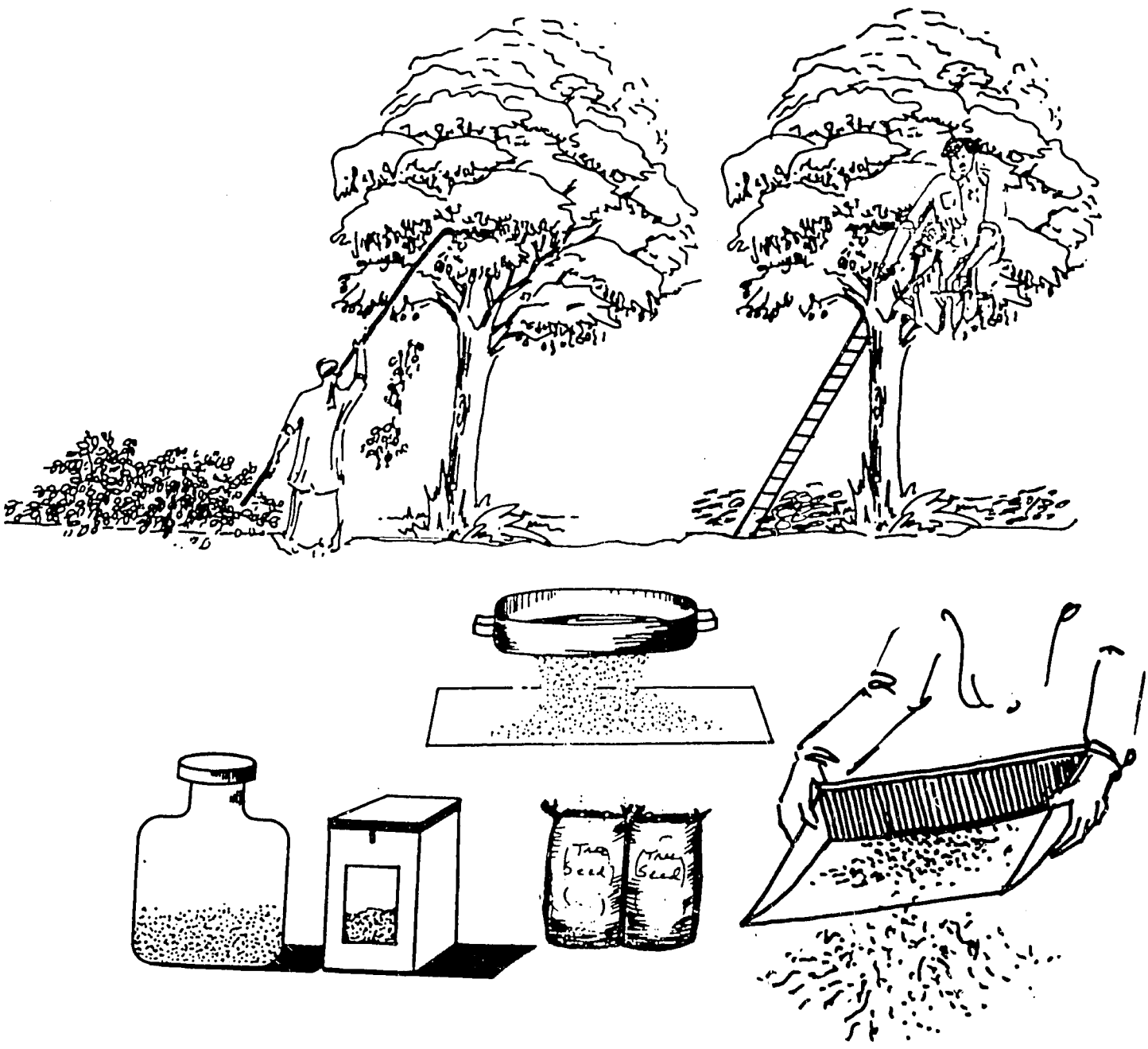
FORESTRY PLANNING & DEVELOPMENT PROJECT
Government of Pakistan-USAID

SEED COLLECTION



Technical Note No. 6

Oct. 1991

TECHNICAL NOTE

FPDP No.6

SEED COLLECTION

By

M. I. Sheikh[1]

1. INTRODUCTION

A very common practice is that tree seed for raising nurseries is collected from where ever it is available. The usual places in a plantation are the forest floor, and the water courses through which seed gets washed to different areas after falling from the trees. Even if it is collected from the tree, age, size, general health, and location of the parent tree is seldom considered or recorded. Often it is purchased from the local tree climbers or contractors especially in the case of conifers. Naturally these people would go for the trees which are accessible and easy to climb.

Due to poor quality of seed the nursery stock is seldom upto the mark falling much below the desired international standards. It is only in the case of Eucalyptus camalduiensis that certified seed is available from the Pakistan Forest Institute, Peshawar.

Farmers for the time being are largely getting their requirements of seed from the forest department. As they expand their business of raising tree nursery seedlings for sale, they will have to look for better seed sources to meet the market competition.

2. SEED RIPENING

Observations made over a number of years have indicated that seed can be collected from different localities in Pakistan at different times of the year. The important tree species showing the time of seed ripening are given in Table 1.

---

[1]Policy and Management Specialist Winrock International, Forestry Planning and Development Project, GOP-USAID, Islamabad.

Table 1: Important Tree Species Showing Time of Seed Ripening

Name of the Species	Time of ripening of seed
A.CONIFERS	
Abies pindrow (Puladdar, Fir)	Late August to October
Cedrus deodara (Deodar)	Late August to October
Cupressus arizonica (Saru)	April-May
Juniperus excelsa (Juniper)	November-December
Picea smithiana (Kachal, spruce)	April-May
Pinus wallichiana (Kail)	September
Pinus roxburghii (Chir)	April-May
Pinus halepensis (Quetta pine)	October-November
B.BROAD LEAVED SPECIES	
Acacia nilotica (Babul/Kikar)	June-July
Acacia catechu (khaththa)	December-January
Acacia modesta (Phulai)	November-December
Acacia senegal (Africi Kikar)	June-July
A. tortilis (Sudani Kikar)	June-July
Acer caesium (Maple, Trekhan)	September-October
Acer Oblongum (Maple, Mandar)	November-December
Aesculus indica (Ban Akhor)	October-November
Ailanthus altissima (Shajri Bahisht)	May-June
Albizzia lebbek (kala Sirin)	December-January
Albizzia procera (Sufed Sirin)	March-April
Alstonia scholaris (Chattian)	May-June
Azadirachta indica (Nim)	June-August
Bauhinia purpurea (Kachnar)	January-March
Bauhinia variegata (Kachnar)	May-August
Bischofia javanica (Indrakne)	December-January
Bombax ceiba (Simal)	August-September
Broussonetia papyrifera (jangli toot)	July-August
Butea monosperma (Dhak)	May-June
Cassia fistula (Amaltas)	May-June
Casuarina equisetifolia (Casuarina)	June-July
Cedrela toona (Tun)	June-July
Celtis australis (Batkar)	October-December
Cordia dichotoma (Lasura)	July-August
Crataeva religiosa (Barna)	June-July
Dalbergia sissoo (Shisham)	January-February
Delonix regia (Gul mohar)	July-August
Elaeagnus angustifolia (Roosi Zaitoon)	July-August
Emblica officinalis (Amla)	November-February
Eucalyptus citriodora (Sufeda)	September
Eucalyptus camaldulensis (Sufeda)	September
Ficus religiosa (Pipal)	October-November
Fraxinus excelsior (Sum)	October
Gleditschia triacanthos (Dozakh)	January
Gmelina arborea (Gumhar)	June
Grevillea robusta (Silk oak)	July-August
Heterophragma adenophyllum (Saanp phali)	July-August
Jacaranda mimosifolia (Neelgulmohar)	January-March
Kigelia pinnata (Guli-fanoos)	July-August
Lagerstroemia indica (Guldasta)	August
Lagerstroemia speciosa (Guldasta)	March-April
Magnolia grandiflora (Magnolia)	August-September
Mangifera indica (Aam)	July-August
Melia azedarach (Bakain)	December-January
Millingtonia hortensis (Nim chameli)	July-August
Moringa oleifera (Sohanjna)	April-June
Morus alba (Tut)	April-June
Parkinsonia aculeata (Juda's thorn)	May
Peltophorum pterocarpum (Peeligulmohar)	December-January
Phoenix dactylifera (Khajur)	August-September
Pistacia integerrima (Kingar)	June to October
Platanus orientalis (Chanar)	June-July
Pongamia glabra (Karang)	March
Prosopis cineraria (Jand)	June-August
Prunus armeniaca (Hari)	May-July
Pterospermum acerifolium (Kanak Champa)	December-january
Putranjiva roxburghii (Putranjiva)	January-February
Pyrus pashia (Batangi)	July-August
Quercus incana (Oak, Shahbaloot)	December-january
Quercus semcarpifolia(Oak, Shahbaloot)	July-August
Robinia pseudoacacia (Robinia)	August-September
Sapindus mukorossi (Retha)	October-January
Sapium sebiferum (Charbi)	November-January
Saraca indica (Ashok)	July-August
Schinus molle (Kali mirch)	May-June
Sesbanea aegyptiaca (Jantar)	July-August
Sterculia alata (sterculia)	November-December
Syzygium cumini (jaman)	July-August
Tamarix aphylla (Farash)	December-January
Tamarindus indica (Imli)	February-March
Tecoma undulata (Lahura)	May-July
Terminalia arjuna (Arjun)	February-may
Terminalia belerica (Bahera)	November to February
Terminalia catappa (Badam)	June-July
Thespesia populnea (Bhendi tree)	June-July
Zizyphus mauritiana (Ber)	March-April

(Local names in bracket)

3. SEED COLLECTION

Marking of seed stands

The trees which have good stem and crown form, are vigorous and healthy would produce good quality seed. Identification of such tree stands in an important first step. A detailed knowledge, based on survey of the stands in the area would be helpful to the forester as well as to the tree farmer. These stands should always be preferred for seed collection. Figure 1 shows the usual composition of a tree stand in Pakistan.

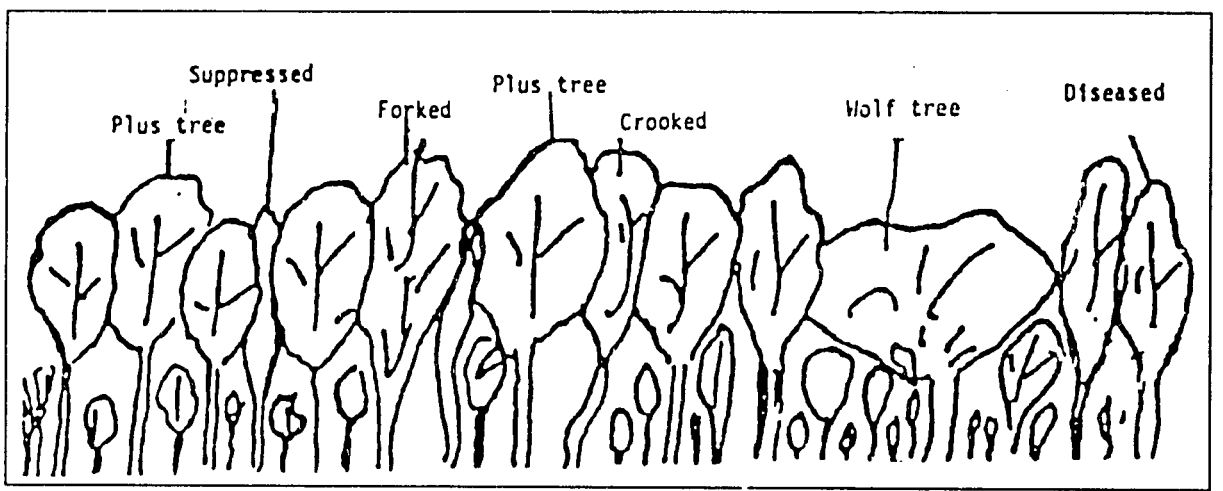


Figure 1.Stand composition of trees in a forest

Steps have to be taken to mark out "Elite" or "Plus" trees from a grove, a plantation or a forest. The selected trees should have the following criteria:

- 10 to 50 years of age depending on the species
- Straight and cylindrical stem
- Free crown, not suppressed from the surrounding ones
- Fairly large and well balanced crown
- Healthy, insect and disease free
- Not forked or twisted
- Reasonable number of symmetrical branches

While marking the seed stands the trees which do not conform to the above specifications are removed leaving the rest for seed collection. A plus mark is placed on the tree at breast height or a white or colored ring is painted on the tree to identify the comparatively superior trees. The stand looks like in figure 2 after the sanitation cut.

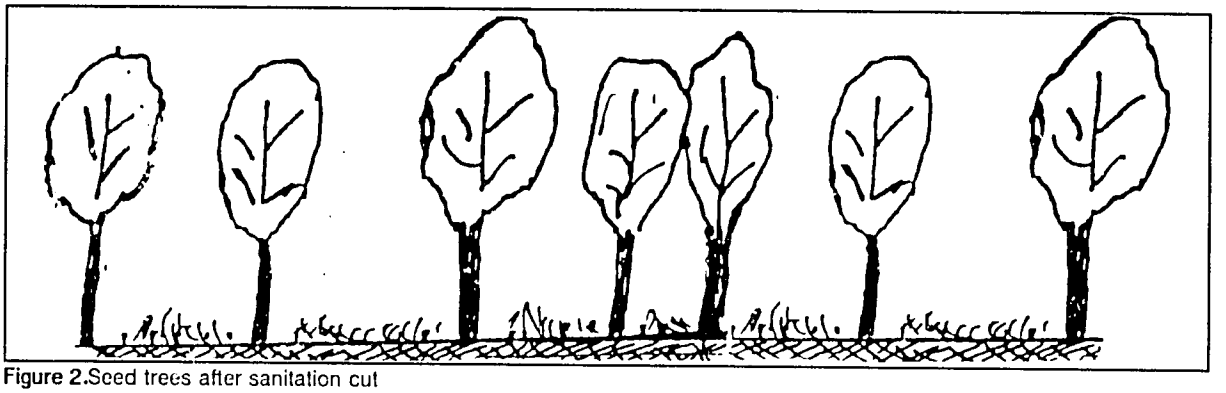


Figure 2.Seed trees after sanitation cut

These improved seed stands are designated as Seed Production Areas (SPA). It would be very appropriate to develop such stands right in the farm plantations so that the farmer does not have to run around looking for good quality seed.

Collection

The seed is usually ripe when it starts falling on the ground. It can be collected in many ways: By climbing a tree with or without ladders and throwing it on the ground where sheets have been spread Acacia nilotica (babul), Zizyphus mauritiana (ber), Melia azedarach (bakain), Terminalia belerica (bahera); by shaking the branches to make the seed fall on the ground Morus alba (mulberry), Melia azedarach (bakain), Azadirachta indica (nim) and Syzygium cumini (jaman); by clipping the branches and throwing these on the ground (eucalypts); by collecting individual capsules (simal) (Fig. 3).

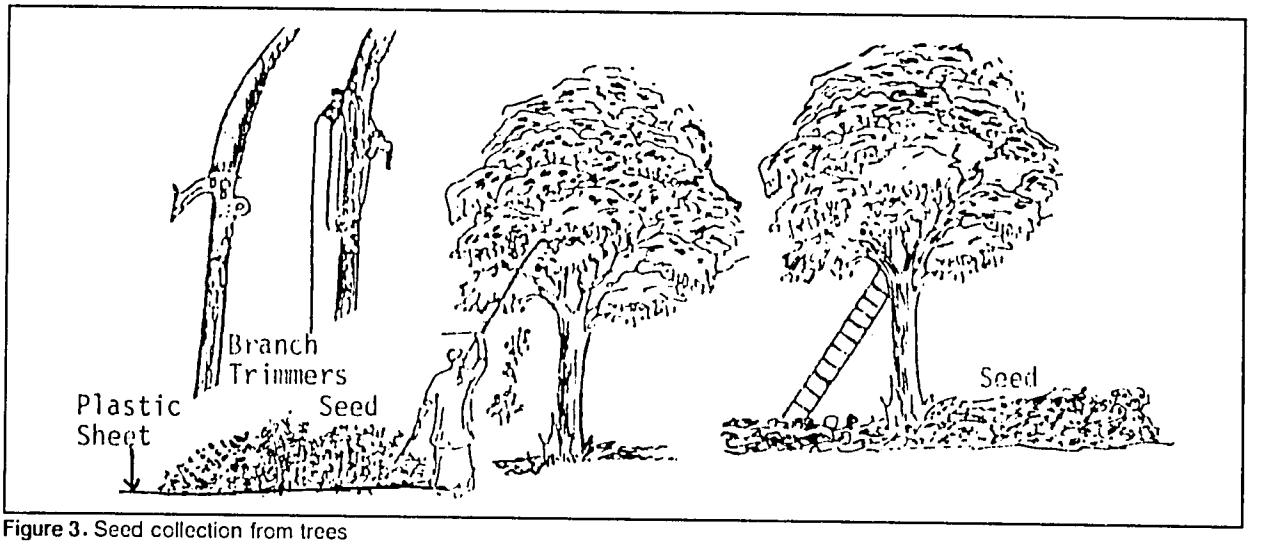


Figure 3. Seed collection from trees

In the case of conifers, cones are collected off the tree while still closed. These are spread out in the sun where they open in 7-10 days. For seed from eucalypts, branches with ripening capsules are spread on a plastic sheet. After a week the capsules will open. The branches are struck on the plastic sheet. Empty capsules and other impurities are removed by sieving.

Weight of the clean and healthy seed varies according to the localities and mother trees. The cost of seed collection differs considerably and is directly linked with weather conditions, efficiency of labor, distance involved and quantity of seed produced and, of course, the quality of the seed year.

4. SEED WEIGHTS AND GERMINATION PERCENTAGE

Available information on seed weight/kg and germination percent is given in Table 2 below. The weight in individual cases varies according to geographical sites, and whether the seed is fresh or dry.

Table 2. Tree Species, Seed Weight and Germination Percent

Name of Species	Seed/Kg.	Germination %
Acacia catechu	32000 - 35000	70 - 75
Acacia farnesiana	9700 - 12100	60 - 70
Acacia modesta	7000 - 9000	60 - 90
Acacia nilotica	6600 - 11000	90
Acacia saligna	66000 - 77000	70 - 80
Acacia senegal	11000 - 15400	60 - 70
Ailanthus excelsa	26400 - 37400	40 - 50
Aesculus indica	20	70
Albizzia lebbek	4800 - 12300	94
Albizzia procera	21000	80
Azadirachta indica	4000	70 - 75
Bauhinia purpurea	2500	80
Bauhinia variegata	3500	80
Bombax cieba (S.malabarica)	28000	80
Butea frondosa	1200	90
Cassia fistula	5500	65
Casuarina equisetifolia	750000	50
Cedrela toona	35000	60 - 80
Cedrus deodara	5000 - 9500	50 - 60
Ceratonia siliqua	3300 - 5500	75 - 85
Cordia obliqua	200 - 300	75
Dalbergia sissoo	13000 - 15400(Pods)90	
Eucalyptus camaldulensis	110000 -660000	90
Eucalyptus citriodora	57000 - 99000	45 - 50
Eucalyptus microtheca	400000 -450000	60
Eucalyptus tereticornis	367400	70
Gleditsia triacanthos	3740 - 9000	70
Gmelina arborea	1400	80 - 90
Grevillea robusta	10500	60
Juniperus excelsa	4600	5
Leucaena leucocephala	28000	90
Mangifera indica	35 (dry)	80
Melia azedarach	1400	65
Morus alba	52000	80
Parkinsonia aculeata	12320	85 - 90
Pinus brutia	19000 - 26000	70 - 80
Pinus halepensis	48000 - 80000	80
Pinus roxburghii	6600 - 22000	75 - 85
Pinus wallichiana	26000	80
Pithecolobium dulce	5500 - 8800	63
Pistacia chinensis	8800 - 9900	60
Pongamia glabra	1540 - 1650	75
Prosopis juliflora	22000	65
Prosopis cineraria	28600	46 - 66
Robinia pseudo-acacia	35200 - 77000	65 - 75
Syzygium cumini	1160	45
Tamarindus indica	880 - 990	60
Terminalia arjuna	176 - 242	60 - 80
Terminalia belerica	62	86 -100
Zizyphus mauritiana	800 - 1000	70

5. EXTRACTION AND CLEANING

In Pakistan seed is usually dried in the open before extraction/cleaning. Seeds of several species require no extraction, except removal of chaff or trash. There are four methods generally used for cleaning of seeds. These are, dewinging/depodding; screening; fanning; and floatation. Often a combination of these methods is used.

Dewinging/Depodding

Seeds of most conifers have to be dewinged after extraction by rubbing them between moistened hands or rubbing them on a mesh by hand or power brush. Packing the seeds loosely in a sack and then trampling on it or beating it with a stick (Fig. 4) or beating the sack against trees or walls is an alternative method. Dewinging machines are also available but are practical only for large scale operations. Seed pods such as Albizzias, Ipil Ipil, and Acacias should be dried in the sun. Beating the pods with a stick will release the seed.

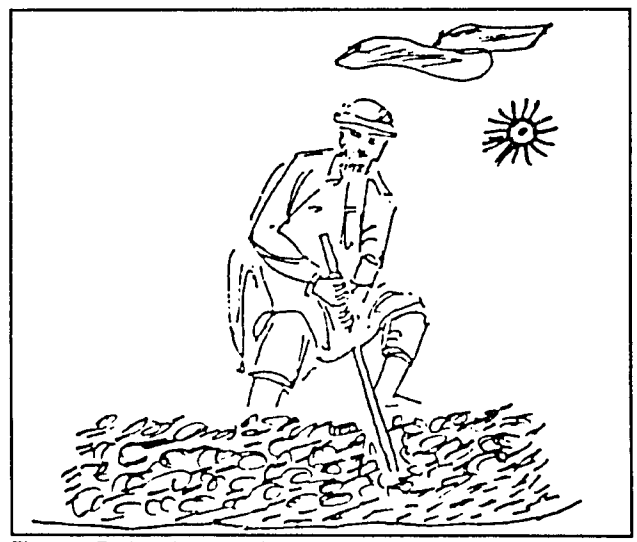


Figure 4.Drying the pods in the sun and beating with a stick for dewinging/depodding

Screening

Seed can be screened satisfactorily by sifting it either dry or with running water through sieves (Fig. 5). Sieves of many sizes are available in the market. The sieve must be of proper size to separate the seeds from the chaff or other materials. Seed, being smaller than the chaff, passes through the sieve of an appropriate size. Small seeds like eucalypts, Alnus, and Platanus can be cleaned through this process.

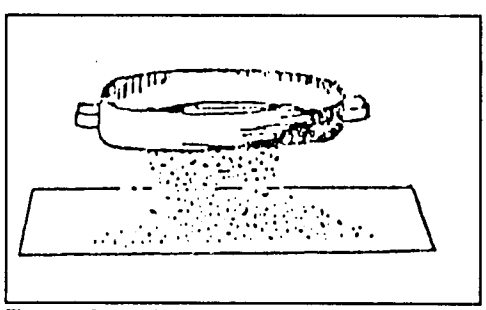


Figure 5.Screening with a sieve

Fanning

Fanning is used to remove wings or light chaff as well as for separating the empty seeds from filled ones (Fig 6). This method is not practicable with light seeds such as eucalypts, poplars and willows. The speed of the fan can be adjusted to suit the size of the seeds. Country "chaj" is also a useful device to clean seed (Fig. 7).

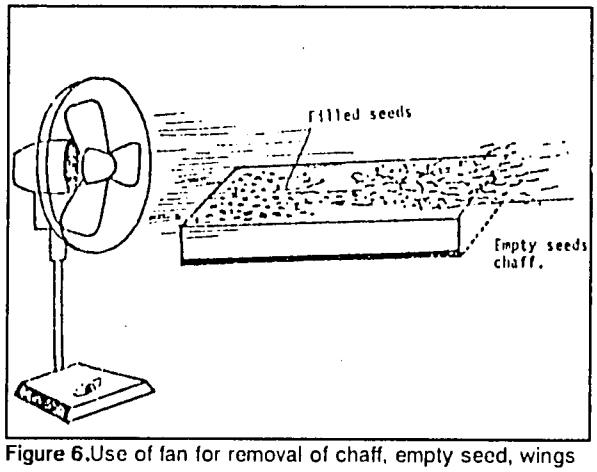


Figure 6.Use of fan for removal of chaff, empty seed, wings

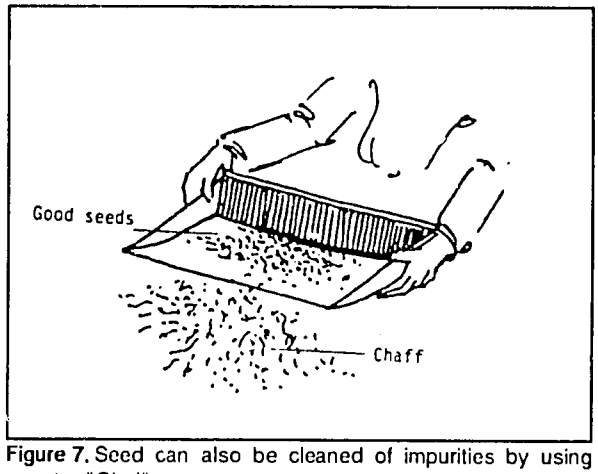


Figure 7. Seed can also be cleaned of impurities by using country "Chaj"

Floatation

Seeds of most pulpy or fleshy fruit can be cleaned by floatation in water after de-pulping on a mesh A. indica (nim), M. azedarach (bakain), Z. mauritiana (ber) and J. excelsa (juniper) (Fig. 8 and 9). Sound seeds usually sink; empty seeds, skins and pulp either float or sink more slowly than the sound seed. The usual method is to place a quantity of macerated fruit in a large wash tub tilted slightly and given a direct stream of water creating a rotary swirl. The material in the bottom is stirred lightly. The pulp and light seeds will come to the surface and be carried over to the edge of the tub by the over flow water.

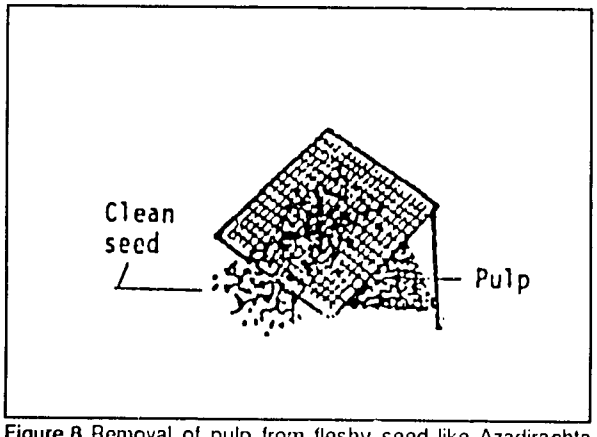


Figure 8.Removal of pulp from fleshy seed like Azadirachta indica (Nim) Syzygium cumini (Jaman), by rubbing on a wire mesh

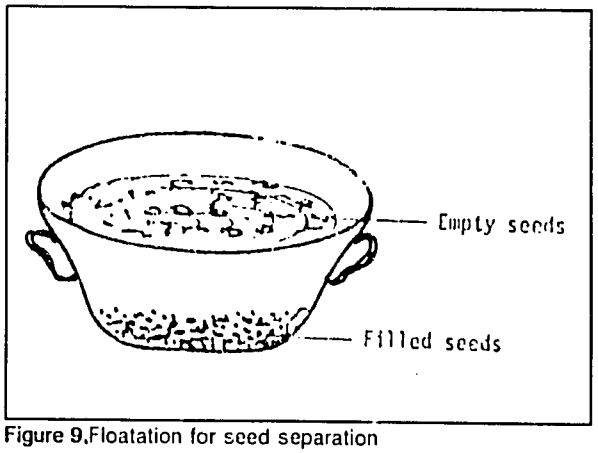


Figure 9.Floatation for seed separation

6. STORAGE OF SEED

Seeds which can be stored for several years in Jute bags or closed tins include A. nilotica (kikar, babul) A. catechu (katha) A. lebbek (black sirin), A. Procera (white sirin), D. sissoo (shisham), L. leucocephala (ipil ipil), M. azedarach (bakain), P. cineraria (jand), P. Juliflora, (mesquite) and Z. mauritiana (ber).

Usually the best germination is obtained when the seed ripens and is sown immediately. Immediate germination is necessary for some species A. indica (nim), S. cumini (jaman) and M. indica (aam). In Pakistan seeds are generally used as soon as they are collected and so long storage is usually not done. Seed is frequently stored till sowing time. Also many species produce good seed crops only at intervals of several years. The seed collected in good years must be stored for several years to provide for the lean period.

Generally the seed is stored at low moisture percent, and low temperatures. In cold storage the best temperature of storing seed of most species is between 3°C to 5°C. The best seed moisture content is below 10% of the oven dry weight for coniferous species but moisture content must be kept above 35% for most of the broad leaved species.

Storage facilities at controlled temperature are only available in Pakistan at PFI. Otherwise seed has to be stored in tin containers after treatment with Lindane and DDT at 1kg of chemical for 40 kgs of seed and kept in specially constructed stores at an elevation of about 1500 meter above sea level. When stacked in storage rooms, mixing of BHC powder at 1Kg/40Kg of seed will keep many insects away. Treatment of one maund (40 kg) of seed with 20 grams of Thiram will save it from fungal attacks in storage.

7. GERMINATION TESTS

Nurseries often fail because the seed collected is rather old, rotten or does not have an embryo. There are several methods to test seed germination percent but the most practical is to take a few samples from thoroughly mixed heap of seed. This composite sample may be divided into several lots of 100 seeds and sown in light soil in pots, 100 seeds to each pot. In a warm place, seed would start germinating within a few days. Number of germinated seeds after about 20 days from the time of the first germination will give a fairly accurate estimate of germination rate. Such tests can also be conducted on a moist blotting paper in a seed germinator in the laboratory under controlled conditions.

Field tests to find out if the embryo is alive and is not shrivelled or dead are done by cutting seeds from a sample with a sharp knife and checking the embryo. If it is plastic in nature it is alive.

8. SEED DORMANCY

Dormancy is normally the result of interaction between environmental conditions and hereditary properties of the plant. Low temperature, moisture and relative humidity also influence dormancy. For instance, seed maturing under arid conditions may become completely dormant. Dormancy may also occur because of prevailing conditions during harvesting, extraction and storage. Prolonged storage can result in dormant seed. Sometimes sound and uninjured seeds may fail to germinate due to reduced activity of the seed or seed parts resulting in blockage of growth. This maybe due to external environmental effects or internal conditions of the seed itself, i.e. embryo dormancy, inert embryos or seed coat dormancy.

9. TREATMENT TO STIMULATE GERMINATION:

There are several methods to stimulate seed germination. These include hot and cold water treatment, keeping seed in cowdung, scarification, acid treatment and stratification.

Soaking seeds in water

Seed coats which prevent water uptake are quite common in Acacias, Robinia and Gleditschia. The seed coat is impermeable in these species. In certain other cases the seed coats are mechanically resistant to embryo expansion. Then there are certain seeds which restrict gaseous exchange. This can be due to accumulation of carbon dioxide or inhibitors. The inhibitors can be leached out by washing the seed in water.

The purpose of soaking seeds in water is to modify hard seed coats, remove inhibitors, and soften the seed coat to reduce the time of germination.

Soaking seeds in water will overcome seed coat dormancy and stimulate germination in some cases. Impermeable seed coats can be softened by dropping the seeds into four to five times their volume of boiling water. The heat is immediately removed, and the seeds are allowed to soak in the gradually cooling water for 12 to 24 hours. Following this, the unswollen seeds can be separated from the swollen ones by suitable screens and either retreated or subjected to some other method of treatment. The seeds should be

planted immediately after the water treatment. Acacias (kikars), Albizzias (sirins), L. leucocephala (iple iple), Bauhinia variegata (kachnar), Cassia fistula (amaltas), Emblica officinalis (amla), Cordia dichotoma (lasura) and Robinia pseudoacacia (robinia) respond both to cold as well as hot water treatment. Shisham and mulberry seed bags are kept in cold water for 24 hours before sowing.

Boiling seeds in water for a few minutes has been done in some cases. Seeds of bakain and ber have responded well to this treatment. But such a procedure is hazardous. Over-exposure to high temperature is likely to injure the seeds.

Seeds of many species such as A. nilotica (kikar babul), A. modesta (phulai), M. azedarach (bakain) and Z. mauritiana (ber) are kept in cowdung for 8 - 10 days. This treatment softens the seed coat and germination is accelerated. Seed of babul is usually collected from goat pens. The pods are eaten by the goats as fodder. The seed is ejected after automatic treatment in the stomach of the goat and is ready for sowing.

Mechanical scarification

The purpose of mechanical scarification is to modify hard or impervious seed coats. Scarification is a process of breaking, scratching, or mechanically altering the seed covering to make it permeable to water or gases. Although some scarification probably occurs during harvesting, extraction, and cleaning, germination of most hard-coated seeds is improved by additional scarification treatment.

Rubbing the seeds on sandpaper, or cracking the seed testa with a hammer or between the jaws of a vise are simple methods useful for small amounts of relatively big seed. For large scale operations, special mechanical scarifiers are used. The seeds may be tumbled in drums lined with sandpaper or in concrete mixers combined with coarse sand or gravel. The sand or gravel should be of different size than the seed to facilitate separation. Germination of ber, bakain, retha, lasura and amla can be hastened with this treatment.

Acid Scarification

The purpose of acid scarification is to also modify hard or impermeable seed coverings. Soaking seeds in concentrated sulfuric acid is an affective method for modifying hard seed coverings. Sulfuric acid must be used with care, because it is strongly corrosive and reacts violently with water causing high temperatures and splattering. Protective clothing gloves and shoes should be

worn, and the operator should be aware of the dangers in its use.

Dry seeds are placed in glass or earthenware containers and covered with concentrated sulfuric acid in ratio of about one part seed to two parts acid. The mixture should be stirred cautiously at intervals during the treatment to produce uniform exposure of coming from the seed coat. Since stirring tends to raise the temperature, vigorous agitation of the mixture should be avoided or else injury to the seeds and splattering of the acid may harm the body of the worker.

The length of treatment should be carefully standardized. It will depend upon temperature, the kind of seed, and sometimes the particular lot of seed. Large lots of seed should be thoroughly mixed prior to treatment to ensure uniformity. The time of treatment may vary from as little as 5 minutes for some species to as much as 30 minutes or more for other species. Acid treatment recommendations of different durations for various species are given in Table 3.

Table 3. Seed treatment, time taken for germination and growth rate

Species treatment	Time taken for		Av.ht.(cms) of seedlings after			Recommended Pre-sowing
	Commencement of germination (days)	Completion of germination (days)	3 months	6 months	1 year	
1. Acacia albida	15	31	20	30	40	10 minutes in H_2SO_4 (conc.)
2. Acacia aneura	05	32	7	10	15	5 minutes in H_2SO_4 (conc.)
3. Acacia cyanophylla	10	21	10	15	20	10 minutes in H_2SO_4 (conc.)
4. Acacia cyclops	14	30	20	30	40	10 minutes in H_2SO_4 (conc.)
5. Acacia senegal	2	23	20	30	40	30 minutes in H_2SO_4 (conc.)
6. Acacia tortilis	7	16	25	30	40	30 minutes in H_2SO_4 (conc.)
7. Acacia victoriae	5	32	30	45	65	20 minutes in H_2SO_4 (conc.)
8. Albizzia procera	5	21	15	20	30	30 minutes in H_2SO_4 (conc.)
9. Cassia fistula	3	28	15	20	30	30 minutes in H_2SO_4 (conc.)
10. Ceratonia siliqua	10	39	10	15	25	30 minutes in H_2SO_4 (conc.)
11. Cupressus arizonica	5	35	15	25	35	15 minutes in H_2SO_4 (conc.)
12. Elaeagnus hortensis	18	40	15	20	30	30 minutes in H_2SO_4 (conc.)
13. Gleditschita triacanthos	5	32	15	20	30	30 minutes in H_2SO_4 (conc.)
14. Maeruva crassifolia	28	45	10	15	20	30 minutes in H_2SO_4 (conc.)
15. Pistacia khinjuk	10	75	15	20	25	15 minutes in H_2SO_4 (conc.)
16. Prosopis juliflora	6	45	10	15	20	30 minutes in H_2SO_4 (conc.)
17. Reptonia buxifolia	15	60	10	15	20	30 minutes in H_2SO_4 (conc.)
18. Sapindus mukorossii	15	45	15	20	36	15 minutes in H_2SO_4 (conc.)

At the end of the treatment period, copious amount of water should be added immediately to dilute the acid as quickly as possible, reduce the temperature, and avoid splattering. Washing the seed for 30 minutes with running water to remove all traces of acid is essential. The seeds can either be planted immediately when wet, or dried and stored for planting when required.

Cold and Hot stratification

Yet another method to activate dormant embryo or to help after-ripening of embryo is moist stratification done at temperature varying from 0-10°C and for a period of 30 to 120 days. Seed is placed in-between the moist layers of sterilized sand, alternating seed and sand in wooden frames. In some cases cold stratification is followed by warm stratification. The seed should be sown immediately after taking it out of stratification.

It is important to remember that all seeds exposed to pre-sowing treatment should be tested for existence of live embryos and germination percent. If the embryo is dead, no method of seed treatment will help.

Acknowledgement: Information for this brochure has been collected from Tree Seed Notes, FAO Forestry Development Paper No.5, Tree planting Practices in Tropical Asia, and FAO Forestry Development Paper No.11. However most of the material has come from the author's own publications and experience on the subject.

MIS:ha

Additional copies of technical note No. 6. are available at Winrock International. Forestry Planning and Development Project GOP-USAID, F-7/2, 58 - Margalla Road, Islamabad.