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Back to Basics, Setting Standards for Success with Seed

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Summary

Plug and plant production of native plants is described for North Creek Nursery including seed collection, dormancy treatments, germination and seedling growth. Standard plugs are produced and finished in a variety of sizes including transplant ready Landscape plugs.

INTRODUCTION

North Creek Nurseries was founded in 1989 by C. Dale Hendricks and Steve Castorani. Dale Hendricks retired from the business in 2008. Steve Castorani is the current President and CEO. North Creek employs approximately 85 full time and 5 part time employees, plus a few interns. Annual liner production is approximately 8 million starter plugs. Facilities are spread between two locations, comprising a total growing range of 320,000 square feet. Modern gutter

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connected greenhouses have a full complement of the latest in production and growing technology. Plants continue to be propagated in a series of older Quonset style houses as well. North Creek offers plugs of perennials, grasses, *Carex*, ferns, woody vines, and a few woody shrubs (**Fig. 1**).

Figure 1. shows the product mix by plant collection and items offered in multiple sizes. All plants are grown as plugs in standard plug trays configurations.

Plugs are grown in four sizes that fit an industry standard 1020 tray. Horticultural sizes, which are produced for finished growers are 72's (72/tray) and 50's (50/tray); 72's are a square plug of 3.60 cu inches and the 50's are round with 6.77 cu inches. Landscape plugs [Tm] are LP 32's, round, with a soil volume of 10.07 cu inches and LP 50's, square and tapered with a soil volume of 11.90 cu inches (**Fig. 2**). Landscape Plugs are often grown for use in landscape projects and can also be employed by nurseries to pot up for the occasional quick finish in containers.

Figure 2. Plug sizes produced at North Creek Nurseries.

Production Efforts

Various production methods are utilized at North Creek based on a history devoted to the production of native plants and native plant selections. Seed production figures prominently in these efforts. In many cases, as dictated by projects or customer type, vegetatively produced native plants offered cuttings may be in short supply or not available (**Fig. 3**). Also, certain projects demand genetically diverse, open pollinated, seed sourced material for revegetation and establishment in natural environments to increase biodiversity.

Other production methods include vegetative cuttings from stock or purchased in, divisions of stock plants, tissue culture, and fern plugs purchased from other propagators and grown on into larger plugs. (example: 288 plugs to LP32).

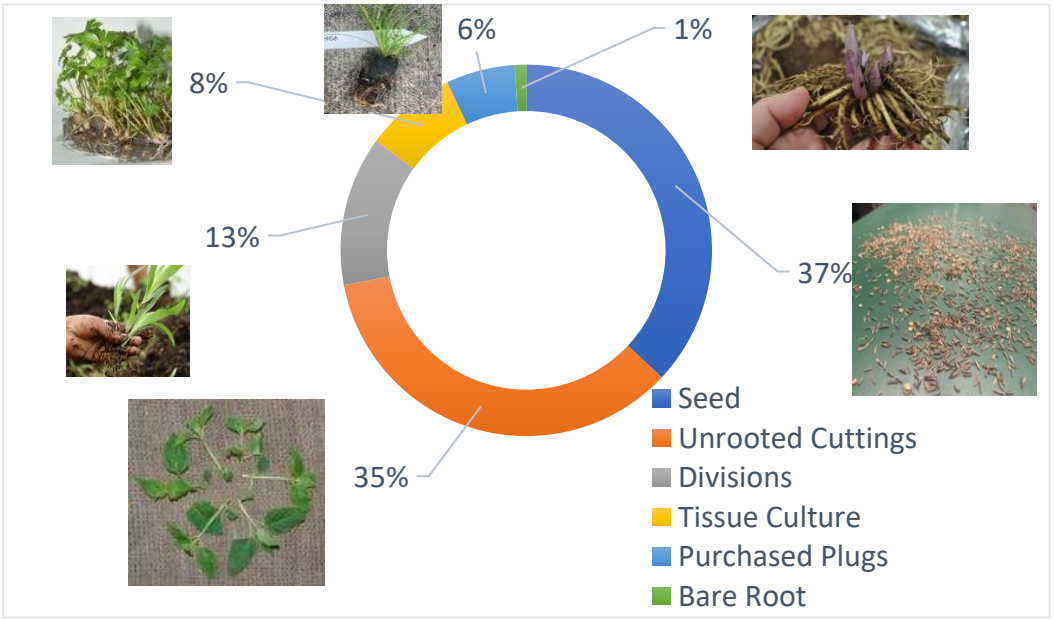

Figure 3. Percentage of production by type.

Seedling Production Data

Seedling production details include:

- 426 total product SKUs
- 135 SKUs from seed
- 23 SKUs collected in house
- 17% seed collected in house
- 83% seed purchased from supplier
- 25% SKUs directly sown on main production line
- 17% SKUs directly sown on seed production line
- 57% SKUs transplanted from 288 trays

In some cases, seed is not obtainable via outside sources and there are situations where seed quality is an issue. In those cases, it is preferable and a priority for the company to produce their own seed. About 23 SKU's (varieties) are grown and collected in-house, which represents 17% of seed needs. It is important to note that growing and producing seed in house also eliminates the possibility of extraneous hybridization with undesirable genetic relatives. Genetically pure seed may not be obtainable on a commercial level. An example would be *Echinacea tennesseensis*, where much of the commercially obtained material is cross bred with *Echinacea purpurea*.

On site seed production is an important aspect of North Creek's production including 20+ species like:

Allium	*Tiarella*	*Heuchera*
Delphinium	*Solidago*	*Hibiscus*
Rudbeckia	*Acorus*	*Monarda*
Zizia	*Amsonia*	*Clematis*
Aster	*Chasmanthium*	*Scirpus*

The company devotes a significant amount of effort to ensure the highest quality seed available is obtained and ensures a systematic approach that encompasses a full growing season which is aptly laid out in **Figure 4**.

A sophisticated system of maps is employed for positive identification on our growing plots, Full color pictures of the specific plant including what the seed looks like (**Fig. 5**). It cannot be stressed enough that proper labelling insures accountability.

Figure 4. Steps in quality seed production.

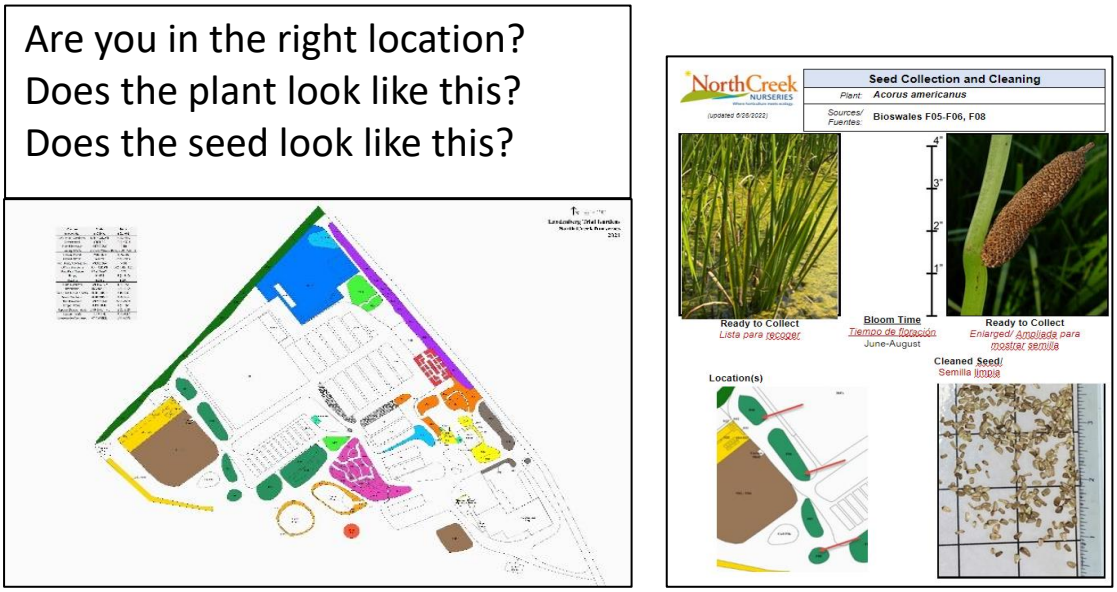

Figure 5. Outlines the process that insures reliable and accurate seed collection.

Figure 6. A target plant in the growing area circle in yellow for positive identification.

Cleaning Seed

Cleaning seed is a critical element in the process. Cleaning is a double check to assure we have the correct seed. Many plants can readily be identified based solely on the seed if one knows what to look for. Cleaning also allows for an immediate status of seed quality so that hollow or malformed seed can be discarded, plus this allows for visual inspection for insects that invariably hitch a ride. Also cleaning allows for easier handling of seed and increases the potential that such seed can be utilized via a seed sowing machine. Cleaning is critical to our success. We hold regular workshops for key employees who work with seeds so that they stay up to date on our processes and needs (**Fig. 7**).

Figure 7. In-house seed cleaning tool use training secession.

Seed Storage

Seed storage is an important aspect of our operation. Some seeds, such as grasses do not necessarily need cold storage and there are instances where a two-year-old grass seed actually germinates better than one year old seed. Other seeds have a short life expectancy unless they are held in dry cold from 38 F to 42F. In all cases it is vital to store seed in a dry environment that is fully rodent proof. Storage in metal containers is critical (**Fig. 8**).

Figure 8. Left - refrigerated cold dry storage at 38 – 42°F. seed packets are stored alphabetical for easy sorting. Right – dry storage.

Curious Facts

No two seed varieties are the same. There would be obvious differences between Helleborus and Asclepias. Two different genus and species, two different families, different natural growing environments, and different cultural requirements, both in the production sequence and in the natural environment. Each individual species has its own brand if you will, and this must be taken into account in the production sequences.

But how different is often determined by practice and experience. In the contest of *Helleborus* vs. *Asclepias* the differences are clear.

Helleborus 'Brandywine' has a grow time of 37 weeks from start to finish, *Asclepias incarnata* can do a turnaround in 8 weeks. The economics of this is significant. When to start the process, anticipate bench requirements for "x" number of weeks. Plug size is also very important. Market demands come into play too. Above all, how is final pricing affected by the production cycle?

The whole production effort is governed by available space, timing, weekly work orders, patching need (filling gaps), cheat sheets (efficiency), and readily available tools to do the job. Certain seeds need a lot of human intervention.

Machines are an important part of the production process. For high volume flat fillers coupled with seed sowing machines are a must (**Fig. 9**). A one-yard mixer can be used for soil incorporation with slow release fertilizer, biologicals, etc. It can be used to can fill ~180 72s/50s cell flats per hour or ~200-gallon pots per hour. We still fill flats the old way by hand for sowing some seeds.

Figure 9. High volume flat filler and seed sowing machine.

Refrigeration is a general requirement for both seed storage and cold moist stratification. Even small operations need several refrigeration units (**Fig. 10**). Cold storage has many applications including seed prep, cold moist stratification, beneficial insect storage and in a separate specialty chemical storage area.

Figure 10. Cold storage units vary from walk-in storage to something as common as a kitchen refrigerator.

Ideally a small sample of seed should be given a water soak to make a judgement to the percentage of sound seed in the sample. Seed that floats are generally considered to be defective and are usually discarded. There are occasions where good seed floats, but it is not common. If adequate supplies are available, then it is probably best to discard the floaters so there are no skips in a plug tray.

Cold Moist Stratification (CMS) can best be described as seed dispersed in a friable (high air content) substrate that is moist and subjected to storage between 32 and 40F. The length of time for each seed lot is carefully monitored, for instance *Helleborus* vs. *Asclepias* is a good example.

Some seeds require **Warm Moist Stratification (WMS)** prior to cold moist stratification. The process is like CMS, but WMS depends on a much warmer 70F storage condition. Caution, some seed will inadvertently germinate during either of the two cycles. Seed lots should be examined in a timely manner to detect this pre-germination. Explanations as to why this occurs are variable and are not generally identifiable prior to the stratification process. Sometimes the entire sequence must be repeated a second time for adequate germination to occur. Finally, it should be concluded that no stratification will occur if the seed is not moist during the process. Moisture is critical for both warm and cold stratification.

Scarification can be described as applying mild physical damage to seed so that the seed coat or shell becomes permeable to water and oxygen. Tools to achieve this vary but can include rock tumblers, hot water soak, and acid soak (caution, dangerous and might harm the seed),

Seed can sometimes be coaxed into germinating by the use of Gibberellic Acid (GA) at 500ppm for GA3, absolutely no more than that. Too much GA will promote germination, but the resultant seedlings will stretch abnormally. Other chemicals include a potassium nitrate soak at 5000ppm. Still others might use a urea solution at 250 ppm. Usually, a 24-hour soak is required, then seed is removed, washed, allowed to dry a little to facilitate handling at sowing.

Some seeds will germinate readily if given a simple water soak, since tap water can vary, it is probably best to use distilled water or rainwater for this process unless it is known that the tap water is acceptable. Lupines for instance don't care, whereas Sarracenia are quite particular about the water used. Rainwater is best.

CONCLUSION

As illustrated here, seed propagation on a grand scale takes many steps to insure a successful crop. Since all crops are affected by production timing, as well as the needs of customers, crops can be in various stages of development at any given time. Certain plants can be tricky, such as Helleborus seed, which has very narrow requirements. Should environmental conditions fluctuate, and higher than anticipated temperatures prevail, Helleborus seed will cease to germinate, and the only recourse is to start the process over again. The Helleborus seed will not die, it just reverts to a new dormancy window. Alternately, *Asclepias incarnata* will not do that. These are just two examples of the many variations and challenges seed production pose. Time, familiarity, experience, and experimentation all play a part in the ongoing success with seed propagation.