HOW TO OVERCOME SEED DORMANCY

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What is Dormancy? When seed is given satisfactory environmental conditions, germination will normally take place. If, however, despite these favourable conditions, germination does not occur and is incapable of doing so until the seed is subjected to different treatment or treatments, the seed is said to be dormant.

Dormancy is a condition of nature which has evolved to ensure the seed's survival, that is to say it will only germinate when the correct environmental conditions occur.

Treatment to remove or prevent dormancy is easier if you consider where the species grows naturally and what type of climatic conditions it is subjected to. This gives you an indication of the possible treatment and handling of the seed to achieve satisfactory germination:

(a) Hot dry conditions tend to produce seeds with very dry and hard seed coats, e.g. *Gleditsia triacanthos.*
(b) Seed from areas that are subjected to long periods of low temperatures tend to need long-term chilling, e.g. *Sorbus aucuparia.*
(c) In seed produced in wet or damp conditions, germination can be impaired by subsequent drying, e.g. *Salix* spp.

Seed may often have more than one type of dormancy and it is important to understand them in order to provide the correct treatment or treatments at the right time and in the correct sequence.

The types of treatments chosen are also influenced by other factors:

Condition of the seed. Has the seed adequate food reserves to enable it to survive through a long type of treatment? Old seed with poor food reserves will often die before treatment is completed and therefore a shorter, perhaps a more complex, treatment would have to be adopted.

Arrival of seed—lack of time. In some cases seed may arrive too late to choose the easiest but longer method of treatment. A different method has to be adopted to reduce the period of treatment if the subsequent seedling is to have an adequate growth period to produce a usable sized plant capable of over wintering. For example, where seed could have been given a warm-moist treatment for 8 weeks or more, acid would have to be considered as an alternative to reduce the treatment time.

Imported seed. Generally late collection and/or over-drying, especially in hotter climates mean dormancies become well and truely formed, making subsequent treatment more difficult and time consuming.

Home collection. Home collection of seed has many advantages, it enables the propagator to choose the optimum time for collection and to provide the right systems of handling to prevent or reduce dormancy.

Time—knowledge. *Many plants will respond successfully to more* than one type of treatment but will vary considerably in the time needed.

For example, *Acer palmatum* seed can be treated with heat and cold to achieve germination the following spring. Alternatively, one can allow nature to provide the treatment which will take a further 12 months.

In many instances it may be more convenient to adopt the longer treatment as it is often easier once continuity is established. There are times, due to crop failure, that the continuity is broken but that can be overcome by adopting the shorter treatment.

The method of seed treatment chosen will depend on the facilities available, the better the facilities the more flexibility one will have *in being able to choose the right method of treatment to obtain the* best results at any given time.

SEED COAT DORMANCY

This can be one of two types, but seed of some species exhibits a combination of both types:

(1) *Hard seed coat.* Seed is able to take up water and oxygen but because of the restrictions of the testa the expansion of the embryo is inhibited and germination will not occur.

(2) *Impermeable seed coat.* Seed is incapable of water uptake and gaseous exchange because of water repellant materials in the coat.

The best techniques will vary from species to species and from year to year. They are governed by the seed size, the relative hardness of the seed coat, and the maturity of each batch of seed. To obtain rapid and more even germination the seed must be subjected to some form of physical or chemical treatment.

Treatments to overcome seed coat dormancy:

Mechanical scarification. This is achieved by agitation of the seed with some form of abrasive material, e.g. grit or coarse sand in a cement mixer or passing it through rollers covered with abrasive material such as sand or emery paper. This is best used for seed with impervious seed coats.

Chipping. As the word implies, this involves the removal of a small part of the seed coat to allow water uptake. It is only practical on

large seeds but can be a useful method with small batches of valuable seed.

Cracking. Hard seed coats can often be cracked without damaging the seed inside, e.g. *Corylus* species lend themselves to this. It can be done with specially developed rollers, or with hammers on a small scale for small batches of valuable seed.

Sulfuric acid treatment. Reduction of the seed coat by the use of acid is an effective method to reduce the time needed to achieve germination but attention has to be paid to ensure that the seed coat is sufficiently broken down without causing damage to the embryo. The length of time to achieve this will vary with each seed batch and from year to year within the same species.

This method is only suitable on dried seed as any trace of moisture will allow the acid to penetrate the testa and destroy the embryo.

Hot water. This can be a very useful technique, which is used on seed where the embryo is dry, e.g., *Robinia, Gleditsia*. If the embryo is not dry it will be killed or damaged during treatment.

The treatment consists of placing the seed in heatproof containers and pouring over them three times their own volume of boiling water. This will break down any organic substances which may be present on the outside of the seed preventing normal water uptake.

The high temperature also causes any air inside the testa to expand and in order to escape it ruptures the micropile which in turn allows water to be imbibed. The high temperature created by the hot water quickly falls preventing damage occuring to the imbibing seed.

Seed is left in the water for a period of 24 to 48 hours. If left for the longer period the water should be topped up with fresh cold water. After this period the water is removed and any seed that has failed to swell up can be carefully sieved out and treated again. The treated seed should be sown immediately or placed in moist peat allowing any further imbibition to take place. At no stage should treated seed be allowed to dry out as germination will be greatly reduced. Within 3 to 4 days of treatment the seed quickly develops, especially under high temperatures. For example, with *Robinia* and *Gleditsia* the radical would have started to emerge and the seed must be sown.

As this is a simple and quick technique it is worth treating samples of seed beforehand with cold and hot water to find out which gives the best results. After 24 hours this will be very apparent.

In some years, when batches contain many soft seeds, cold water will prove more successful, in other batches, hot water may prove the best. On the other hand, if both produced poor results, acid treatment would then be adviseable.

This technique sometimes works well on other species that have dry embryos and cannot imbibe water, such as *Tilia* and *Koelreuteria*.

Heat or warm period. This consists of subjecting the seed to a period of heat in a moist, aerated medium which can be achieved by mixing one part of seed with two parts by volume of moist peat and placing it in a frame, container, or plastic bag. The mixture should be shaken or turned on a regular basis, say once a week, to maintain good aerobic conditions, adding further water to the medium if necessary.

With the use of a glasshouse or a cold frame the energy of the sun can be captured to provide the heat required for treatment; heating cables can be used to top up the heat during cooler periods.

An alternative is to insulate a room and provide a heat source. Fitting a fan maintains an even air heat distribution, which is very important if racks are to be used. A thermostat or probes should maintain the air and media temperatures at the desired levels, normally around 80 °F. The length of heat period required for each species will vary from batch to batch and year to year.

Acid + heat. It may not always be possible to reduce the seed coat to the desired level with the use of acid, in these cases the seed is given a shorter period of moist-heat conditions to complete the treatment.

EPICOTYL DORMANCY

With this type of dormancy, once the seed has received a moist-warm period the radicle will emerge but the plumule cannot emerge until the seed has received a period of cold to enable the epicotyl to develop.

The most practical way to deal with this type of dormancy is to sow the seed before it has received any warm period, into prepared beds outside to allow the root to develop straight. If necessary, provide protection in early spring as germination can occur very early. An example of this is *Viburnum opulus.*

COLD PERIOD DORMANCY

Many plants exhibit a dormancy that can only be overcome by a period of exposure to cold temperatures, usually between 1 and 5 °C. The seed must be fully imbibed otherwise the seed is only being stored; it must be in an aerated condition to allow respiration.

The length of time required will be governed by the depth of dormancy. Some plants exhibit a very shallow dormancy, e.g., *Betula* spp. (2 to 3 weeks). Others may be much deeper, e.g. *Sorbus aucuparia* (12 weeks plus).

When treating any batch of seed some will require less cold than others and therefore will start to grow in advance of the rest. This problem can be reduced with home collection of seed and by keeping each batch separate rather than mixing them together or collecting when the seed is evenly developed.

To find out the optimum duration of cold required, samples of the seed will have to be treated well in advance of the main batch. This is why, when importing seed, it is important to receive the more dormant species early so you can test the seed in advance.

Cold can be provided in two ways:

Naturally. Seed can be stored outside in a growing medium where it is subjected to natural cold and then spring-sowing before germination occurs. Alternatively sow direct in the autumn or early winter and allow it to receive its cold *in situ* over a long period.

Artificially. Seed is placed in an imbibed condition into a domestic refrigerator or cold store. It must be shaken up at least once to keep the medium separated; water should be added if the medium or seed shows signs of drying out.

Cold period dormancy can be reduced with home collection of seed by not drying the seed out after extraction but placing it in moist peat and preventing any further drying and hardening of the seed coat. This technique reduces the subsequent duration of cold required to obtain germination.

IMMATURE EMBRYO

Some plants will produce seed with an immature embryo and in order that germination can take place a period of moist-warm conditions are required to enable this embryo to develop to mature size. Only then can the cold period dormancy be broken—examples of this type of dormancy are found in *Hamamelis* and *Fothergilla*.

OTHER FACTORS

Early collection. As dormancies are formed in the final stages of ripening, provided the embryo is mature, it is possible to collect the seed before these developments occur thus eliminating the problem, e.g. *Daphne mezereum, Carpinus betulus*, and *Viburnum lantana*.

Removal of fruit. Seed should never be treated with its fruit in place as these often contain inhibitors which may take a long time to break down and greatly increase the period of treatment.

Collection and handling. Many problems we have with seed are self-inflicted. With home collection, good timing and subsequent good handling we can reduce many of the problems with which we are faced. Keeping detailed crop records each year over a period of time will provide valuable information enabling one to choose the correct treatment for different species in different conditions.