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Mark P. Widrlechner
United States Department of Agriculture, isumw@iastate.edu

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SEED STORAGE FOR THE COMMERCIAL PROPAGATOR[1]

MARK P. WIDRLECHNER

United States Department of Agriculture—
Agricultural Research Service
North Central Regional Plant Introduction Station,
Iowa State University
Ames, Iowa 50011

INTRODUCTION

Commercial propagators routinely produce a diverse mix of seedlings, yet the volumes of the *Proceedings of the International Plant Propagators' Society* have remarkably little advice on seed storage. Most propagators plant freshly-collected seeds or store seeds only briefly before planting. But there may be advantages to storing seeds for future use. This report will consider some of those advantages, summarize pertinent reports on seed storage for landscape plants, and present some personal experiences with germination of stored seeds.

ADVANTAGES OF SEED STORAGE

For plants that are normally propagated from seeds, seed storage allows propagators to overcome year-to-year fluctuations in seed production. Many species, such as apples, oaks, and pines (12), produce good seed crops at irregular intervals. Seed storage may also be used to spread out the production of plants from seed lots of especially high quality or from those that are difficult to reobtain.

For species that are normally propagated vegetatively (excluding cultivars), storage can preserve seeds that may eventually be grown to replace diseased or declining stock plants. Some viral diseases are not transmitted by seed (16), and periodic replacement of stock plants with new seedlings may improve propagation success, not only by reducing disease, but also by restoring juvenility (2). Stored seeds can also serve the propagator as a bank for generating future genetic variability to develop improved selections.

STORAGE CHARACTERISTICS

Though the seeds of different plant species have widely different storage characteristics, seeds of most temperate landscape plants have similar responses to changes in storage temperature and

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humidity. These seeds are said to display "orthodox" (10) storage characteristics. For orthodox seeds, longevity increases with decreasing storage temperature and humidity (at least to 5 to 10% seed moisture) (4).

There are two main groups of temperate landscape plants that have seeds that do not follow the orthodox pattern. "Recalcitrant" (10) seeds quickly lose viability when dried or frozen. It is difficult to store these seeds for more than a few months, even under highly controlled conditions. Many recalcitrant species are tropical, but common examples encountered by the commercial propagator include chestnut, oak, and silver maple (3, 15). The second group is made up of species whose seeds have no dormancy and a short life at temperatures above freezing. This group includes most species of willow and poplar (18). However, these seeds can be stored for up to 3 years at -10 to -20° C (14, 18).

Useful references describing the storage characteristics of seeds of common landscape plants include *Seeds of Woody Plants in the United States* (12), *A Revised Table of Seed Storage Characteristics* (3), and *Seed Manual for Ornamental Trees and Shrubs* (4). Other resources include reports by Plummer *et al.* (9) and Stevens *et al.* (13) for western range plants and by Grzeskowiak *et al.* (5) for rosaceous rootstocks.

PREPARING SEEDS FOR STORAGE

Evaluations of the storage life of seeds of many species have indicated that vigorous seed lots store the best (1). Therefore, a propagator should collect and process seeds for storage under carefully controlled conditions to maximize quality. Seed lots not collected and processed by the propagator may have encountered unfavorable conditions between the time collected and the time received. Samples of seed lots of unknown quality should be germinated before storage is attempted.

Recommendations on seed collection, drying, and cleaning vary by species. Detailed instructions can be found in *Seeds of Woody Plants in the United States* (12), *Collecting, Processing and Germinating Seeds of Wildland Plants* (17), *Seed Manual for Ornamental Trees and Shrubs* (4), and in recent reports by Lee (6), Luke (7), and Schaff (11). One should also note that seed lots destined for storage should not be scarified by using physical abrasion or chemical agents for this will significantly reduce longevity.

IDEAL STORAGE CONDITIONS

Storage of recalcitrant seeds for more than a few months is difficult. *Seeds of Woody Plants in the United States* (12) and *Seed*

Manual for Ornamental Trees and Shrubs (4) both describe techniques for high-humidity storage of such seeds. These same references (4, 12) also give advice on the storage of orthodox seeds. Dried seeds can either be stored in airtight containers, reducing the need for humidity control in storage, or they can be stored in containers that allow seed moisture to equilibrate with the surround air (17). Practical seed storage of landscape plants with orthodox seed storage characteristics can be accomplished under refrigeration (3 to 5 ° C) for periods of up to five years (4). If dried seeds are not stored in airtight containers, the relative humidity of the storage area should be held below 40% (4).

PERSONAL EXPERIENCES

The North Central Regional Plant Introduction Station in Ames, Iowa routinely stores ornamental seeds as part of its germplasm collections. The Station has stored this collection at 4 ° C and 40% relative humidity since the 1950's. Most seed lots of landscape plants were of unknown quality when stored. Over the last 6 years, I have been trying to germinate many of these samples to regenerate populations and to find new materials for the NC-7 Regional Ornamental Trials.

Because stored seed lots may have different germination requirements than do fresh ones (7,8), and given that there are few recommendations for ideal germination treatments for many species I have tested, the failures that I have experienced in germinating stored seed lots may not necessarily reflect their true viability. With that in mind, I would like to share a list of the successes. Table 1 lists species that have been germinated from seed lots stored at least 5 years, along with the germination percentage, if it could be calculated. In some cases, the date when the seed lot was collected is known. If the collection date is unknown, the date received was noted. Such seed lots are actually older than indicated in Table 1. Table 1 is a diverse list with the legume and rose families well represented. The longevity of hard-seeded legumes is widely documented (12), but the ultimate longevity of many of the other species is unknown.

Table 1. Species whose seeds are successfully germinated after storage for at least 5 years.

Species	Sample year	Germination year	Percent germination
Acer campestre	Received 1975	1986	1
Amelanchier ovalis	Collected 1975	1986	15
Caragana arborescens	Received 1972	1987	26
Celtis australis	Collected 1975	1984	60
Celtis caucasica	Collected 1959	1987	24
Celtis sp.	Collected 1959	1987	4
Cercis canadensis	Collected 1971	1984	62
Crataegus monogyna	Collected 1969	1986	34
Crataegus laciniatus [syn. *C. orientalis*]	Collected 1969	1986	1
Crataegus pinnatifida	Collected 1960	1987	1
Cytisus commutatus	Received 1966	1984	unknown
Cytisus decumbens	Received 1966	1984	unknown
Fraxinus anomala	Collected 1984	1989	64
Fraxinus ornus	Received 1976	1984	71
Hovenia dulcis	Received 1981	1987	25
Jamesia americana	Collected 1984	1990	unknown
Ligustrum vulgare	Received 1975	1985	unknown
Ostrya carpinifolia	Received 1974	1987	5
Petteria ramentacea	Collected 1975	1984	unknown
Physocarpus opulifolius	Received 1966	1986	1
Pinus bungeana	Received 1981	1987	6
Pinus nigra	Received 1975	1984	unknown
Rhamnus sp.	Received 1974	1986	3
Staphylea colchica	Collected 1971	1988	8

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LITERATURE CITED

1. Delouche, J.C. and C.C. Baskin. 1973. Accelerated aging techniques for predicting the relative storability of seed lots. *Seed Sci. & Technol.* 1:427-452.

2. Dirr, M.A. and C.W. Heuser, Jr. 1987. *The Reference Manual of Woody Plant Propagation: From Seed to Tissue Culture.* Varsity Press, Athens, GA. 239 pp.

3. Ellis, R.H. 1984. Revised table of seed storage characteristics. *Plant Genet. Resour. Newsl.* 58:16-33.

4. Gordon, A.G. and D.C.F. Rowe. 1982. *Seed Manual for Ornamental Trees and Shrubs.* Forestry Commission Bull. 59. Her Majesty's Stationery Office, London. 132 pp.

5. Grześkowiak, H., B. Miara, and B. Suszka. 1983. Long-term storage of seeds of *Rosaceae* species, used as rootstocks for cherry, plum, apple and pear cultivars. *Arbor. Kórnickie* 28:283-320.

6. Lee, D. 1987. Seed collection and cleaning. *Proc. Inter. Plant Prop. Soc.* 37:61-65.

7. Luke, A.G.R. 1989. Tree and shrub seed: Warning!—Handle with care. *Proc. Inter. Plant Prop. Soc.* 39:193-199.

8. Norton, C.R. 1987. Seed technology aspects of woody seed germination. *Acta Hortic. (The Hague)* 202:23-34.

9. Plummer, A.P., D.R. Christensen, and S.B. Monsen. 1968. *Restoring Big-Game Range in Utah.* Utah State Div. Fish & Game Publ. 68-3. 183 pp.

10. Roberts, E.H. 1973. Predicting the viability of seeds. *Seed Sci. & Technol.* 1:499-514.

11. Schaff, S. 1988. Mechanical and hand methods for processing seed. *Proc. Inter. Plant Prop. Soc.* 38:141-145.

12. Schopmeyer, C.S. (ed.) 1974. *Seeds of Woody Plants in the United States.* Agric. Handbook 450. US Department of Agriculture, Washington, DC. 883 pp.

13. Stevens, R., K.R. Jorgensen, and J.N. Davis. 1981. Viability of seed from thirty-two shrub and forb species through fifteen years of warehouse storage. *Great Basin Naturalist* 41:274-277.

14. Tauer, C.G. 1979. Seed tree, vacuum, and temperature effects on eastern cottonwood seed viability during extended storage. *For. Sci.* 25:112-114.

15. Tylkowski, T. 1984. The effect of storing silver maple (*Acer saccharinum* L.) samaras on the germinative capacity of seeds and seedling growth. *Arbor. Kórnickie* 29:131-141.

16. Walkey, D.G.A. 1985. *Applied Plant Virology.* Heinemann, London. 329 pp.

17. Young, J.A. and C.G. Young. 1986. *Collecting, Processing and Germinating Seeds of Wildland Plants.* Timber Press, Portland, OR. 236 pp.

18. Zasada, J.C. and R. Densmore, 1980. Alaskan willow and balsam poplar seed viability after 3 years' storage. *Tree Planters' Notes* 31(2):9-10.