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**GUIDELINES FOR
ORDERING TREE SEED**

*by
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DANIDA FOREST SEED CENTRE



Norway's International
Climate and Forest Initiative
(NICFI)

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Danida Forest Seed Centre (DFSC) is a Danish non-profit institute which has been working with development and transfer of know-how in management of tree genetic resources since 1969. The development objective of DFSC is to contribute to improve the benefits of growing trees for the well-being of people in developing countries. DFSC's programme is financed by Danish International Development Assistance (Danida).

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1. INTRODUCTION

These guidelines are general and their relevance is not limited to seed procurement from Danida Forest Seed Centre.

Some seed buyers may know exactly what they want to order and how to do it, while other buyers know less about what is relevant or useful to know in connection with ordering tree seed. However, even experienced seed purchasers may find something of interest.

The guidelines may be too general to answer a specific question, but readers are always welcome to contact DFSC for further information.

2. POINTS TO CONSIDER

2.1 End Use

It is very important to know what the plants/trees are to be used for before tree seed is ordered. Some trees provide timber, some fuel or fodder, while others may be appropriate for shelter or for fighting desertification. Some tree planters may want to establish seed or conservation stands, others provenance or progeny trials.

Therefore, the purpose for which the trees are to be used should be made quite clear.

2.2 Tree Species

Usually a number of tree species can fulfil the purposes in question.

If both indigenous and exotic species are relevant, it may be safest to choose an indigenous species. Indigenous species have shown their ability to grow in the region and the local risk of pests and diseases is better documented. However, documentation of successful performance of exotic species may make you choose such species. If seed of an exotic is to be ordered from abroad, quarantine measures or special permissions may be necessary (cf 2.9 Restrictions).

Researchers may have tested a number of so-called provenances of the species you are interested in. It is worth investigating the results as there may be significant differences between the performance on different sites. Advice should be sought either with national or regional seed centres (some addresses are given in appendix 2) or with reliable seed dealers.

If you already know the tree species you want to order, make sure that the name of the species is a generally accepted one. If you only know the local name, you must contact someone who knows or can look up the proper Latin or botanical name of the species. Otherwise you may receive a wrong species and this can have serious consequences.

2.3 Planting Site

Through generations, trees have evolved to become better suited for the area where they live naturally. Some species have evolved in the tropics and can grow well only there, while other species grow well in other climates. This means that trees develop differently in different climates and on different planting sites, therefore it is important to know where the plants/trees are to be grown.

Some tree species have a wide natural distribution and many of these have developed provenances, which are groups particularly suited for the region where they grow naturally. This means that it is important to purchase seed from areas where growth conditions are as similar as possible to the area where the plants/trees shall grow in the future.

Growth conditions relate to temperature, rainfall, and light (day length), but they also cover soil characteristics, though these are of less importance than climatic ones.

Therefore, when you order seed, state as accurately as possible the following data of future planting site: altitude; longitude; latitude; annual rainfall; length (and time of the year) of possible dry period(s); and any particular or extreme character of the soil (clay or sand; pH; salinity; slope; drainage; aspect). You may also state which other species are planted at or grow near the planting site.

It is not realistic to procure seed particularly suited for all provided data, but the more information you are able to state, the more likely it will be that the supplier can provide seed that will develop successfully.

2.4 Seed Quality

When we talk about the quality of the seed, we think of both physiological quality, which covers the state of health of the seed, and the genetic quality, which covers the properties that the seed has inherited from the parent trees.

The **physiological** quality of a seed is usually revealed in a germination test or a staining test with tetrazolium chloride. Both require laboratory facilities. To get an immediate idea of physiological quality, note these points: (1) the seeds should be clean (without dirt, leaves, twigs or fruit flesh); (2) there should be no insect holes or fungi; (3) the seeds must appear intact and without cracks in the seed coat; (4) the embryos should look firm and healthy and there should not be many empty seeds in the seed lot.

When seed is bought from seed dealers, results from germination tests, moisture contents and number of living seeds per kg should be documented. High moisture content in orthodox seed (cf. 2.7 Seed Handling) may indicate bad quality.

It cannot be avoided that seed lots undergo some degree of deterioration during storage. Therefore young seed lots should preferably be chosen.

In order to show the inherent/**genetic** qualities the seed must usually be grown into large plants or trees. As this is a lengthy affair, it is very important that information on the seed is available with the seed lot.

It should be known what the trees are suited for; the home area (origin) of the parent trees should be known to make sure that seed source matches future planting site; it should be known what kind of mother stand the seed lot has been collected in, e.g. from many trees, from single or isolated trees, from a 'selected' stand with generally good looking and well growing trees or from a number of trees of mixed form and health.

To have good **genetic** quality the seed lot should (1) be suited for the purpose of tree planting, (2) be suited for the planting site, i.e. come from a similar climate or have proven suitable under similar conditions, (3) come from not less than 25-50 mother trees, and (4) come from average or better than average trees in a good stand. Crooked trees along roadsides may be of below average genetic quality and should in general not be used.

2.5 Cost of Seed

A number of expenditures are necessary for establishing a tree stand. Of these the cost of the seed makes up only a very small amount, while the majority is made up by clearing and soil treatment of the planting area; sowing and transplanting in the nursery; field planting and weeding etc. The **difference in price** between 'bad' and 'good' seed is usually of no significance for the total amount of establishment cost, whereas buying the cheapest seed, merely because it is cheap, may turn out to be very costly in the long run.

Getting hold of the best possible seed is money well spent. The 'best' covering (1) the most appropriate for the end use, (2) the best genetic quality and (3) the healthiest.

The price should also relate to the number of living seeds per kg. As mentioned above in section 2.4, seed lots inevitably undergo some degree of deterioration, which means that older seed lots of the same kind should usually be cheaper than younger ones (in spite of the fact that extra storage costs are involved).

2.6 Amount of Seed

It may be difficult to estimate how much seed to order as seed weight and viability vary greatly. It may be easier to calculate how many seedlings/nursery plants one would like to end up with or how large an area the seed should be sufficient for. When the buyer informs the seed dealer of number of required seedlings or size of planting area, the seed dealer can calculate the necessary amount of seed based on seed purity, seed weight, expected loss in nursery and during transport, and expected amount for replacement in the field ¹⁾.

If the seed is to be used for seed research, both seed weight and number of seeds needed should be stated.

If you want to try out a species that has never been grown in your local area, it should be tested in a pilot planting first.

2.7 Seed Handling

Seeds are living organisms and must be treated with care, otherwise they may suffer external or internal damage. The seed should not be thrown about or injured in any way, and it should be kept under appropriate conditions, which for most species means that they are kept cool and dry.

Orthodox seeds, e.g. seeds of pines and eucalypts, can be stored for years if they are dry and kept under cool conditions. For these seeds, a rule of thumb applies that the mean viability period of the seed will double each time storage temperature is lowered 5 degrees (between 50°C and 0°C) and each time moisture content is lowered 1 % (between 14 and 5 %).

¹⁾ Examples: purity may be 90 %; germination 75 %; nursery mortality 50 %; mortality in the field to be replaced 20 %, but great variation is experienced.

However, many tropical tree seeds are recalcitrant. This means that they do not tolerate drying and tropical recalcitrant seeds usually do not tolerate temperatures below 15°C. These seeds should be kept at minimum 15°C, at high humidity and with good aeration, as the seeds respire and need oxygen. Recalcitrant seeds should be sown as fast as possible after collection.

Ask your seed supplier if any pretreatment before sowing is necessary and how the seeds should be stored. If you collect seeds yourself and cannot find information about storage conditions, you must make your own experiments to find out how the seeds should be handled. If the seeds are relatively small and dry when they are collected, there is a good chance they are orthodox. If they are relatively large and have a high moisture content, they might be recalcitrant.

Some seed, e.g. of some pine species, requires the supply of specific microsymbionts for successful growth. Ask your seed dealer to supply any necessary microsymbiont inoculum.

2.8 Time of Delivery

It is important that seedlings are transplanted into the field at the proper time of the year, mostly with regard to the rainy season(s). Therefore seed should be delivered in good time for the seed to be sown and to develop into plants of plantable size, which again means that seed should be ordered well in advance.

Another reason for ordering well in advance is the better chance of the dealer having the wanted seed in stock. If seed is not immediately available, additional seed collection or seed purchase from other sources will be necessary. As most trees only bear fruit at certain times of the year, this may take many months. It may even take years as some tree species only have good fruit crops at years' intervals. So, in some cases it is quite reasonable to order seed several years in advance.

For recalcitrant seed, which cannot be stored, it is particularly important to order well in advance as seed dealers do not have these in stock.

2.9 Restrictions

The quarantine authorities in your country may require an import permit for seed bought abroad. This should be applied for well in advance and sent to the seed supplier. There may also be restrictions on import of certain seed because of the risk of pest and diseases, which means that a phytosanitary certificate has to be acquired.

For recalcitrant seed, it is particularly important to avoid delay in customs. Therefore check with the authorities which documents are needed for seed import.

Questions of intellectual property rights, access to genetic resources and patenting have become issues of political importance at international level. In response to this, it is getting more and more common that a signed 'Material Transfer Agreement' (MTA) is required by the seed supplier. MTAs define future intellectual property rights or plant variety rights over the plant genetic resources. MTAs may take a variety of forms depending on the intentions of the seed supplier. As one extreme they may be designed to avoid future intellectual property rights over the material and as another extreme they may be designed to encourage patenting and describe how benefits from such actions should be divided. MTAs are commonly used both for commercial seed trade and for seed which is supplied for research purposes, and may as such cover both donor/recipient and buyer/seller relationships (see example in appendix 3).

2.10 Seed Supplier

As you can understand from the above, it is of great importance to order your seed from a reliable seed dealer. To be able to identify the right seed dealer, contact your national or regional tree seed centre, who may be able to supply seed or have experience with local seed dealers; or go through 'Tree Seed Suppliers Directory' issued by ICRAF; also, seed dealers can be asked to send their catalogues, and those providing most information on the seed are usually the most serious ones. However, it is usually a good idea to seek the advice of colleagues or national seed-centre staff, who may know the seed dealers and have experienced how serious and reliable they are.

2.11 Documentation

Seed suppliers should be able to document 1) seed species, origin and provenance; 2) collection data (when, where and from how many trees); 3) germination percentage and moisture content and 4) state of health i.e. lack of pests and diseases.

Seed users should keep a seed register with information on the seed received, name of supplier, how it is treated, and how well it germinates and develops.

The information may be important later; e.g. if a seed lot gives good results, more seed of the same kind may be ordered; and if the results are poor, it will be equally important to avoid ordering the same again. Also it is important to register the results of the treatment applied to the seed.

3. REFERENCES

Literature on seed biology and chemistry of tropical tree species is quite limited. Below you will find some suggestions for useful literature.

Articles on tropical tree seeds are frequently published in the journals 'Seed Science and Technology' and 'Seed Science Research'. If you look for information on specific species, 'Seed Abstracts' issued by Commonwealth Agricultural Bureau are useful.

FAO 1983. Guidelines for Seed Ordering. In: Forest Genetic Resources information no. 12, (p. 30-31). FAO, Rome.

FAO 1987. Information to be provided when ordering seed for experimental purposes. In: Forest Genetic Resources information no. 15, (p. 26). FAO, Rome.

ICRAF (Kindt, R. with Muasya, S., Kimotho, J. and Waruhia, A.) 1997. Tree seed suppliers directory: sources of seeds and microsymbionts. Nairobi: International Centre for Research in Agroforestry.

Lauridsen, E.B. 1994. Seed Documentation. DFSC Lecture Note C-13. Danida Forest Seed Centre, Humlebaek, Denmark.

Poulsen, Karen and Thomsen, Kirsten 1999. Seed Handling Manual. Guidelines and Logbook for Seed Processing. DFSC Technical Note No. 54. Danida Forest Seed Centre, Humlebaek, Denmark.

Schmidt, Lars 2000. Guide to Handling of Tropical and Subtropical Forest Seed. Danida Forest Seed Centre, Humlebaek, Denmark.

Willan, R.L. 1995. International Transfer of Forest Seed. DFSC Technical Note No. 35. Danida Forest Seed Centre, Humlebaek, Denmark.

Summary of Three Steps for Ordering Tree Seed

1. Questions to be answered before seed is ordered

What is the purpose of the tree planting in question?

Which tree species can fulfil the purpose?

Which of these species have been tried locally before with success, or are some of them indigenous?

Where can we get information about relevant species, seed sources etc?

Do we know reliable seed dealers or who can advise us?

2. What to remember to include in the seed order

Full address of seed buyer, incl. telephone, e-mail, fax, airport, port, railway station etc.

Accepted name of tree species, possibly also subspecies and provenance

Details of planting site

Amount of seed; number of required seedlings or area to be planted

Required time of seed delivery

Information on possible storage facilities

Information on necessary official documents (import permit, phytosanitary certificate etc.)

Cost and conditions of payment

3. What should be done in connection with receipt of seed

Preparations made for germination (and possible pretreatment) or storage

Receipt acknowledged with information on the state of the seed on receipt

The supplier informed of any shortcomings as soon as they are realised

All available information on the seed lot entered into a seed register

Payment arranged according to agreed conditions

SUPPLIERS AND ADVISERS

International Centre for Research in Agroforestry (ICRAF) has issued 'Tree Seed Suppliers Directory: sources of seeds and microsymbionts'. It is currently being updated and can be found on the following web site: www.cgiar.org/icraf/inform/inform.htm

National or Regional Tree Seed Centres

Please note that not all of these centres supply seed, but they may be able to advise you about reliable seed suppliers.

Australia and Oceania

Australia:	Australian Tree Seed Centre P.O. E 4008 Kingston Canberra ACT 2604	e-mail: atsc@ffp.csiro.au www.ffmpeg.csiro.au/tigr/atsemain
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Papua New Guinea:	National Tree Seed Centre P.O. Box 87 Bulolo
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Asia

Cambodia:	Cambodia Tree Seed Project Department of Forestry and Wildlife, 40 Norodom Blvd Phnom Penh.	e-mail: ctsp@bigpond.com.kh
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India:	Tropical Forest Research Institute P.O. – R.F.R.C. Mandla Road, Jabalpur 482 021	e-mail: tfri-dir@x400.nicgw.nic.in
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Indonesia:	Indonesia Forest Seed Project Taman Hutan Raya Ir. H. Juanda Dago Pakar, Bandung 40198	e-mail: ifsp@indosat.net.id
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Laos:	Indochina Tree Seed Programme Lao Tree Seed Project P.O.Box 9111, Vientiane	e-mail: andersj@loxinfo.co.th
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Malaysia:	Seed Centre, Forest Research Institute Kepong, Selangor, 52109 Kuala Lumpur	e-mail: baskaran@frim.gov.my web site: www.frim.gov.my
	Seed Centre, Forest Research Centre P.O. Box 1407, 90715 Sandakan, Sabah	

Nepal:	TISC/NARMSAP GPO Box 6055 Hattisar, Naxal, Kathmandu	e-mail: tisc@mos.com.np
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Pakistan:	Forest Seed Centre Garhi, Dopatta Mozaffarabad, Ajk	
Philippines:	FRD PICOP Tabon, Bislig Suriagao Sur 8311	e-mail: tqadri@mail.asiandevbank.org
Thailand:	ASEAN Forest Tree Seed Centre Muak Lek District 18180 Saraburi FORGENMAP Royal Forest Department Silvicultural Research Division 308 Phaholyotin Road 61 Chatuchak, Bangkok 10900 Northern Forest Seed Centre Ngao, Lampang 52110	e-mail: ssaelim@hotmail.com e-mail: forgen@forest.go.th e-mail: verapong@lpg.cscoms.com
Vietnam:	Indochina Tree Seed Programme Vietnam Tree Seed Project 62 Cau Dien Township Tu Liem, Hanoi	e-mail: itsp@fpt.vn
Latin America		
Argentina:	Area Forestal Instituto Nacional de Tecnologia Agropecuaria Av. El Libertador 2472 (3384) Montecario, Misiones.	
Bolivia:	Centro de Semillas Forestales P.O. Box 5453, Cochabamba	e-mail: renaser@pino.cbb.entelnet.bo
Brazil:	Instituto de Pesquisas e Estudos Florestais CP 530, CEP 13400-970 Piracicaba – SP.	e-mail: petsanto@jatoba.esalq.wsp.br
Costa Rica:	Banco Semillas Forestales CATIE/PROSEFOR 7170 Turrialba	e-mail: rsalazar@computo.catie.ac.cr web site: www.catie.ac.cr
Guatemala:	Banco de Semillas Forestales 7 a Avenida 7 00, Zona 13 Guatemala City	
Honduras:	Banco de Semillas ESNACIFOR Aptdo 45, Siguatepeque SETRO. S de R.L. P.O. Box 116, Seguatepeque	e-mail: esnabase@sdnhon.org.hn e-mail setro@hondutel.hn web site: www.setros.com

Nicaragua: Banco de Semillas Forestales y
Mejoramiento Genetico
Aptdo 630, km 79,
Carretera Leon, Leon

IRENA
Aptdo. 5123, Managua

Peru: Banco Nacional de Semillas
Natalio Sanchez 220
CF 402 Jesus Maria, Lima

Africa

Botswana:	Botswana National Tree Seed Centre Private Bag 003, Gaborone	e-mail: bntsc@info.bw and patmut@hotmail.com
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Burkina Faso:	Centre National de Semences Forestieres B.P. 2682 Route de Kaya Ouagadougou 01	e-mail: cnsf@fasonet.bf
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Eritrea:	National Tree Seed Programme Research and Extension Division P.O. Box 4627, Asmara	e-mail: thomson@eol.com.er and research@eol.com.er
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Ethiopia:	Forest Research Centre National Tree Seed Project P.O. Box 30708, Addis Abeba	e-mail: frc@padis.gn.apc.org
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Kenya:	Muguga Regional Forestry Research Centre Kenya Forestry Seed Centre P.O. Box 20412, Nairobi	e-mail: kefri@arcc.or.ke
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Lesotho:	National Tree Seed Centre P.O. Box 774, Maseru	
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Madagascar:	Silo National des Graines Forestieres B.P. 5091, 101 Antananarivo	
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Malawi:	Forestry Research Institute of Malawi Tree Seed Centre P.O. Box 270, Zomba	e-mail: frim@malawi.net and web site: www.fstcu.org
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Mozambique:	Centro de Sementes Florestais Centro de Experimentação Florestal DNFFB, Ministerio da Agricultura C.P. 1406, Maputo	e-mail: cefdnffb@teledata.mz
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Namibia:	SADC Tree Seed Centre Network P.O. 50295, Windhoek	
	National Tree Seed Centre P.O. Box 396, Okahandja	e-mail: nfrc@iafrica.com.na
Niger:	Centre National de Semences Forestières B.P. 578, Niamey	e-mail: direnv@intnet.ne
Nigeria:	Seed Store Unit Forestry Research Institute P.M.B. 5054, Ibadan	
Senegal:	PRONASEF km 20 Route de Ruffisque B.P. 3818, Dakar	
South Africa:	Tree Breeding/Seed Centre P.O. Box 69; 1260 Sabie	
Sudan:	National Tree Seed Centre P.O. Box 7089, Soba, Khartoum.	e-mail: efcdmasl@sl.t.lk
Swaziland:	SADC TSCN Regional Office East P.O. Box 162, Mbabane	
Tanzania:	National Tree Seed Programme P.O. Box 373, Morogoro	e-mail: ntsp@twiga.com web site: www.twiga.com/ntsp
Uganda:	National Tree Seed Project P.O. 23899, Kampala	e-mail: treeseed@swiftuganda.com
Zambia:	National Tree Seed Centre Forest Research Division P.O. Box 22099, Kitwe	e-mail: sadctscn@zamnet.zm
Zimbabwe:	Forestry Research Centre Seed Centre P.O. Box HG 595, Highlands, Harare	e-mail: frchigh@internet.co.zw

Example of a Material Transfer Agreement

Danida Forest Seed Centre

Since the establishment of Danida Forest Seed Centre¹ (DFSC) in 1969, the centre has been involved in collection of forest tree seed throughout the tropics in collaboration with national institutes, FAO and other partners. DFSC supports free exchange of tree seed and information between researchers and practitioners, and seed stored at the DFSC seed-bank is available, free of charge, for species and provenance trials, establishment of seed sources, conservation stands and research purposes. DFSC encourages the sustainable use and the fair and equitable sharing of the benefits arising from utilization of its seed.

The majority of the seed in the DFSC seed bank has been collected prior to the United Nations' Convention on Biological Diversity (CBD) of 29th December 1993 coming into force. Seed acquired after this date was collected with prior consent from the country of origin and with the understanding that it could be made available for any research or breeding purposes.

Seed can only be issued by DFSC if the recipient complies with the conditions specified in this agreement, regardless of whether the seed was collected before or after the above mentioned date.

Rules for the future exchange of germplasm for food and agriculture are currently being discussed in the FAO Commission on Plant Genetic Resources, in co-ordination with the Conference of the Parties to the Convention on Biological Diversity. Depending on the results of these negotiations, the contents of this material transfer agreement may be changed in the future to conform to a revision of FAO's International Undertaking on Plant Genetic Resources and/or to internationally agreed standards.

In the meantime, DFSC grants delivery of seed from its seed bank under the conditions specified overleaf.

¹ Danida Forest Seed Centre is an institution under the Danish International Development Assistance (Danida), the Ministry of Foreign Affairs. DFSC is a non-profit organisation.
Contact details: DFSC, Krogerupvej 21, DK-3050 Humlebaek, Denmark. Phone +45 49190500.
Fax +45 49160258, Email: dfsc@dfsc.dk

The recipient hereby agrees

- not to claim ownership nor to seek intellectual property rights or plant variety rights over the genetic material received or material derived hereof, unless in agreement with the appropriate authority in the country of origin;
- to ensure that any person or institution to whom it makes samples subsequently available is bound by the same provisions and undertakes to pass on the same obligations to future recipients;
- to make publicly available any relevant performance data produced by the recipient arising from the characterization and evaluation of the received material;
- to assume full responsibility for complying with the recipient nation's quarantine and biosafety regulations and rules governing the import or release of genetic material;
- that Danida Forest Seed Centre does not accept liability for any consequences resulting from the use of the seed.

Please note that seed will only be issued by DFSC upon receipt of a signed copy of the MTA

Name of person or institution
requesting germplasm:

Full address

Signature

_____ Date _____

Name and position



PATSPO/ICRAF Office c/o ILRI Campus, Gurd Shola
P.O. Box 5689, Addis Ababa, Ethiopia
Phone: 251-116172000 ext. 2491
Email: K.Hadgu@cgiar.org

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