus	x	x	x	x	x	x
45	Cupressus lusitanica						
46	pyramidalis					x	
47	Dalbergia melanoxylon	x	x	x		x	
48	Delonix regia	x	x	x	x	x	x
49	Diospyros abyssinica				x		x
50	Dodonaea viscosa				x		x
51	Dovyalis caffra	x	x	x		x	
52	Erythrina abyssinica			x			
53	Eucalyptus camaldulensis	x	x	x	x	x	x
54	citriodora		x	x			
55	brevifolia		x			x	
56	maculata	x	x				
57	paniculata	x	x			x	x
58	tereticornis	x	x			x	
59	Ficus natalensis			x			
60	capensis		x				
61	Gmelina arborea	x	x			x	
62	Grevillea rhousta	x	x	x	x	x	
63	Jacaranda mimosifolia	x	x	x	x	x	x
64	Kigelia africana	x	x	x			
65	Lawsonia inermis	x	x	x	x	x	x
66	Leucaena leucocephala	x	x	x	x	x	x
67	Macnarium tipu		x		x		x
68	Maesopsis eminii		x		x		x
69	Mangifera indica	x					
70	Melia azedarach	x	x	x	x	x	x
71	volkensii	x	x	x	x	x	x
72	Moringa stenopetala			x			
73	oleifera				x		x
74	Newtonia hildebrandtii	x	x	x	x	x	x
75	Parkinsonia aculeata	x	x	x	x	x	x
76	Phoenix reclinata		x	x	x		x
77	Piliostigma thonningii			x	x		x
78	Prosopis juliflora	x	x	x	x	x	x
79	Psidium guajava						

APPENDIX 1

C H E C K L I S T

No.	SPECIES	PHENOLOGY	EXTRACTION	PRETREATMENT	WEIGHT	DAYS OF GERMINATION	PHOTO
1	Adenium obesum		x		x		x
2	Acacia abyssinica		x	x	x	x	x
3	albida		x	x	x	x	
4	auriculiformis			x			
5	cadaba				x		x
6	gerrardii	x	x	x	x	x	x
7	holoicilica	x	x	x	x	x	x
8	hypophylla			x		x	
9	juliflora					x	
10	nearnsii			x			
11	nellifera	x	x	x	x		x
12	nilotica	x	x	x	x	x	x
13	polyacantha	x	x	x	x	x	x
14	pendula			x		x	
15	plectocarpa					x	
16	pruinocarpa					x	
17	salicina			x		x	
18	senegal	x	x	x	x		x
19	stenophylla			x			
20	seyal				x		x
21	tortilis	x	x	x	x	x	x
22	torulosa					x	
23	tunida					x	
24	xanthophloea		x	x	x	x	x
25	Acrocarpus fraxinifolius	x	x	x	x	x	x
26	Albizia amara	x	x	x	x	x	x
27	anthelmintica	x	x	x	x	x	
28	lebbeck				x		x
29	Azadirachta indica	x	x	x		x	
30	Azanza garckeana			x	x		x
31	Banaunea thorngii	x	x		x		x
32	Bombax rhodognaphalon	x	x	x		x	
33	Balanites aegyptiaca	x	x	x	x	x	x
34	Boscia aungustifolia						
35	Caesalpinia decaptiata						
36	decapetala	x	x	x	x	x	x
37	Callitris robusta	x	x	x	x		x
38	Carrica papaya						
39	Cassia siamea	x	x	x	x	x	x
40	spectabilis	x	x	x	x	x	x
41	Casuarina equisetifolia	x	x	x	x	x	x
42	Cordia ovalis			x	x		x
43	Croton macrostachyus				x		x
44	megalocarpus	x	x	x	x	x	x
45	Cupressus lusitanica						
46	pyramidalis					x	
47	Dalbergia melanoxylon	x	x	x		x	
48	Delonix regia	x	x	x	x	x	x
49	Diospyros abyssinica				x		x
50	Dodonaea viscosa				x		x
51	Dovyalis caffra	x	x	x		x	
52	Erythrina abyssinica			x			
53	Eucalyptus camaldulensis	x	x	x	x	x	x
54	citriodora		x	x			
55	brevifolia		x			x	
56	maculata	x	x				
57	paniculata	x	x			x	x
58	tereticornis	x	x			x	
59	Ficus natalensis			x			
60	capensis		x				
61	Gmelina arborea	x	x			x	
62	Grevillea robusta	x	x	x	x	x	
63	Jacaranda mimosifolia	x	x	x	x	x	x
64	Kigelia africana	x	x	x			
65	Lawsonia inermis	x	x	x	x	x	x
66	Leucaena leucocephala	x	x	x	x	x	x
67	Machaerium tipu		x		x		x
68	Maesopsis eminii		x		x		x
69	Mangifera indica	x					
70	Melia azedarach	x	x	x	x	x	x
71	volkensii	x	x	x	x	x	x
72	Moringa stenopetala			x			
73	oleifera				x		x
74	Newtonia hildebrandtii	x	x	x	x	x	x
75	Parkinsonia aculeata	x	x	x	x	x	x
76	Phoenix reclinata		x	x	x		x
77	Piliostigma thonningii			x	x		x
78	Prosopis juliflora	x	x	x	x	x	x
79	Psidium guajava						

Continue

No.	SPECIES	PHENOLOGY	EXTRACTION	PRETREATMENT	WEIGHT	DAYS OF GERMINATION	PHOTO
30	Salvadora persica	*					
31	Sesbania grandiflora	*	*	*	*	*	
32	sesban	*	*	*	*	*	*
33	Sesbus wolle	*		*	*	*	
34	Soatnodea nilotica	*		*	*		*
35	Tamarindus indica	*	*	*	*	*	*
36	Tecoma stans	*	*	*	*	*	*
37	Terminalia brownii	*	*	*	*	*	*
38	cattapa		*	*		*	
39	sentalis	*		*	*	*	
40	prunioides	*	*	*	*	*	*
41	spinosa	*	*	*	*	*	
42	Thevetia peruviana	*	*	*			
43	Tipuana tipu			*			
44	Tricalia roka			*			
45	Trema orientalis		*		*		*
46	Vitex doniana				*		*
47	Ziziphus mauritiana	*	*	*	*		*
48	Zysigum cuminii			*			

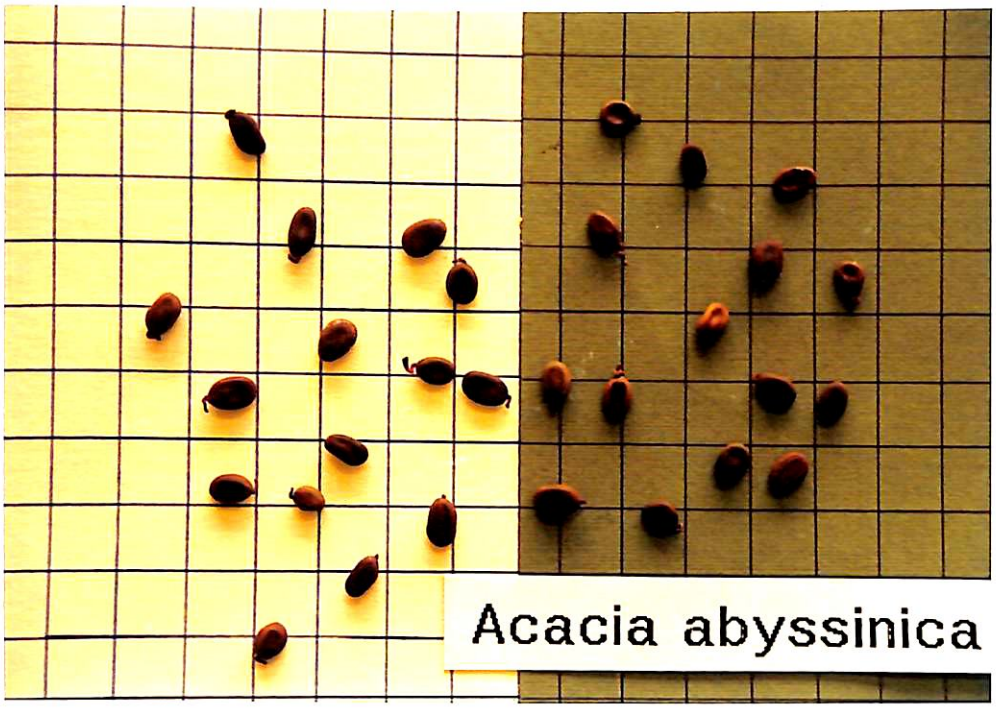
N.B. : * This mark shows the species mentioned in this guide book which have been extracted, pretreated, weighed, taken photos, and also days of germination.

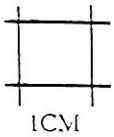
Cont'd

No.	SPECIES	PHENOLOGY	EXTRACTION	PRETREATMENT	WEIGHT	DAYS OF GERMINATION	PHOTO
30	Salvadora persica	x					
31	Sesbania grandiflora	x	x	x	x	x	
32	sesban	x	x	x	x	x	x
33	Schinus molle	x		x	x	x	
34	Soatiocea nilotica	x		x	x		x
35	Tamarindus indica	x	x	x	x	x	x
36	Tecoma stans	x	x	x	x	x	x
37	Terminalia brownii	x	x	x	x	x	x
38	cattapa		x	x		x	
39	mentalis	x		x	x	x	
40	prunioides	x	x	x	x	x	x
41	spinosa	x	x	x	x	x	
42	Thevetia peruviana	x	x	x			
43	Tipuana tipu			x			
44	Teichilia roka			x			
45	Trema orientalis		x		x		x
46	Vitex doniana				x		x
47	Ziziphus mauritiana	x	x	x	x		x
48	Zysigum cuminii			x			

N.B. : x This mark shows the species mentioned in this guide book which have been extracted, pretreated, weighed, taken photos, and also days of germination.

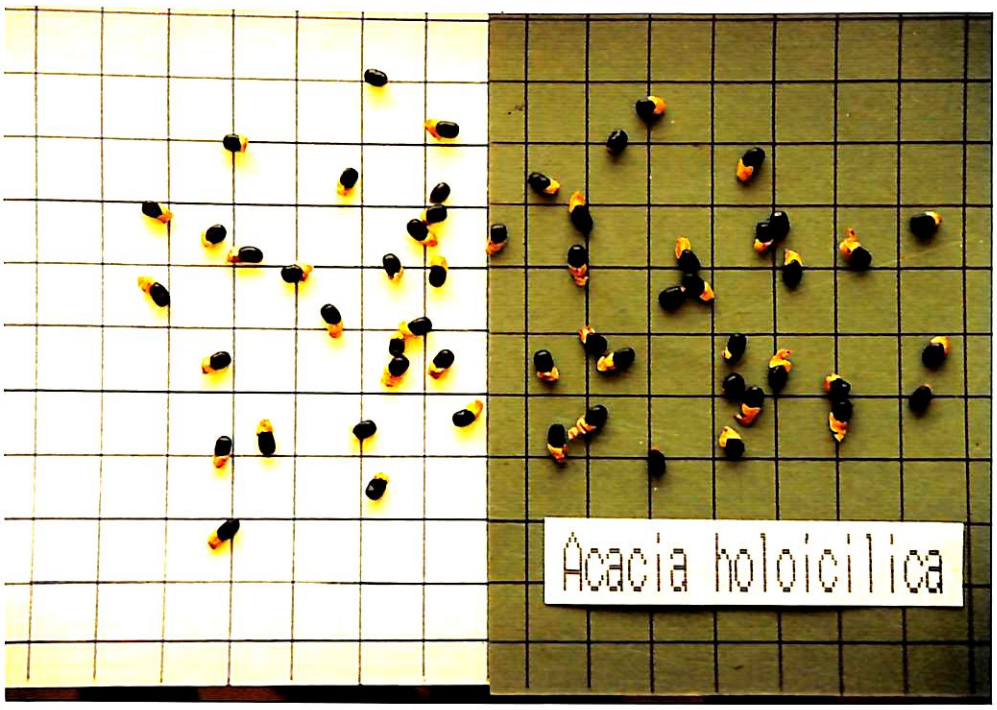
APPENDIX II: PHOTOS OF VARIOUS TREE SEEDS

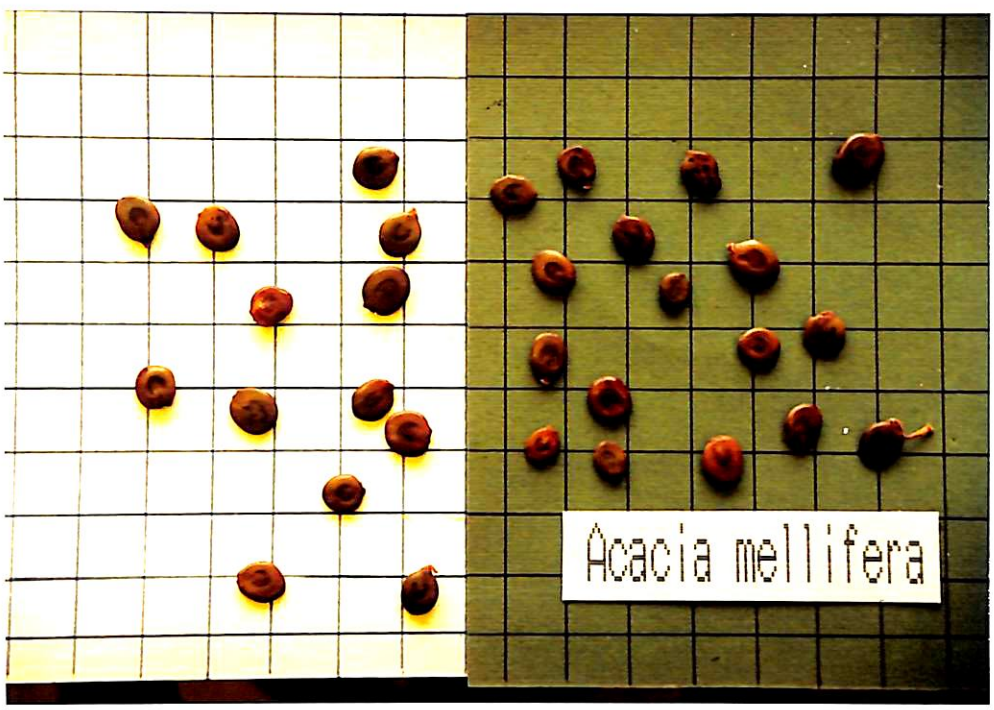

Acacia abyssinica

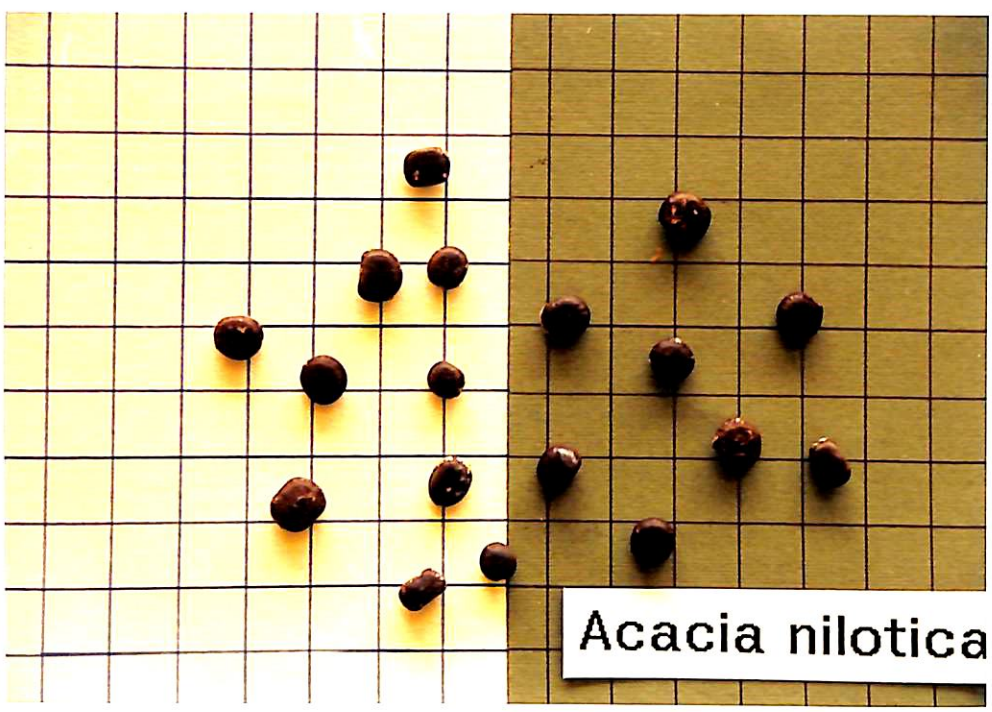

1CM

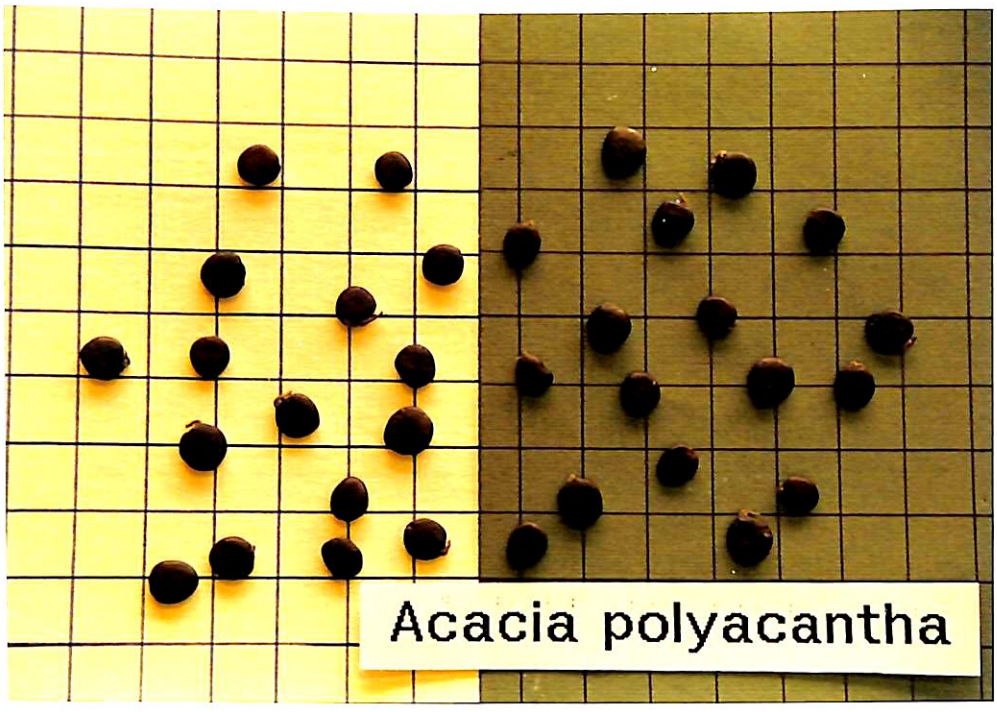

Acacia cadaba


Acacia gerrardii


Acacia holoicilica


Acacia mellifera


Acacia nilotica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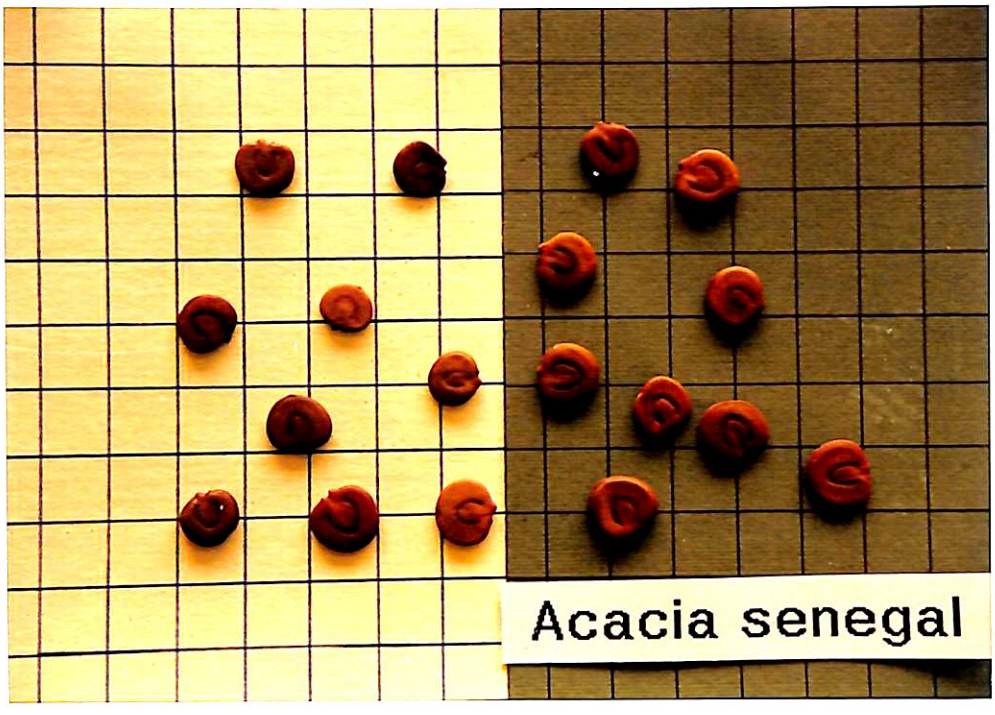
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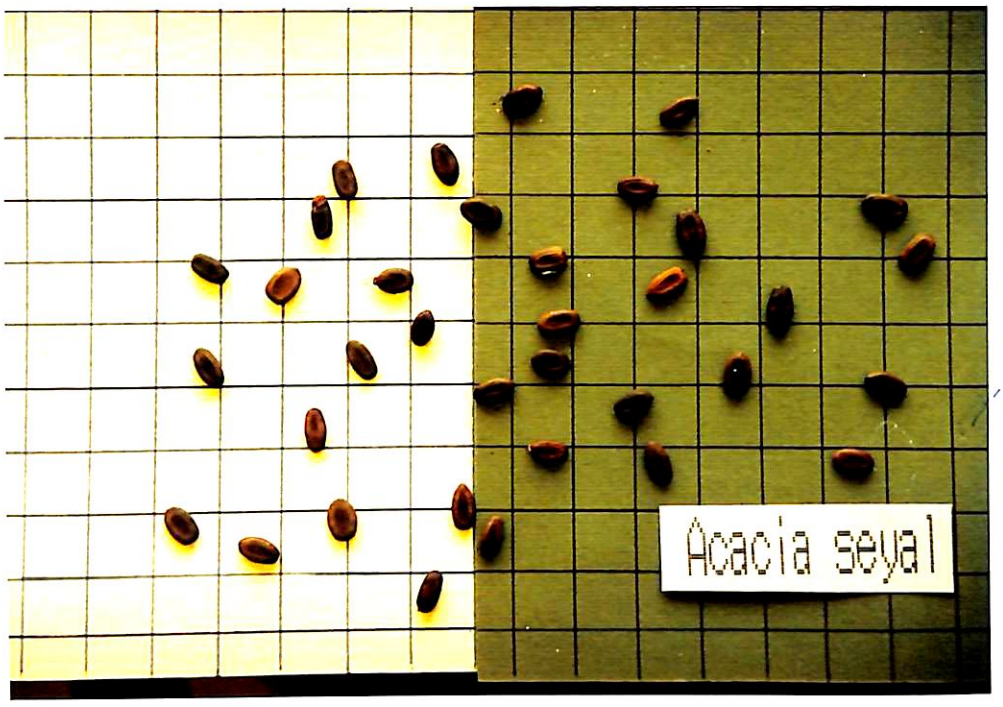
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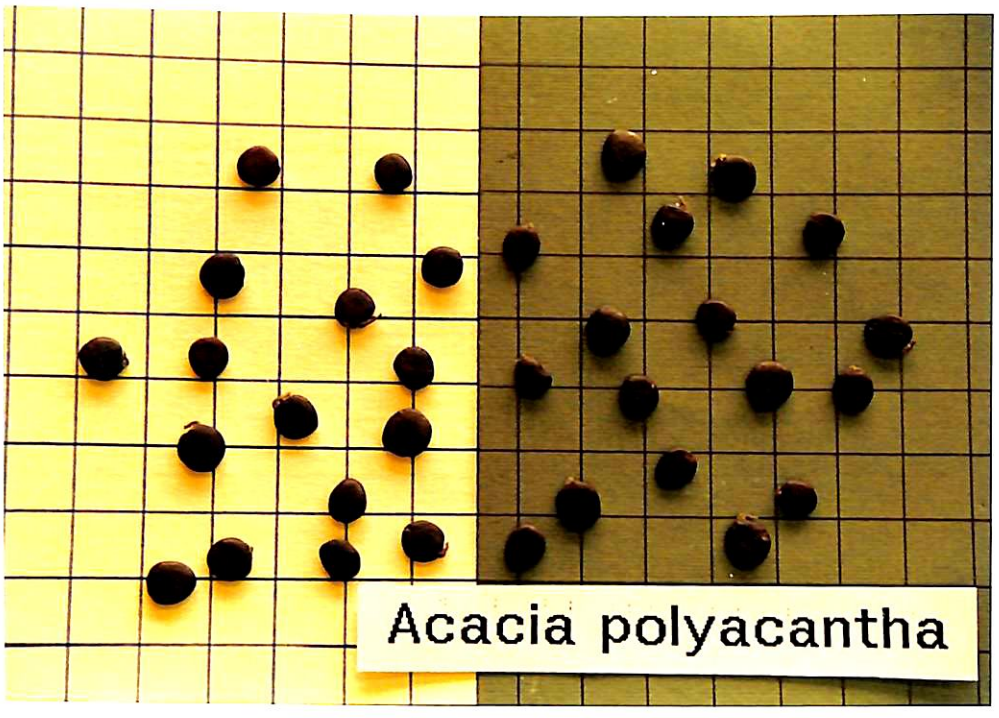
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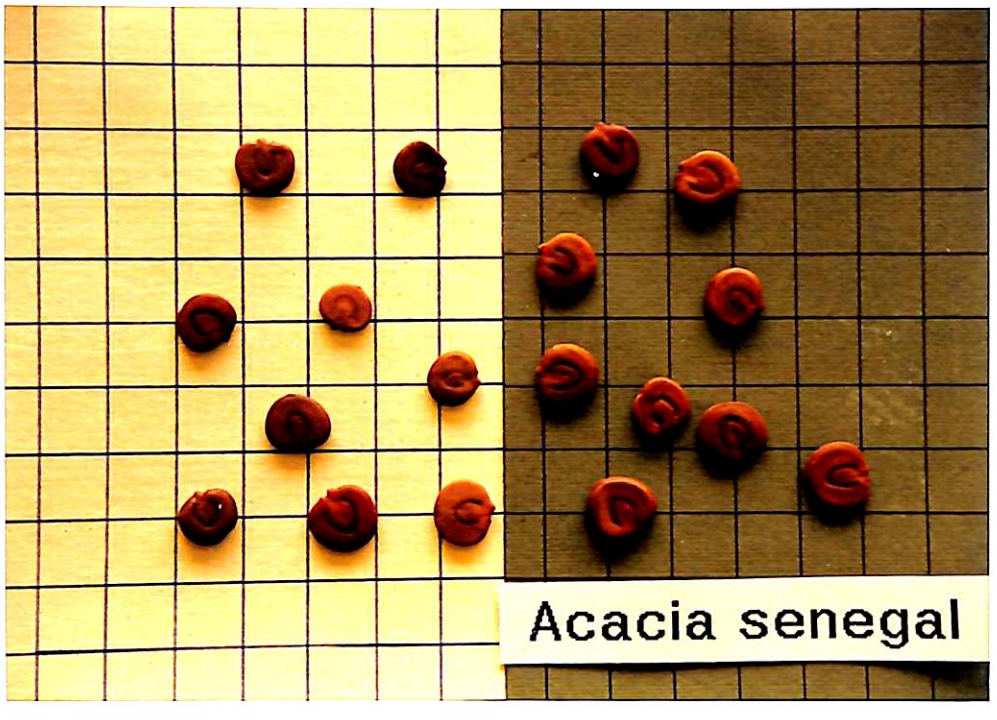
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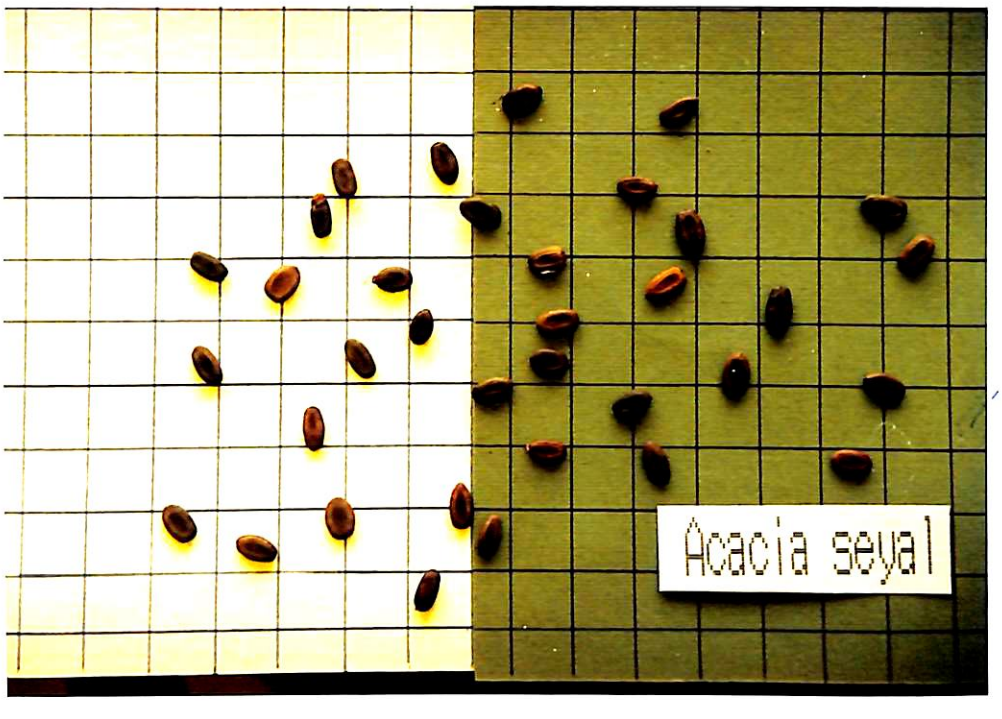
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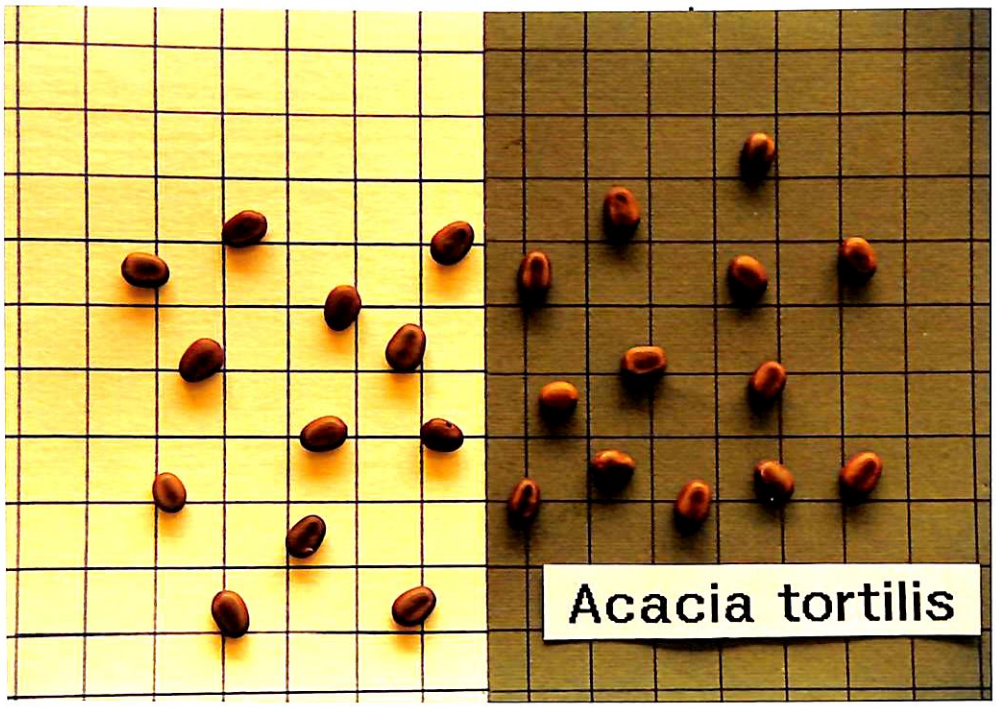
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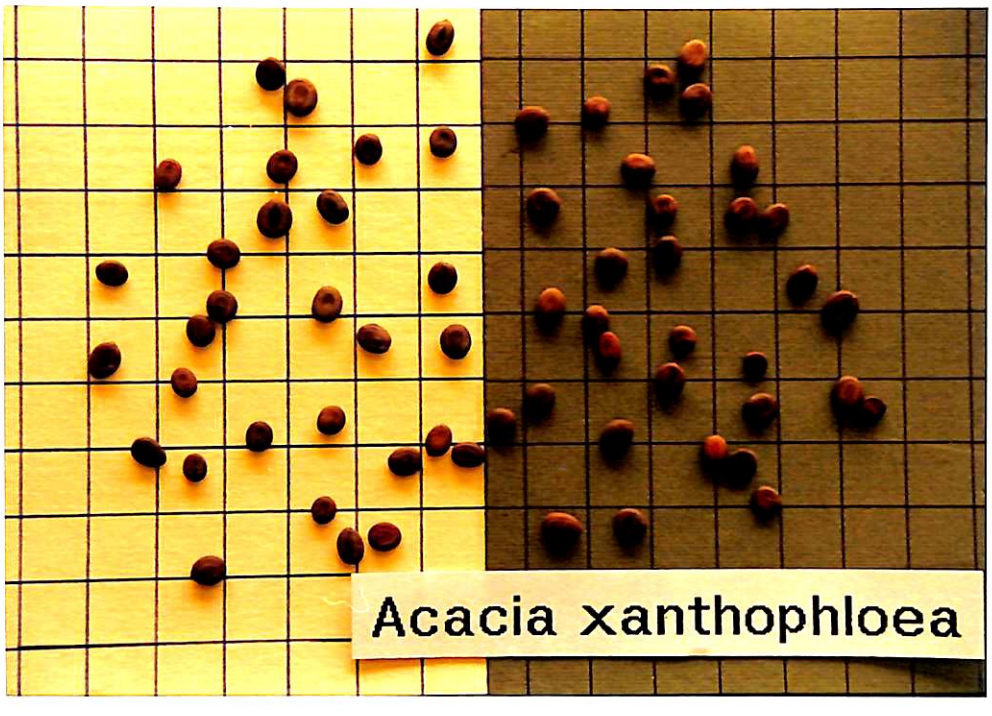
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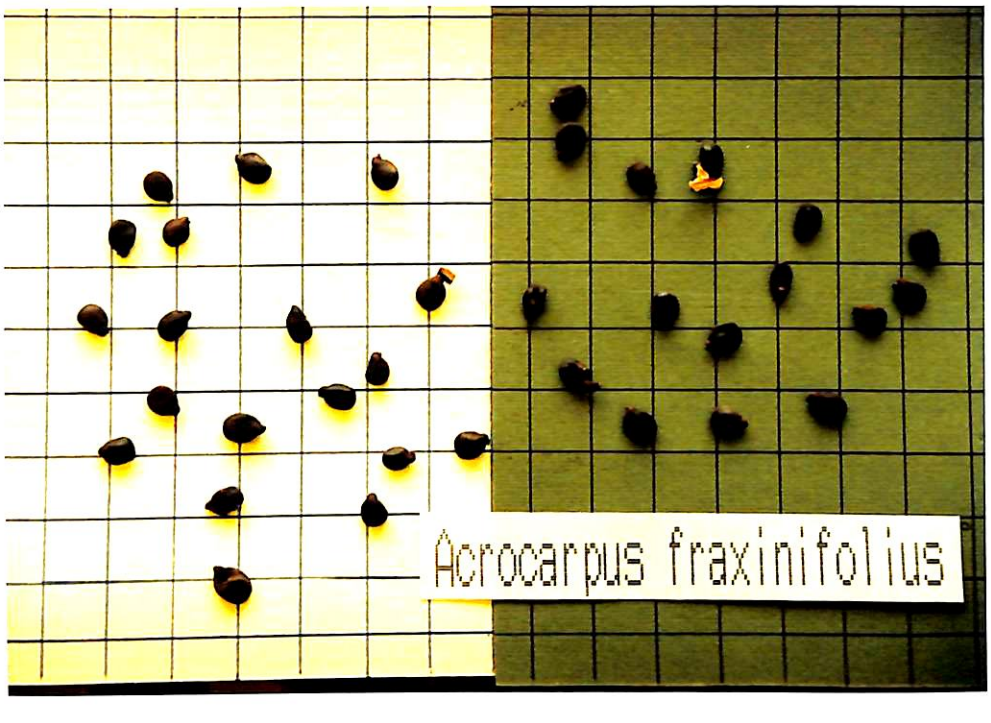
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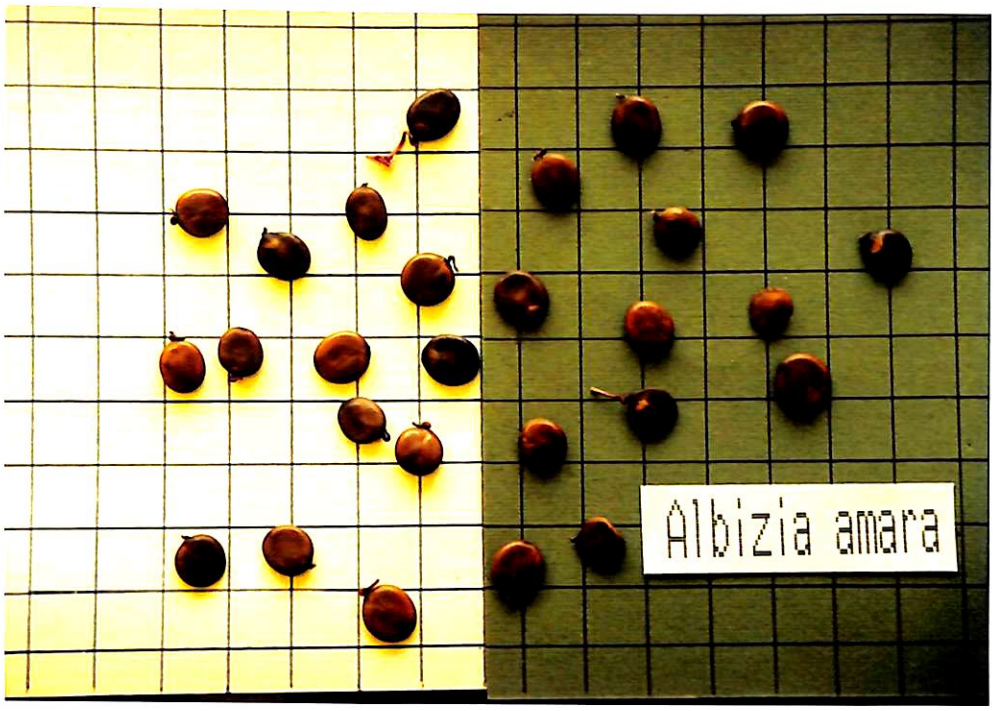
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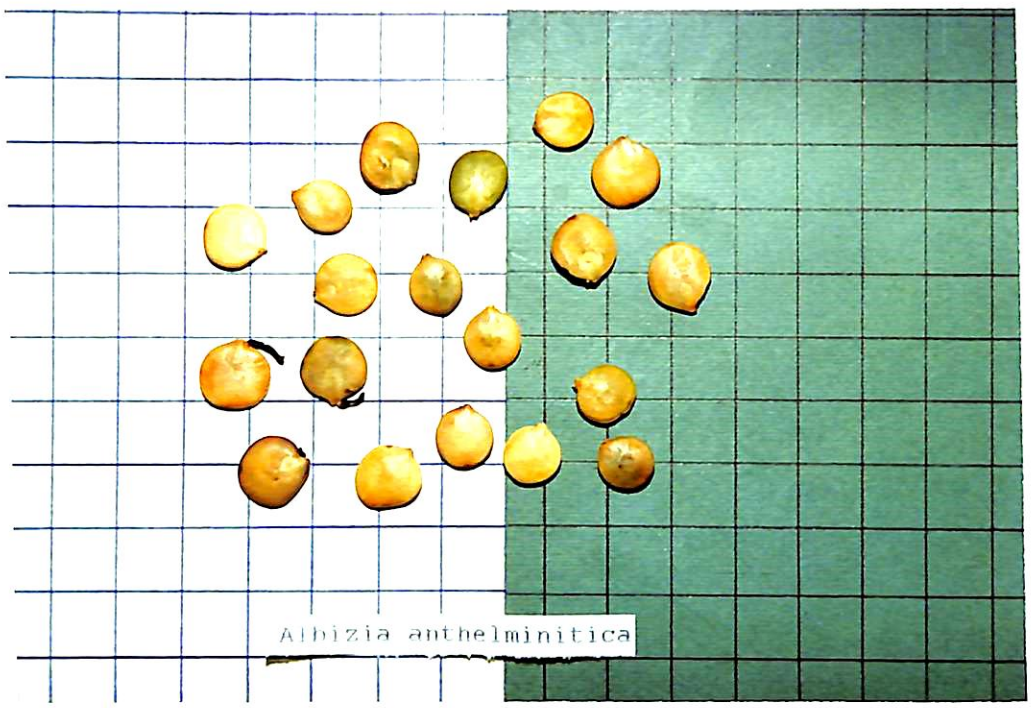
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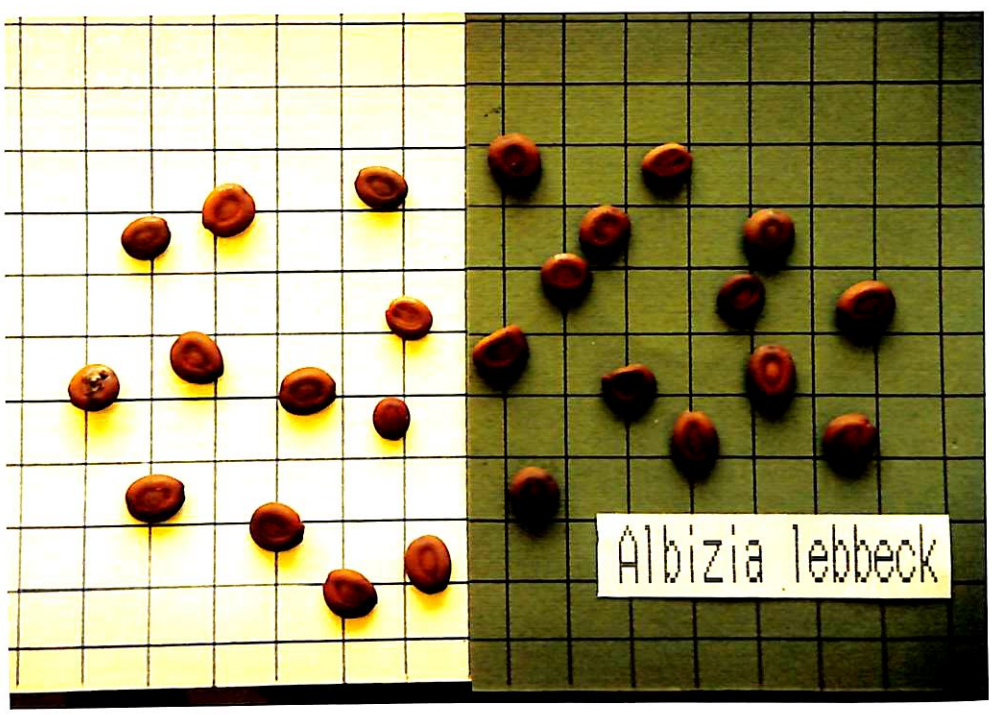
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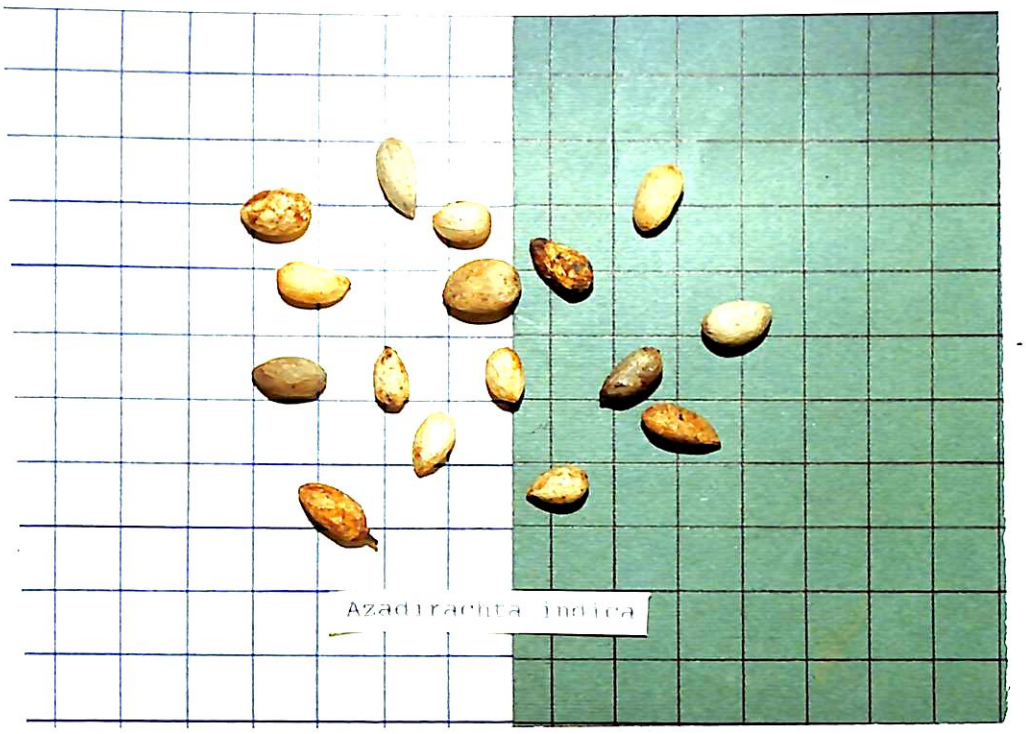
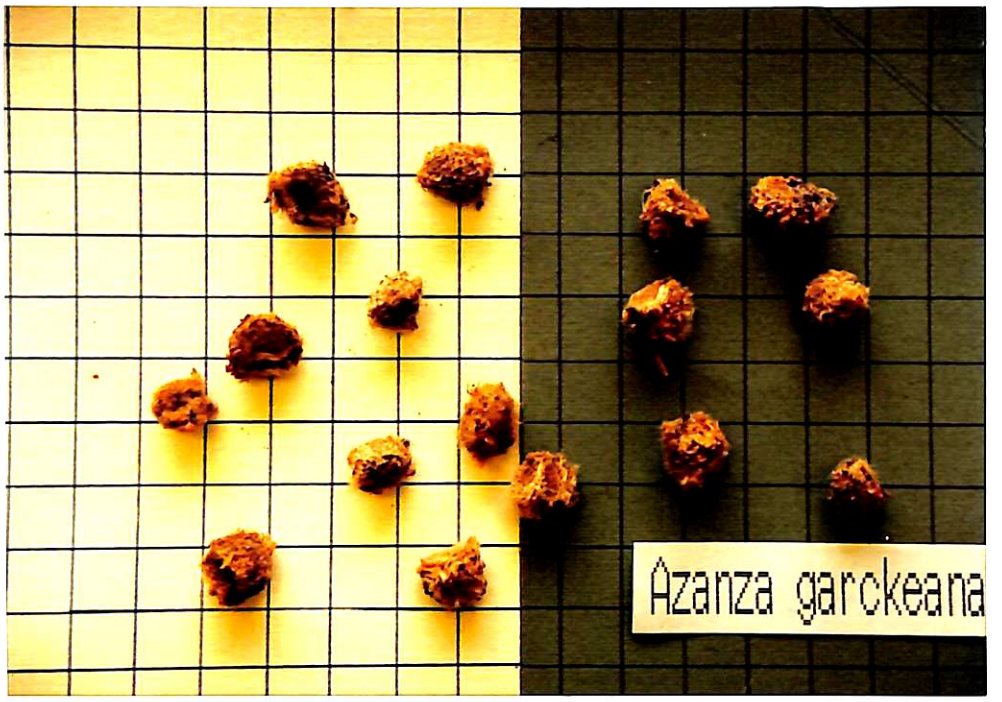

Azadirachta indica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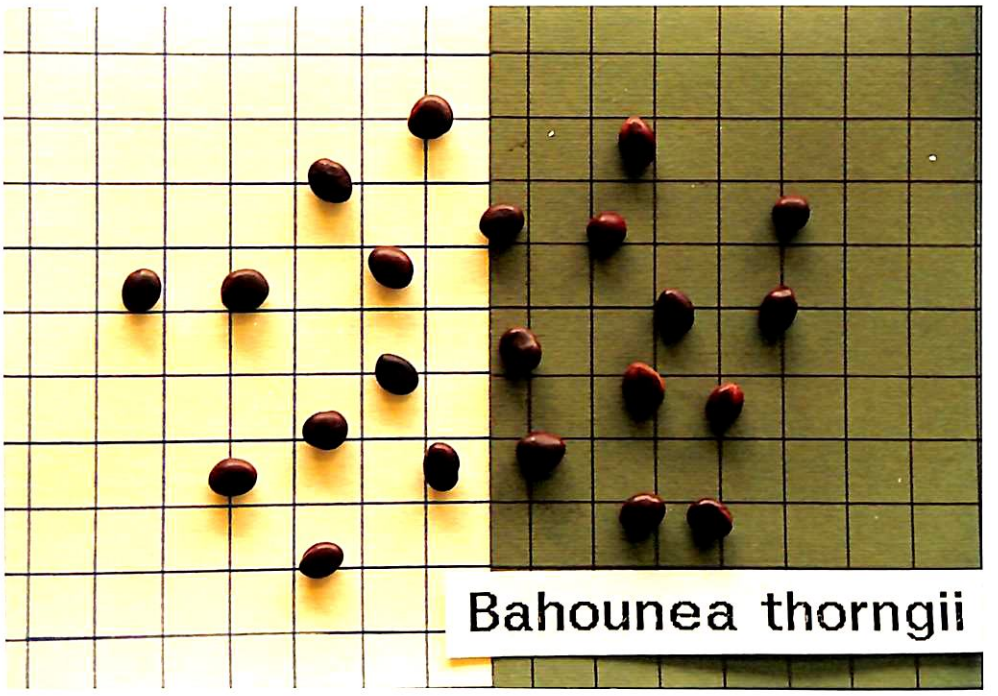
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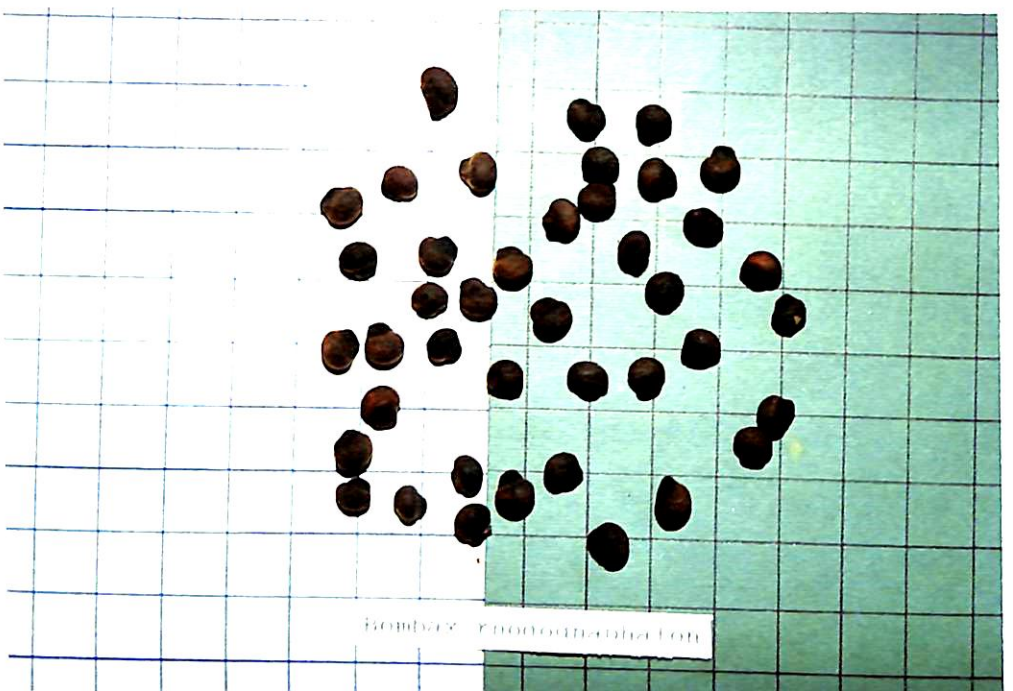
Balanites aegyptiaca


Berchemia discolor

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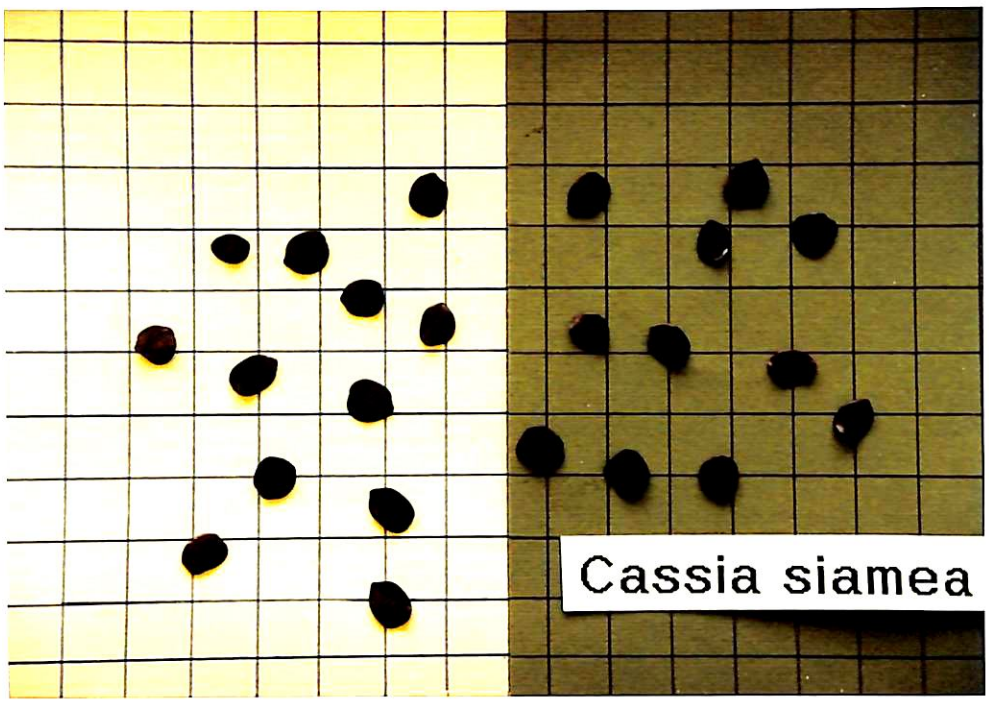
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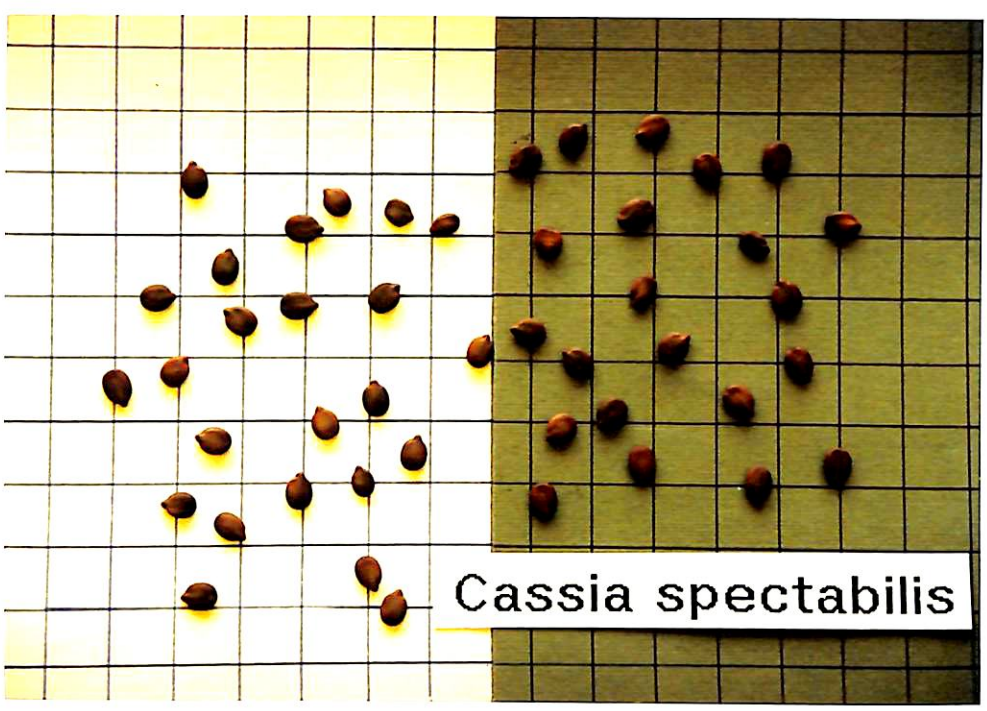
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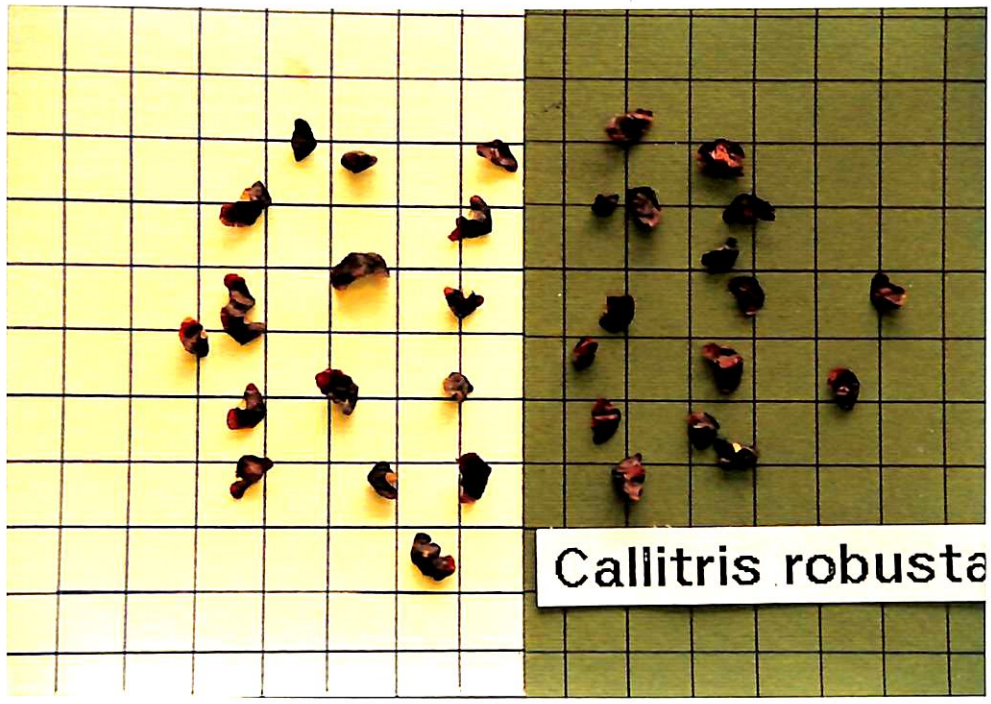
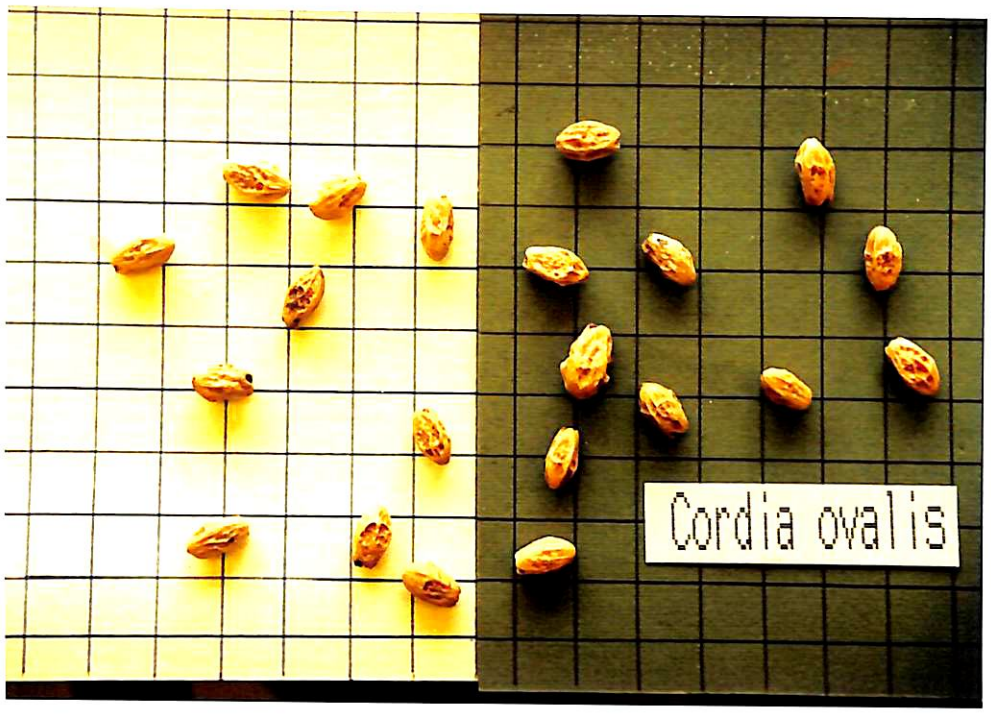
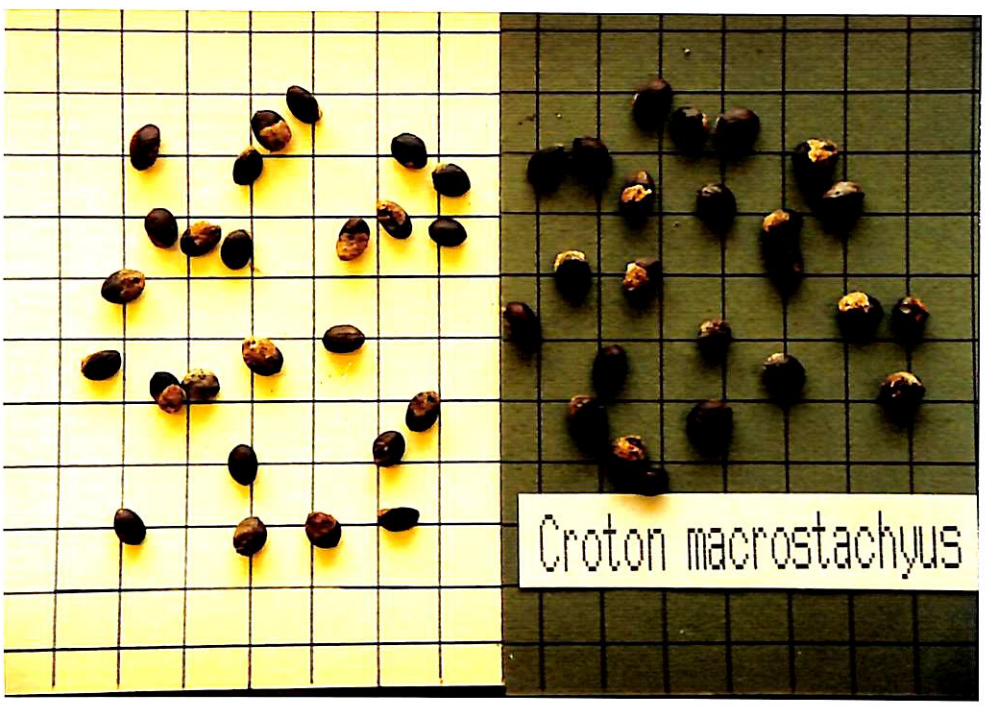
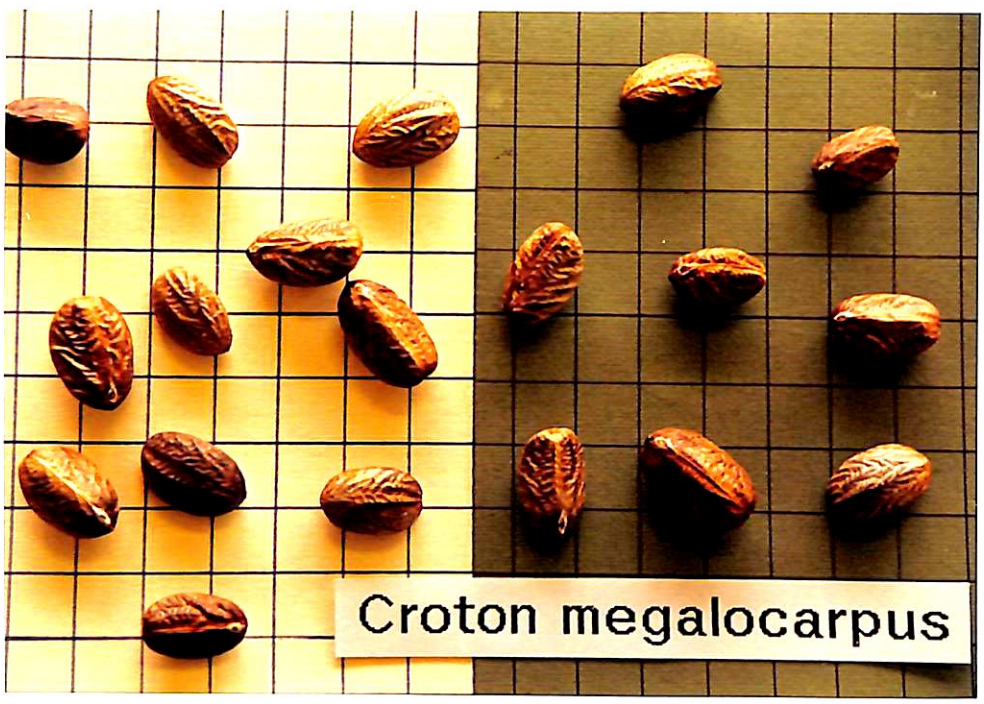

Callitris robusta


Casuarina equisetifolia


Cordia oval is


Croton macrostachyus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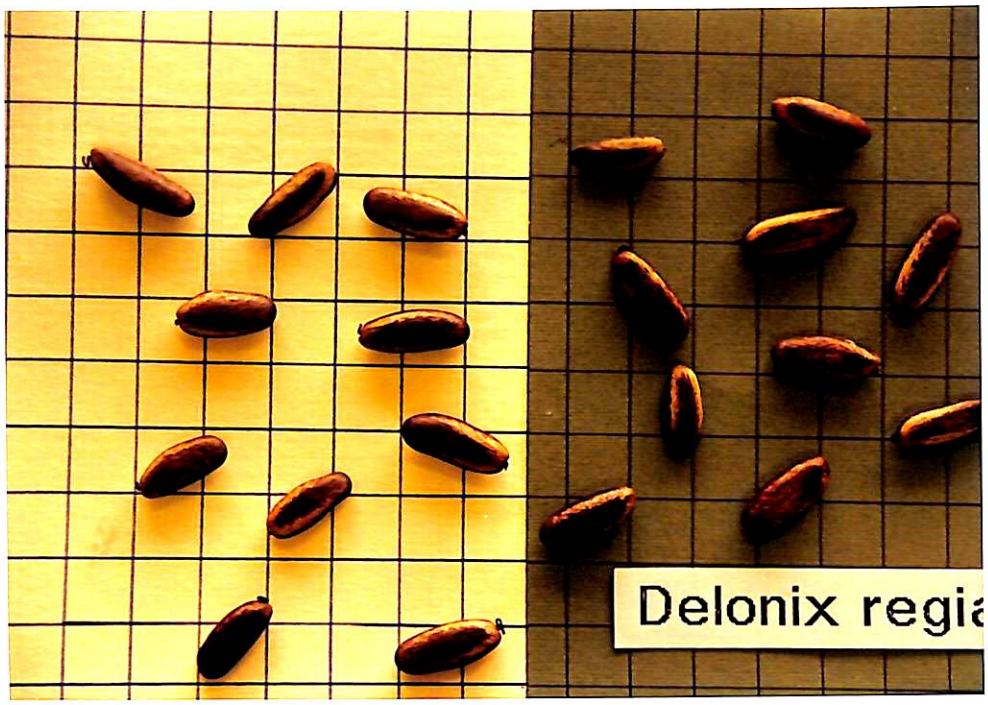
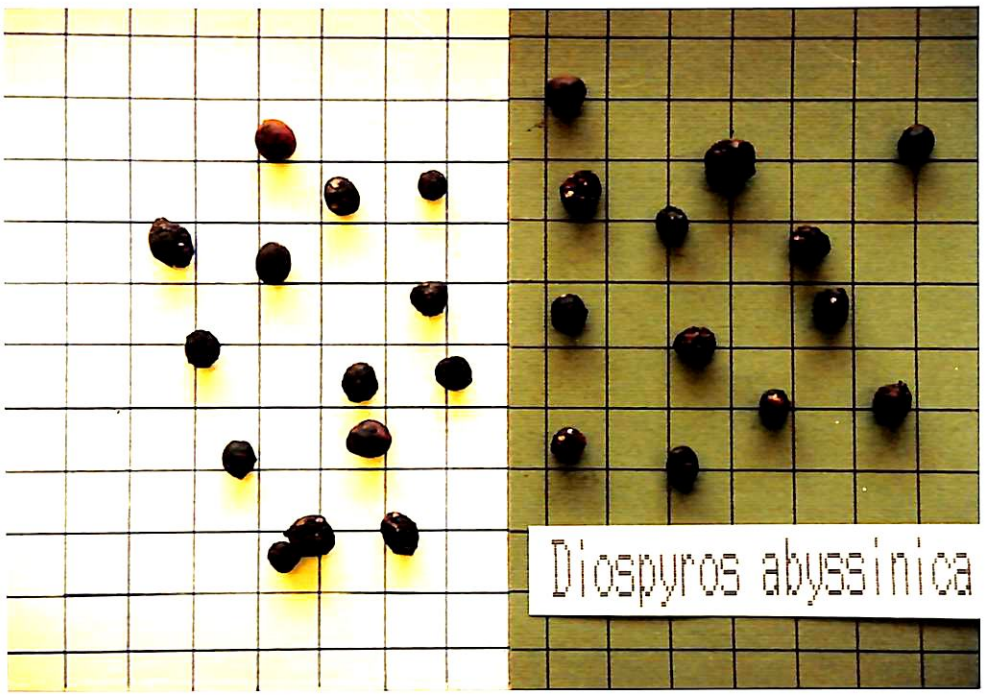
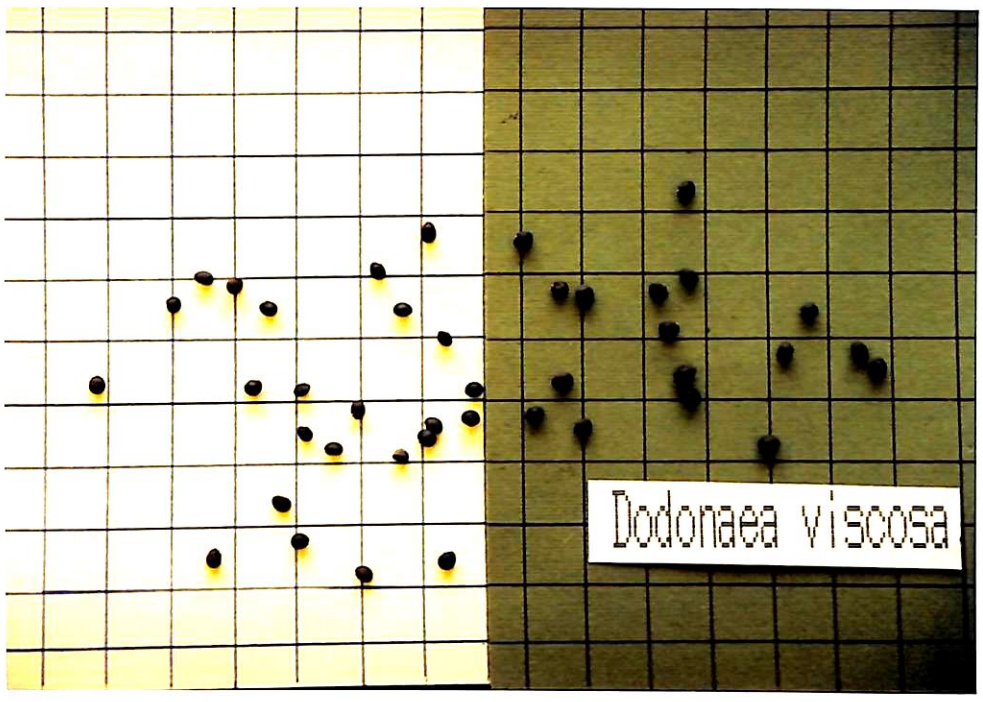
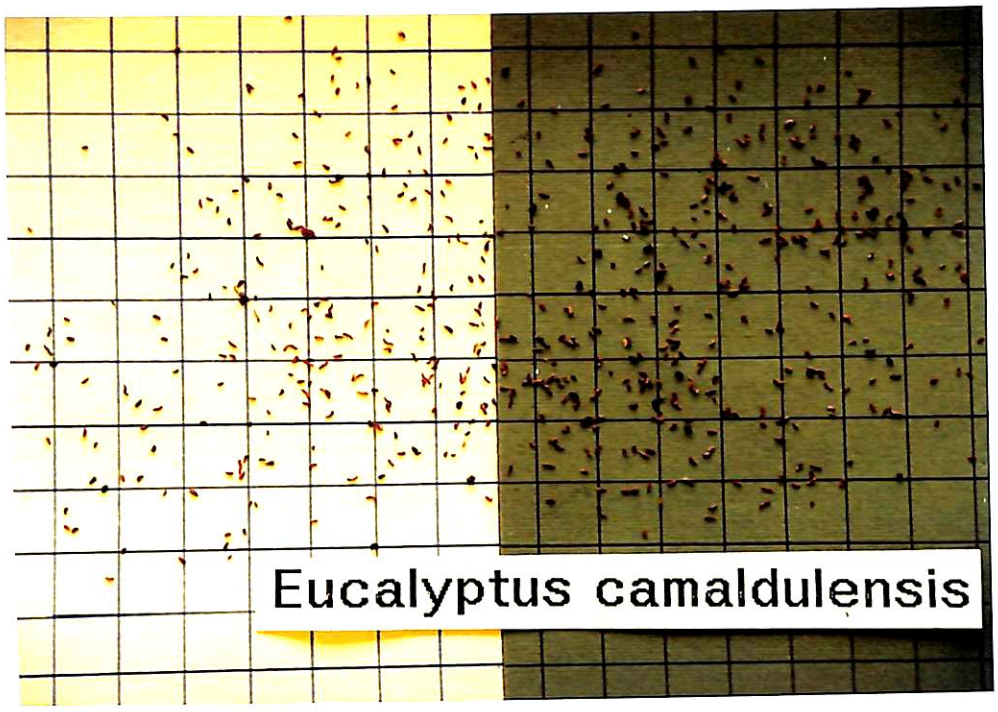
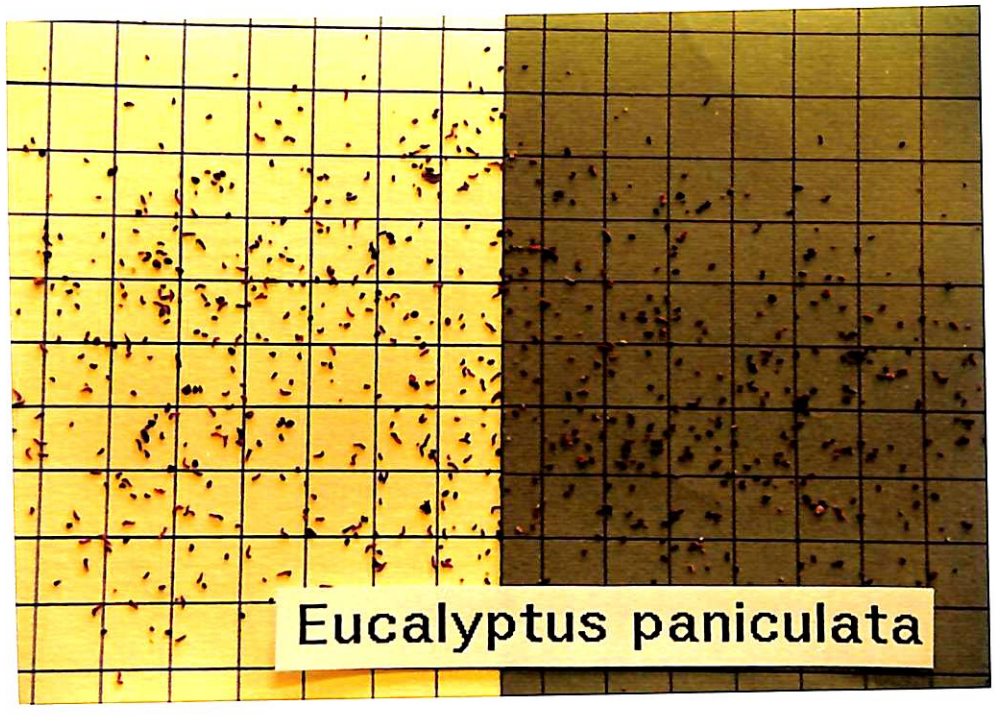

Delonix regia


Diospyros abyssinica


Dodonaea viscosa


Eucalyptus camaldulensis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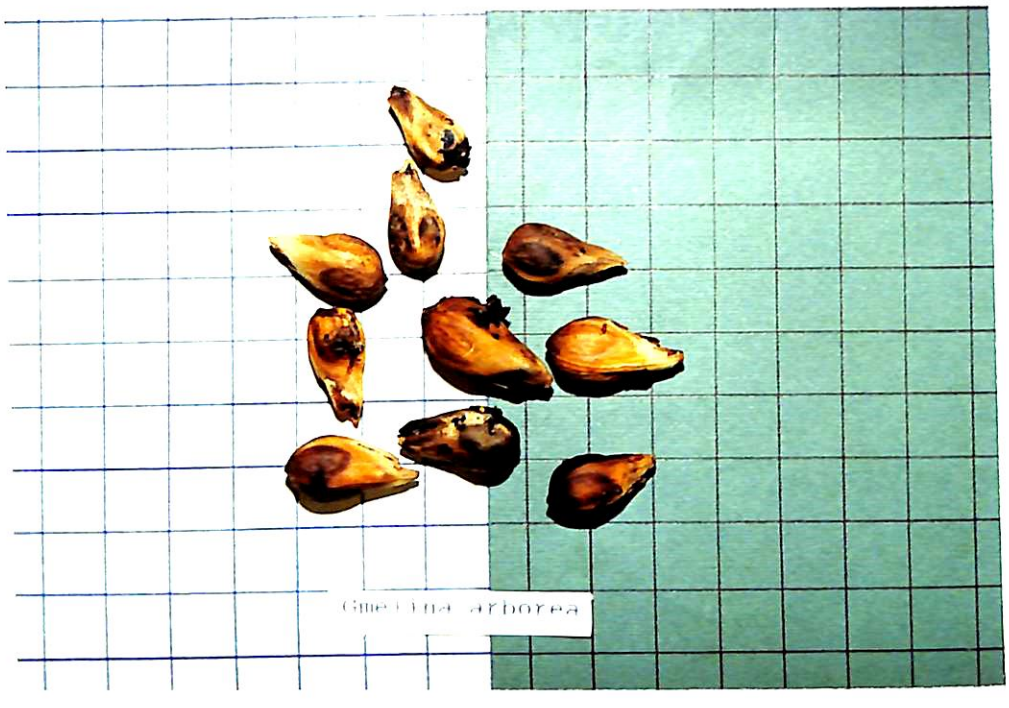
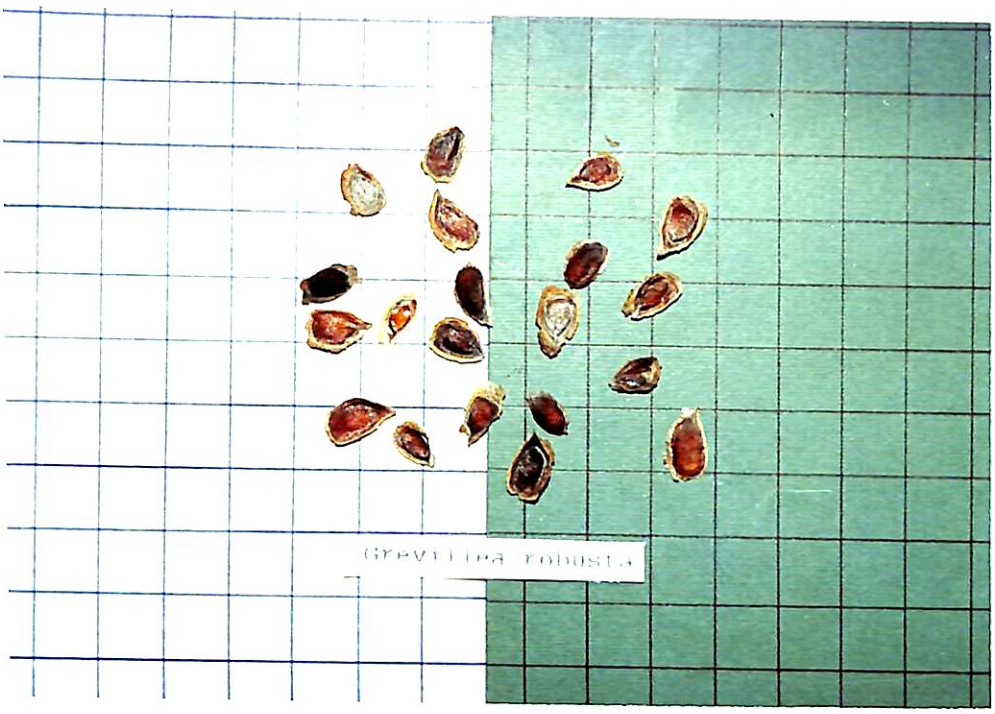
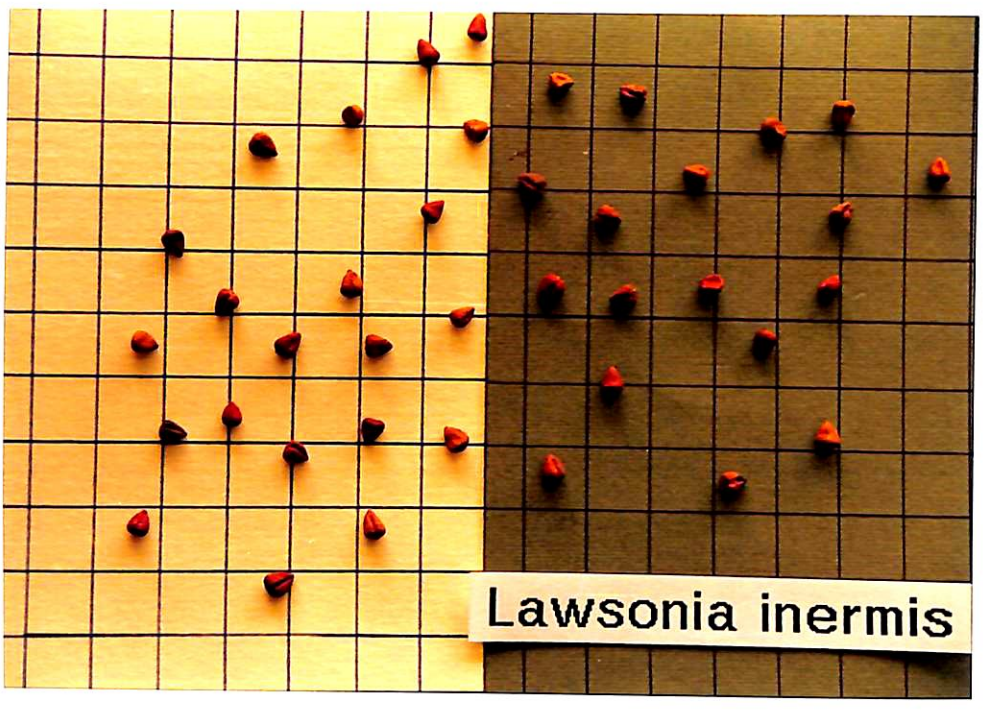
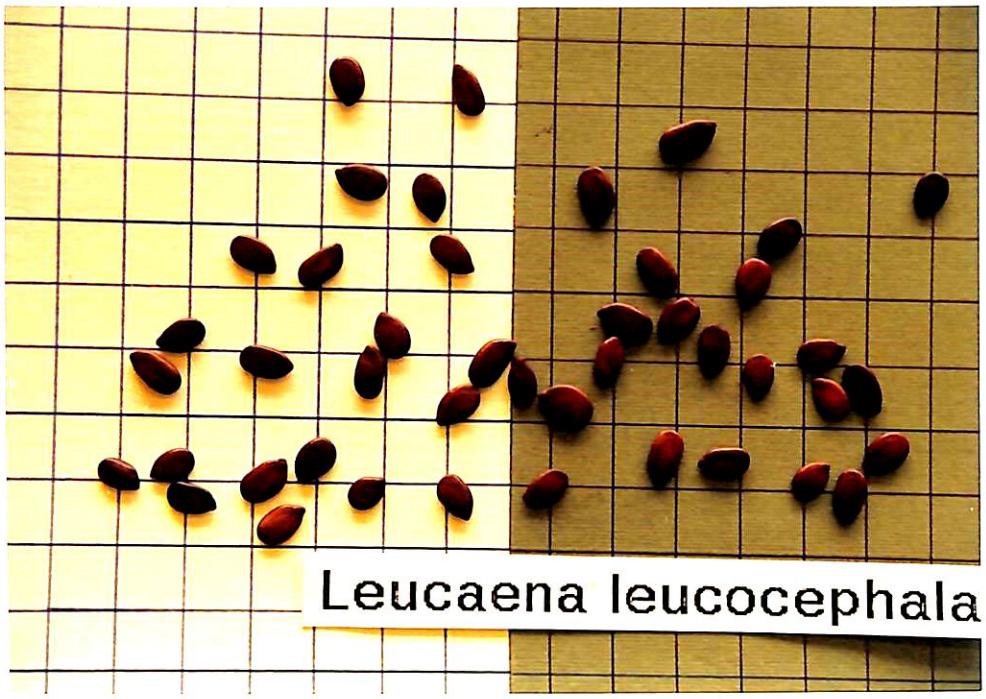

Gmelina arborea


Grevillea robusta


Jacaranda mimosifolia


Lawsonia inermis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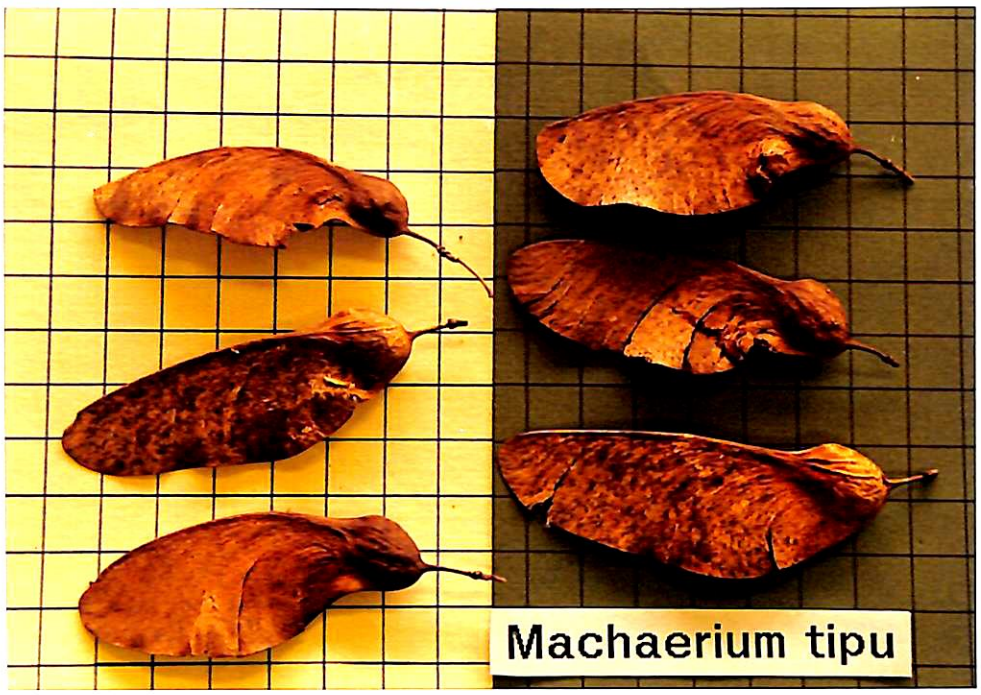
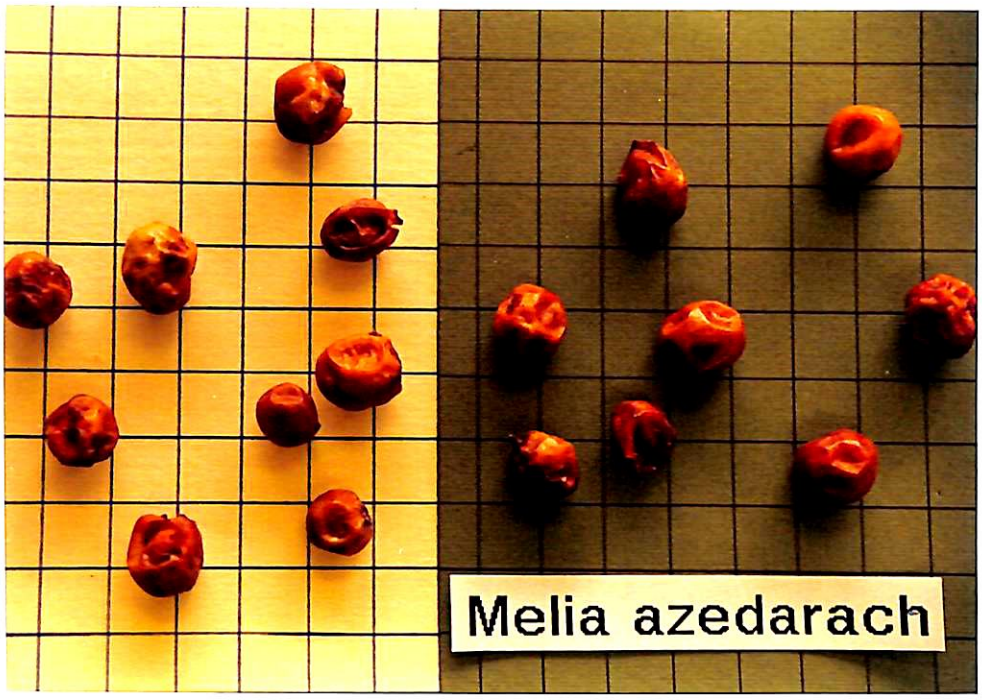
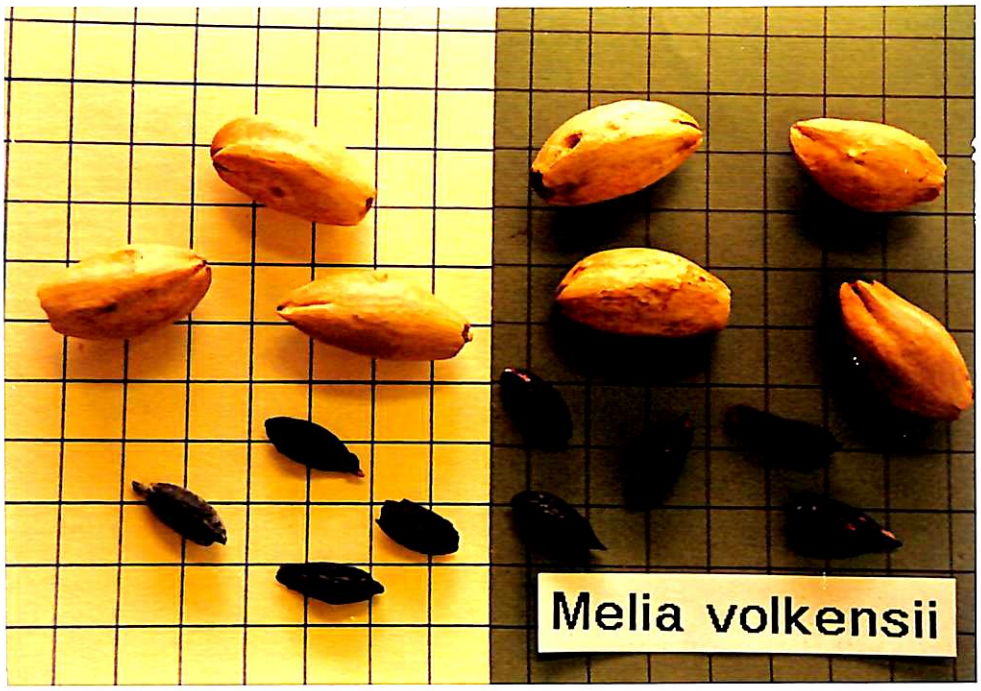

Machaerium tipu


Maesopsis eminii

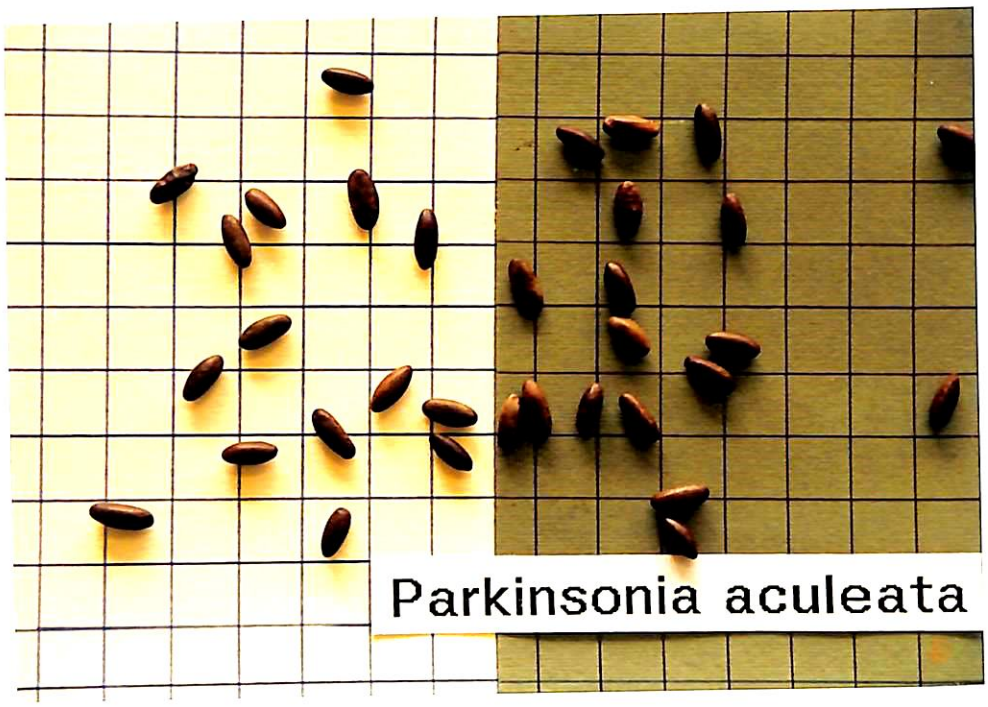

Melia azedarach

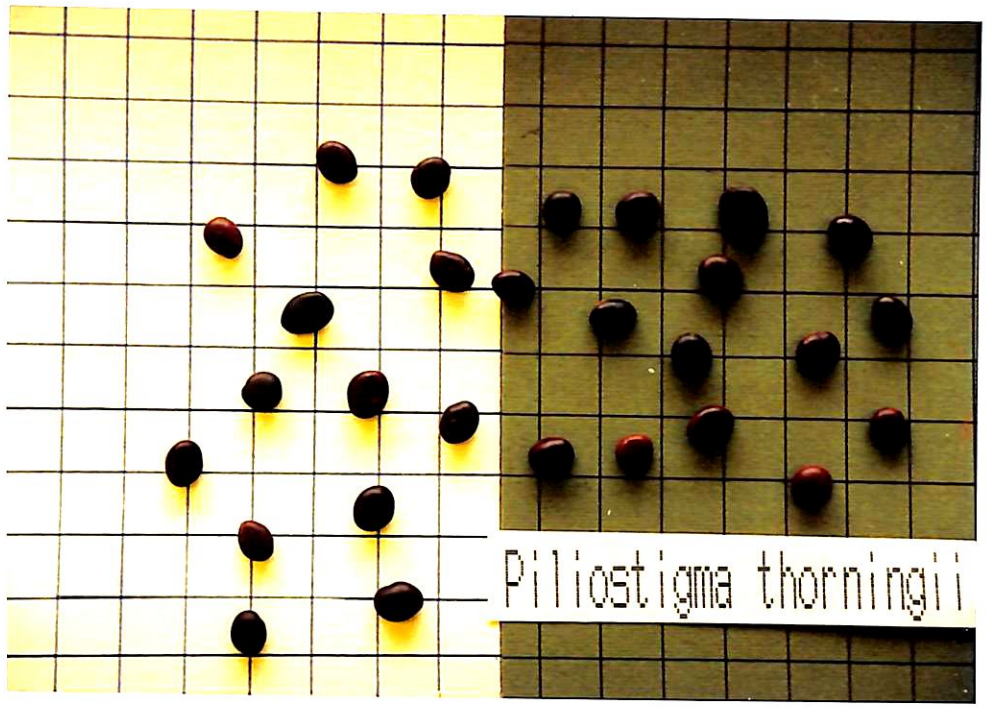

Melia volkensii


Moringa oleifera


Newtonia hildebrandtii


Odesum obesum


Parkinsonia aculeata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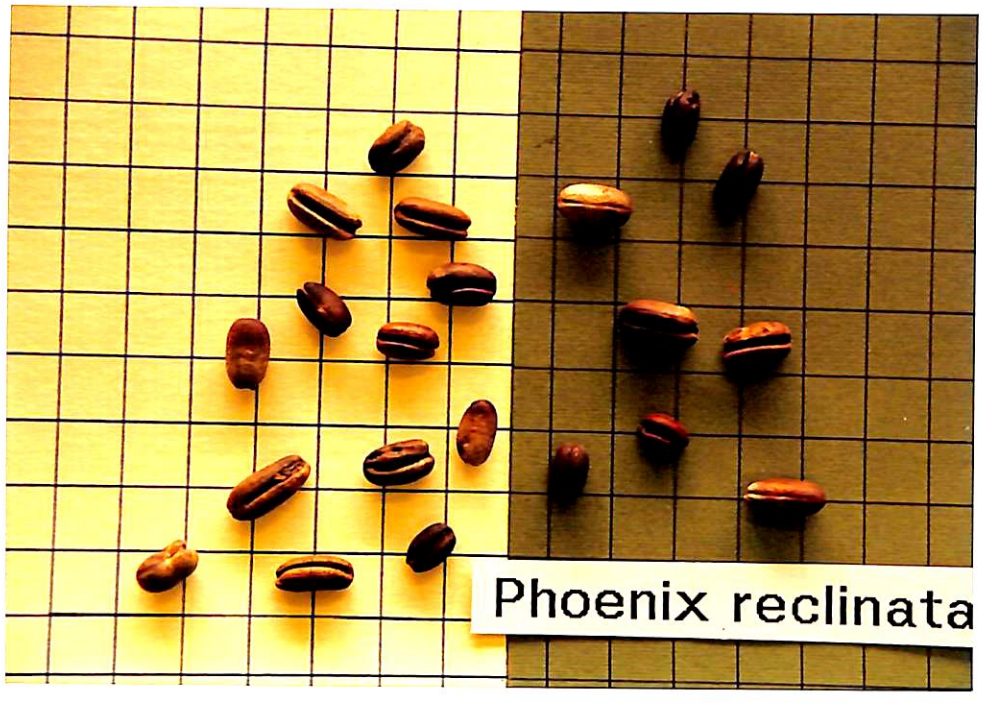
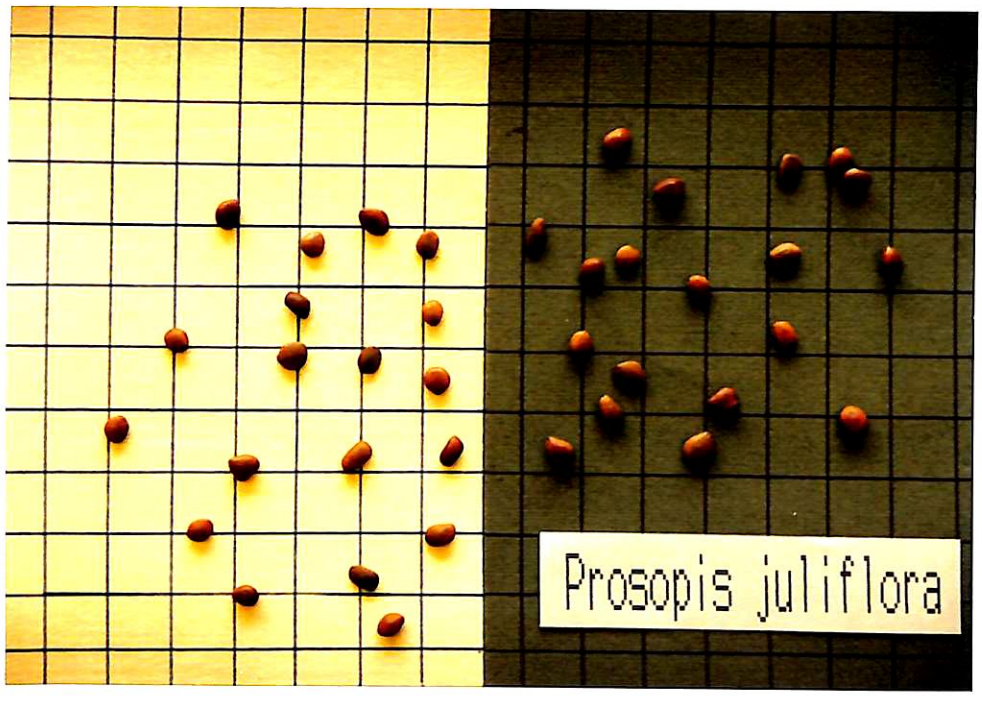
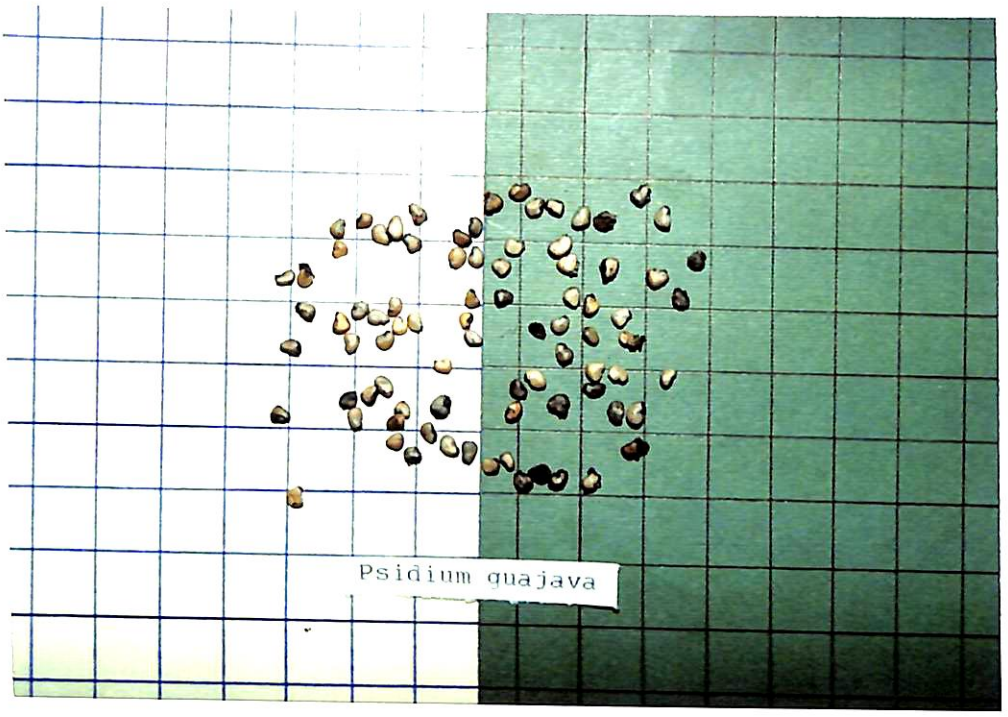

Phoenix reclinata


Prosopis juliflora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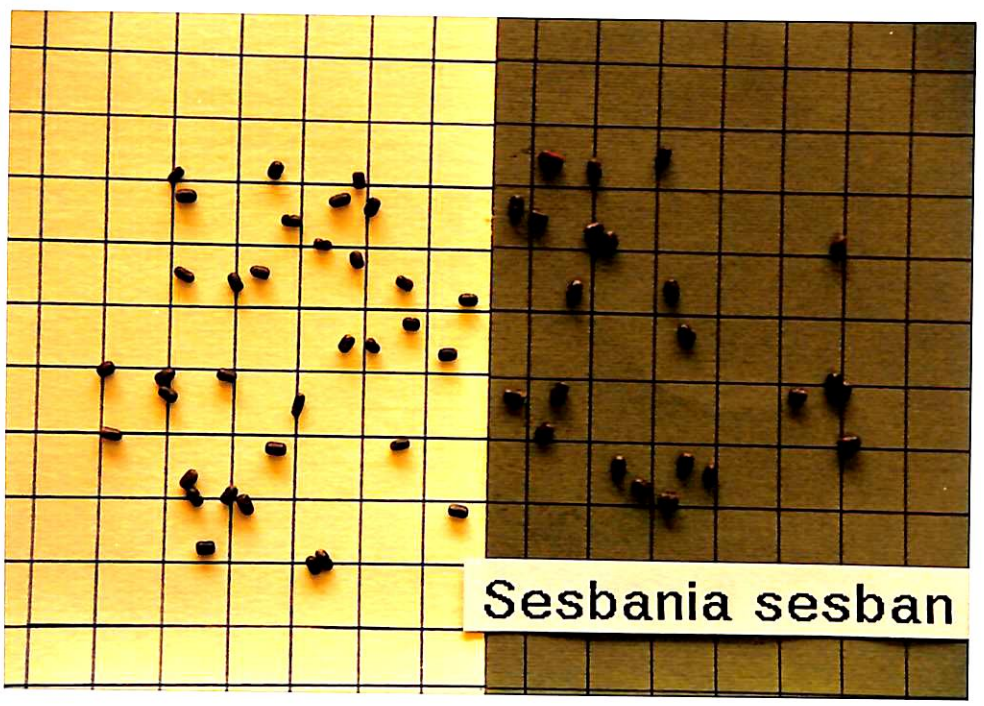
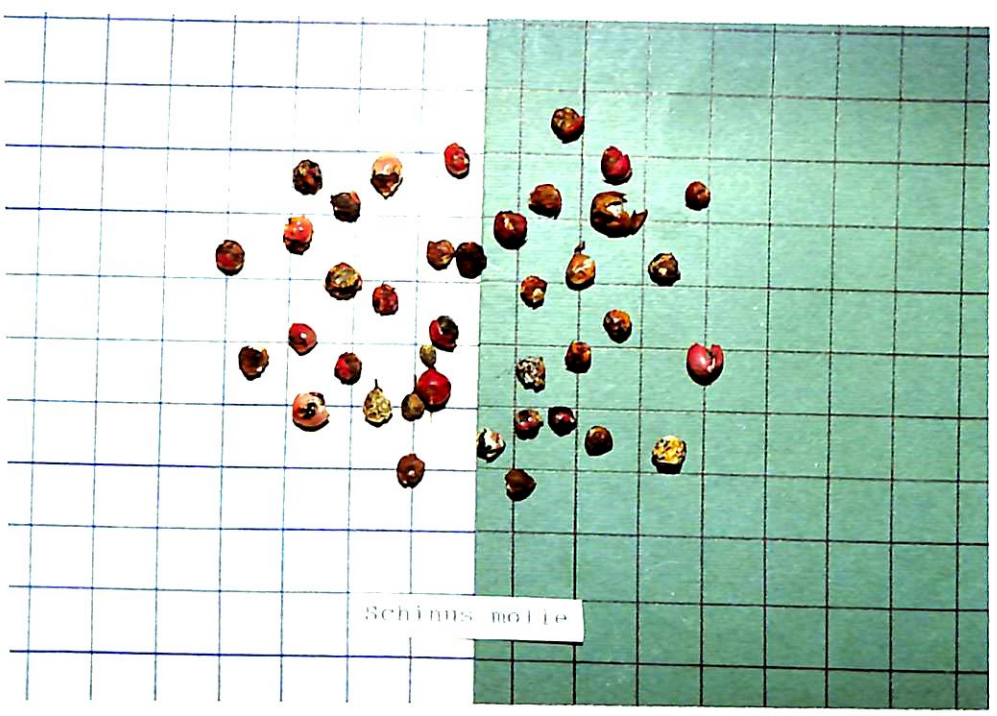
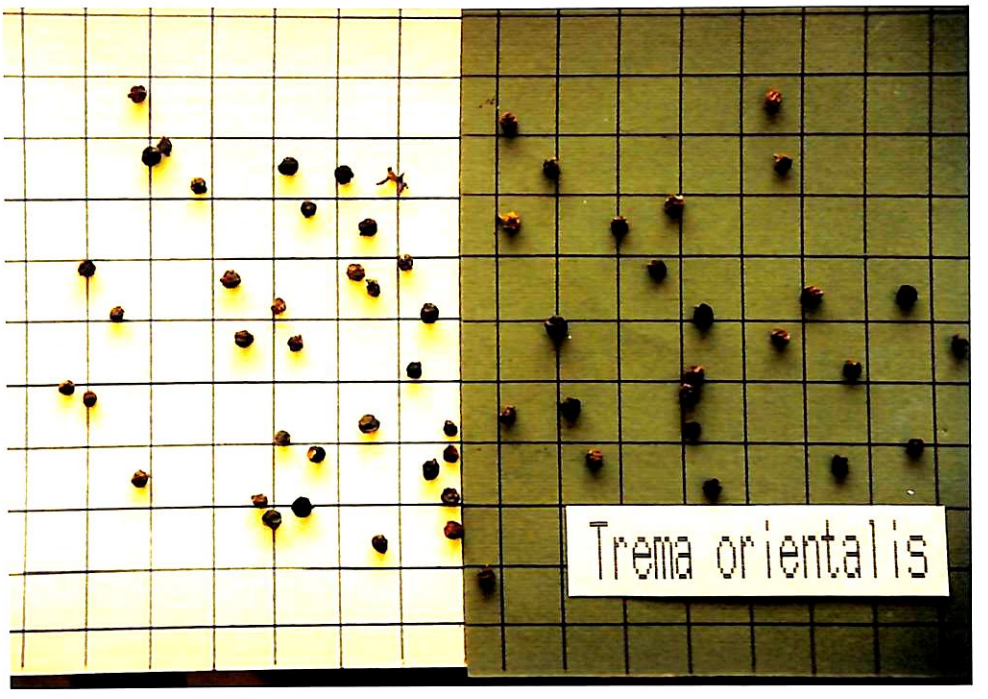

Sesbania sesban


Schinus molle

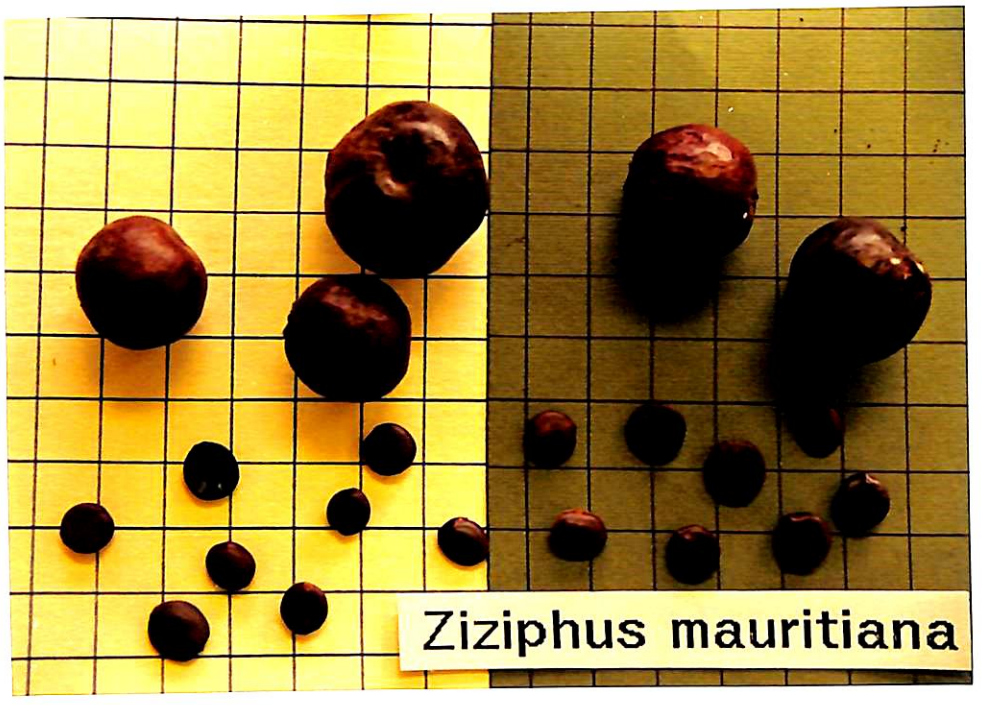

Terminalia brownii


Terminalia mentaly


Terminalia prunioides


Trema orientalis


Vitex doniana


Ziziphus mauritiana