Propagation of Willamette Valley, Oregon Endemics for Seed and Plugs©

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INTRODUCTION

Most recent surveys conclude that there is less than 1/10th of 1% of indigenous grassland and oak savanna habitat remaining in Oregon's Willamette Valley (Noss and Peters, 1995). Before Euro-American settlement of the Valley (pre-1850s), the Native American practice of setting frequent, low-intensity fires maintained oak savannah habitat and numerous grass and forb species that evolved with that fire regime. Loss of this habitat has caused the subsequent decline of wildlife species that it supports (Hagar and Stern, 1997). Consequently, this habitat is considered of the highest priority for conservation, restoration, and enhancement by the Oregon Department of Forestry, Bureau of Land Management, Oregon Department of Fish and Wildlife, United States Fish and Wildlife Service, the Natural Resource Conservation Service, and the Nature Conservancy. In 2001, Heritage Seedlings Inc. (an ornamental tree and shrub nursery) hired me to facilitate restoration of 20 acres of oak savanna habitat on one of its farms. To ensure sufficient seed was available for the restoration, we also began a native seed production program. In Fall 2001, we started with 60 species in small test-plots on 1 acre. In 2002, I chose 50 of the most important prairie species and increased the grow-out by 7 acres. Surplus seed is being made available to agencies, researchers, contractors, and others conducting restoration in the Willamette Valley. In addition, we began greenhouse propagation of five endemic species federally and/or state listed as threatened and endangered or as species of concern. A proposal for the collection and propagation of these taxa was submitted to and accepted by the Oregon Department of Agriculture.

ISSUES SURROUNDING PROPAGATION OF NATIVE PLANTS FOR SEED

Before starting the 2002 production, I spoke with various land managers to try to understand their needs and concerns regarding their purchase of native seed. The most pressing concern for some is the seed source location. When reintroducing native species onto a restoration site, many land mangers feel it is best to keep the source as local to the site as possible due to concerns about out-breeding depression. However, others feel that fragmentation of habitat may cause in-breeding depression, and the reintroduction of new genetic material to the site may be beneficial. Thus the acceptable seed transfer zone is an individual choice — it might be 20 miles, 60 miles, the eco-region (such as the Willamette Valley), or the geographic range of the species.

The concern over an acceptable seed transfer zone directly influences seed producer choices. If the majority of seed buyers prefer local seed, it behooves the grower to collect or procure seed from no wider an area than the eco-region or perhaps their local area. I chose to limit our collection to Marion and Polk counties (mid-Willamette Valley).

Another issue for both buyers and growers is contract grow-out, as compared to speculation. In the past, many agencies were able to contract with a seed grower to

produce the seed needed. However, shrinking budgets have limited contract awards. Contract grow-out is appealing to a grower since start-up costs and seed purchase are guaranteed. The other alternative is speculation — more risky to the grower.

What to grow? How to grow it? How much to invest? What is the market? Are others growing it and, if so, is the market large enough for two or more producers? These are questions that must be asked before collection. In the Willamette Valley, the market is still relatively small; thus, it is vital that a grower define his/her niche carefully. I chose to start with many species in small lots. Over time, it should become clear which taxa are in greater demand so that I can better determine our production goals.

A great resource for both buyers and sellers is a new nonprofit website <Nativeseednetwork.org>. Its purpose is to develop economical sources of native plants and to develop a network for collection, propagation, and marketing of native plant material. Additional goals are to consolidate demand to assure availability, and to track seed from source location to cultivated population (Kuykendall pers. comm., 2001). Buyers can find out who has seed and what species are best for their sites, and growers can list seed in numerous ways.

FIELD PROPAGATION OF WILD SEED

Collection, Cleaning, and Sowing. During the summer of 2002, two interns and I collected 100 lb of wild seed from prairie remnants in Marion and Polk Counties, Oregon. We always obtained permission from the landowner. This seed was hand-cleaned using various screens and air separation with a stationary fan. My goal was to collect enough seed of each taxon so that it could be mechanically sown, harvested, and cleaned. This would ensure we kept our costs as low as possible and had enough seed for our own restoration projects.

We prepared flat seed beds 8 ft wide and 600 ft long with 4 ft grass strips in between beds. Before sowing the seed, glyphosate herbicide was applied to the beds after the first fall weeds had germinated. For each species, sowing rates were calculated using information from other growers, as well as the number of seeds/lb, the size of the seed, and the stature of the plants. A standard grain drill was used to sow the seed. Since only eight rows were to be seeded at 1-ft intervals and the grain drill has 24 double-disc openers 6 in. apart we had to remove all unneeded openers (the outer 4 on each side and every other one in the center). The unneeded seed cups were taped off as well. In addition, we had to deal with the difficult challenge of seeding small amounts of seed (1-2 oz per row) with a relatively large grain drill. To solve this dilemma, we used medium-grade vermiculite as a spreading agent. It suspends both bulky seed and tiny grain seed very well. In order to deliver the seed in a controlled manner, we improvised funnels out of 2.5 gal jugs, one for each row. To find out how much vermiculite we would need, we calibrated the drill speed to deliver a given amount of vermiculite in a single row for 600 ft. This amount was then multiplied by 8. The seed was mixed with the vermiculite and then divided into eight equal parts, placed into each jug, and drilled.

Growing Season. Weeds are a constant struggle for any plant propagator. However, it is a more significant problem for seed production fields since the resultant seed crop must be as weed-free as possible. Although herbicide was applied before sowing, not enough of the weed seed had germinated before crop emergence and

it was a constant struggle. Most of the native annuals seed as well as some of the perennials germinated soon after planting. This eliminated any possibility of further herbicide use, so they had to be hand-weeded in spring. Perennial species that did not germinate until late winter or early spring were carefully monitored and glyphosate applied just before germination. Even these beds had to be hand-weeded prior to harvest, due to the emergence of summer weed.

Since we grow prairie species that are drought tolerant, I chose not to irrigate the seed beds. From the 2001 trial grow-out, I noted that watering produces much taller plants with numerous flowers in the first year. But the plants are the same size by the 2nd year without irrigation. Also we found that irrigation extends the flowering period resulting in erratic seed production timing. In addition, native annuals in seedbed production, even without irrigation, are much larger in stature and produce many more flowers than they do in the wild with competition from other plant species.

The seed production year must be considered in start-up costs. Many native perennials will have low yields after the first year, or do not produce seed until the second year. Some liliaceous and composite species do not produce flowers for 3-5 years.

One important pest problem was gophers. We propagate four species (*Lomatium* sp. and *Perideridia* sp.) in the *Apiaceae* (carrot family). In our 2001 test-plots, all four species were destroyed. In our 2002 planting areas, we aggressively trapped and used a "gopher gun" which ignited acetylene gas into their tunnels. These methods may seem extreme, but if it is desirable to field grow native species in this family, there may be no other choice.

Harvest. When the seed was ready, we used a swather to cut the plants into windrows. Grasses were swathed in the soft-dough stage and left to dry in the bed. Forbs were swathed when most of the seed was reaching maturity. Finding the "optimal" time to harvest wildflowers is the greatest challenge. Each seed matures differently and often the seed will not mature when it is cut too early. Forb species cannot be left in the windrow to dry because the drying fruits will shatter. Many growers cut forb material onto paper, which is then tied down with string and stapled to the ground. Our site is too windy for this method. Thus, I chose to pitchfork the material into a trailer lined with plastic and haul the material to a staging area to dry.

Since the plots to harvest were small, we purchased a 50-year-old Allis Chalmer (AC), pull-type combine. This machine is ideal for our needs. Whereas a large combine takes a long time to clean and has many places to lose seed, the AC can be cleaned with a shop-vacuum and an air compressor in ½ h. This keeps our labor costs down. Grasses were combined directly using a belt pick-up and the forbs were stationary combined by pitchforking the material onto the belt pick-up. Most seed lots took between 1 and 2 h to process. The seed was cleaned using a large Crippen, four-screen/air cleaner. An additional expense will be more screens, needed for the numerous varied species we are trying to clean.

GREENHOUSE PROPAGATION OF WILD SEED

In Summer 2002, seed of *Erigeron decumbens* (Willamette daisy), *Aster curtus* (white-topped aster), and *Delphinium oreganum* (Willamette Valley larkspur) were collected from private land with permission. Seed of *Sidalacea nelsoniana* (Nelson's checkermallow) was collected on federal land and *Delphinium pavonaceum* (pea-

cock larkspur) from state land with the proper permits. Plants grown from the former will be transplanted to our restoration site. Plants from the latter will be transplanted to restoration sites on lands managed by the United States Fish and Wildlife Service. Six additional forb species were grown for plugs due to the small sizes of the seed lots.

All of the forbs species required 11 weeks of cold, moist stratification (with the exception of *Erigeron decumbens,* which required 13). The seed was placed in moist vermiculite in ziploc bags, sealed, and placed in a 1 ºC refrigerator. After stratification, the seed was mixed with more vermiculite and hand-sown into flats. The planting medium was a mix of medium grade, screened for bark and supplemented with controlled-release fertilizer. Germination of all species was noted within 7 days. When the plants reached the seedling stage (3-6 true leaves) they were transplanted into pots. The size of the pots was determined by how large the plant would grow.

Problems with this method were encountered due to high germination rates. The seed was sown much too thick in the flats, making transplanting difficult. An alternative method used by other native plant propagators would be to stratify the seed in a mesh or veil material embedded in moist peatmoss (exposing to air at least once a week to prevent mold), then sowing the seed into pots by hand or with a seeding machine (Archibald pers. comm., 2001, and Kittel (pers. comm. 2003). We will try this method in the future or dilute the seed with more vermiculite before sowing.

CONCLUSION

The first 2 years have been an invaluable learning experience in the propagation of many Willamette Valley endemics. We have learned their germination and re-emergence times, discovered which species are more difficult to propagate for seed and which are easier, and caught a glimpse of their potential seed yields. In order to keep costs to a minimum, we are constantly looking for ways to improve our efficiency. We have improved our weed control methods and will be looking for ways to improve our harvest of the seed.

Use of native plant materials for restoration, revegetation, mitigation, and gardening is increasing. This gives plant propagators a wonderful opportunity to expand into a new and growing market, and gives them the satisfaction of knowing they are giving these species a better chance to endure and thrive.

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