Production and Storage of Perennial Seed

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The great majority of perennial seed are specially raised for our company in regions that are particularly well suited for that particular species. Thus, we control and inspect a cultivation network that stretches from north of the arctic circle through the whole of Europe to northern Italy and the northern part of the U.S.A. as well as Chile. Altogether, we have people producing seed for us in 23 different countries. We have no production in tropical or subtropical regions, since we specialize in hardy perennials. With these plants the source (origin) of the seed plays a major role in determining the "hardiness" of the plants.

Sometimes, however, we really do have to seek and find particular seeds. This can be very difficult and may take years — particularly when we need original material from the natural location. Just one example: For many years there was a certain *Campanula raineri* on the market, which actually was not *C. raineri*, but *C. carpatica* var. *turbinata*. A botanist friend of mine from Switzerland searched for the real *C. raineri* in the Dolomites of northeastern Italy and finally found it above 6500 ft on Monte Baldo near Lake Garda. He propagated this species for us in his acclimatization garden at an altitude of some 3000 ft. Thus we've been able to offer seeds of the true *C. raineri* now for the past 14 years. An acclimatization garden is an intermediate station where high alpine plants (that is — those occurring at 6500 ft or higher) can become adjusted to lower altitudes gradually to prepare them for life in the lowlands.

The seed cultivation network that I operate is in the hands of specialists and plant experts — some of them are internationally known. Some parts of the seed harvest arrive to us already well cleaned by the growers. But the main parts of the harvest are still in the seed capsule, and often still with the stems attached. Two and often three of our employees do nothing but clean seeds year round. The dry seed is stored in large bags made of absorbent paper or in paper sacks. These bags are very practical and they are also used to transport the seed during harvesting.

Until the seeds are cleaned, they are kept in these paper bags and stored in a special wooden structure with temperature-controlled air circulation. This system is very efficient and keeps the seeds dry. The seeds are cleaned by specially made machines as well as by hand.

We are often working with small volumes of small seeds such as *Cypripedium reginae, Eritichium nanum, C. portenschlagiana, Haberlea, Ramonda, Primula juliae* (true), and others. With such seeds one can't use big machines. After the final cleaning the seed batches are weighed and registered. At this stage, samples are taken for analysis — one for the germination laboratory and one for determining the water content of the seed. These control samples are very important for determining the storage life of the seed as well as determining other necessary treatments that may be needed in the processing of the seed. If the water content is too high we have a simple but effective way for reducing it quickly. A very low water content is essential if the seed is destined for freeze storage. This is a very dependable method for long-term storage, when the seed has been properly treated. One could say that

this is our own "gene bank". For this type of storage the seeds are vacuum-packed and then frozen at -10 to -20C. This is a shock-freezing that takes place within seconds; something that never occurs in nature. Since water expands when it freezes, this would burst the cell walls and kill the seed. In nature, the freezing procedure takes place much more slowly, so that the expanding water has time to diffuse through the porous cell walls, thereby establishing a pressure equilibrium. Due to this osmotic pressure within the seed cells, the seed doesn't freeze until the outside temperature is down to about -5C. Chemical processes in the seed continue until they reach the critical freezing point. Thus, the temperature for germinators can be reduced to -4C. The Ranunculaceae typically have a higher osmotic pressure in the seed, and therefore, need a somewhat lower temperature during the cold period. But if the seed is frozen at -8C, then it is in a preserved state that no longer has any effect on the germination of the cold germinator! We store the seeds of certain species in a refrigerator at 3C. These are mostly seeds that have a naturally high water content that cannot be reduced without damaging the seed. Yet other seeds are stored in water in a refrigerator and are delivered moist (or wet) to our customers. These are mostly the seeds of water plants. All seed not stored in the freezing-storage or refrigerator are stored in a special climatically controlled chamber with constant humidity and temperature. After the cleaned batches have been checked for germination ability and water content, they are stored.

From the storage room we have a continual supply of seed for the weighing room. In the weighing room some species are kept in special jars. These jars guarantee that the seeds remain dry, despite repeated opening of the jars. There is a compartment built into the stopper, which contains silica gel — sometimes called "blue gel". The compartment has a porous bottom that allows the silica gel to immediately absorb moisture that enters when the jar is opened. When the silica gel has become saturated with moisture, it loses its blue color, and it is then replaced.

Keeping the seeds uniformly dry is very important for their viability and later germination energy. When the humidity is continually changing, the seed must repeatedly absorb water and then evaporate it again through its membranes when the air becomes drier again. This causes "stress" for the seed. Stress affects the seed just like it affects us — it weakens the constitution and shortens life expectancy.