Another area of concern occurs when individuals attempt to trademark a species or cultivar already in the trade. This approach to protecting a plant is an inappropriate use of the trademark. The International Code of Binomial Nomenclature does not allow a trademark to be applied to a cultivar name. This has the potential of creating litigation in the industry.

There have always been perennial trends. This paper has listed and discussed several notable trends, some good and some bad. Some of the above trends will decrease in importance and others will replace them. However, in the view of this writer, the future of perennials is strong and we will see a perennial industry long into the future.

Perennial Seed Propagation and *Helleborus*©

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WHAT WE KNOW GENERALLY ABOUT PERENNIAL SEED GERMINATION

- Plant selection and breeding can produce seeds that germinate uniformly with normal greenhouse temperatures.
- Normal moist-cold treatments will not do any harm to hardy herbaceous perennial seeds. Fluctuating temperatures can be helpful both in the warm greenhouse and during the moist-cold period.
- Sowing seeds and immediately subjecting them to freezing temperatures below -7 °C (20 °F) will often kill the embryos. Seeds can be subjected to colder temperatures but need a slow acclimatization (Jelitto, 1996).

Dormancy Can Have Various Causes

1) Embryo unripe or physiologically inactive.
2) Seed coat may be mechanically difficult to penetrate: impermeable to water and gases (i.e., oxygen).
3) Presence of inhibitors (germination inhibiting substances) such as phytohormones — also known as growth regulators, e.g., abscissic acids.

These three types may occur alone or in combination, *Helleborus* seed germination involves a combination of numbers 1 and 3.

SEED PROPAGATION OF HELLEBORES

Introduction. Hellebores are propagated routinely by seeds. The process requires patience and a basic understanding of seed physiology. The seeds, accompanied by a trailing soft membrane called an elaisom (Latin = oil body) — rich in fat, sugar, and protein — are dispersed in late spring and early summer. In nature, ants are lured by this food source, and drag seed to a comfortable resting spot that will hopefully prevent dehydration and keep the embryo alive. At this point the seeds have only rudimentary or undeveloped embryos that require a warm-moist period of ripening followed by a moist-cold period before the initiation of germination.

Germination. Seeds of hellebores should be sown in July and August from the fresh harvest. Seeds are best sown in deep 6½ cm (2½ inch) deep open flats in a well-drained growing medium with a pH 5.8–6.8. Lightly cover the seeds. For the next 6 (minimum) to 12 weeks (better), the seed flats must be kept moist and experience a range of 60–85 °F temperatures. If conditions are too dry, they will die. Adequate soil moisture is essential during the entire warm and cold periods. Some years may require the warmer period extending the full 12 weeks. Indeed, the lengthier warm period may help, and cannot hurt. During this initial warm period the rudimentary embryo develops and — at the same time — produces abscissic acid (ABA) and other inhibiting substances. (Twenty-five inhibitors are known today in the plant world, and can occur alone or in combination.) These are stored in the ripened embryo. The seeds are mature enough now for germination but are principally hindered by ABA which is eventually replaced by gibberellic acid (GA) during the cold-moist phase. There is little need for light at this stage, nor is there any need for fertilizer.

The 2nd phase requires cool temperatures of -5 to 4 °C (25 to 40 °F) for 4 to 10 weeks. Again, it is safer to presume the benefit of the longer cooling period. Cooler autumn and early winter temperatures are usually accommodating. The moist-cold period encourages the metabolic production of GA, and also auxins and cytokinins. These three phytohormones are necessary for inititiating germination once the temperature goes above 4 °C (40 °F). The ABA is not directly converted to GA but helps to produce this out of enzymes, phenol, acids, proteins, and flavones. Cytokinins and auxins are similarly produced. Other substances, not as strong as ABA, like alkaloid, aldehyde, benzoic acid, coumarin, ethylene, and xanthoxin — among others — also inhibit perennial seed germination. When these substances, and most of the ABA, are broken down, and the temperature is suitable, GA helps start the embryonic shoot cells. Simultaneously, auxins extend the cells and cytokinins divide them. Germination will not commence if any of the three is missing. Subsequently, auxins help stimulate root development and cytokinins assist bud development.

Be careful not to suddenly expose the flats to extremely cold temperatures. Seeds can be subjected to colder temperatures but this needs be done gradually, as in nature. Unlike most herbaceous species, members of the Ranunculaceae family can withstand colder temperatures to – 7 °C (20 °F) but if temperatures go any colder, the chemical process can be frozen, thus delaying the metabolism until the temperature is raised again. (Note: these colder periods (below 20 °F) cannot be counted in the 4- to 12-week moist-cold requirement.)

The dormancy in the genus *Helleborus* is a little different in various species. *Helleborus niger* has a deeper dormancy. Germination inhibitors are easier to overcome in *H. argutifolius, H. orientalis,* and various hybrids. These latter may not need the extended cold period or temperatures colder than -2 °C (28 °F). As the seeds develop on the mother plants they are influenced by the phytohormones and enzymes that are affected by the site, light, and moisture — changing constantly until maturity.

In the weeks preceding germination cover the seeds with a thin (¼ inch) layer of medium vermiculite to reduce the likelihood of liverworts. Germination can begin at 4 °C (40 °F) and will continue as temperatures gradually rise to 10 °C (50 °F) between December and April. Natural light is adequate. Do not be tempted to rapidly raise temperatures; raise them gradually. A sudden return to seed dormancy can occur if temperatures increase suddenly. Newly germinated seedlings can die and developing seeds can be fooled into thinking it is mid-summer and ABA once again reclaims the receptors.

Furthermore, if seeds are not given adequate warm and cold temperatures, a second warm and cold period might be necessary. Indeed, if this is required, it will be absolutely necessary to provide a 2nd cold period of 10 weeks or more.

Transplanting should commence while the seedlings are still in the cotyledon stage. Prick-out the seedlings as they emerge. Hellebores can withstand early transplanting into 1¾ inches (4.5 cm) deep 70 cells or larger. A larger profile 3½ inch (9 cm) deep may prevent chloritic root tips (Seidler, 2004). Seedling roots can elongate very quickly, so transplanting should be done early on. Again, use a well-drained medium including trace elements. Begin fertilization 3 to 4 weeks following transplanting with a constant feed of 100 ppm nitrogen, 10 ppm phosphorous, and 100 ppm potassium.

By mid-April, the cell trays should be 50% shaded and by late spring to early summer will be ready to transplant to 4½-inch (11.5-cm) pots. A slow release fertilizer 13N-13P-13K or 14N-14P-14K can be applied at a rate of ½ tsp per 4½-inch (11.5-cm) pot.

From transplant to salable plant is 8 to 10 weeks. Late winter and early spring flowers are produced the second year following germination.

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