CHAPTER 3

Seed Collection

TIMING COLLECTION

The timing of seed collection from wildland plant species is one of the most crucial and difficult steps in their propagation. Often the thought and desire to collect seeds of a wild plant is based on the sudden observation of a desirable species while hiking, fishing, or otherwise enjoying wildlands. Seldom do wildland plants in fruit catch would-be gardeners' attention. Exceptions are the cones of conifers and other showy fruits. Usually the flowers are what attract collectors' attention, and obviously most plants in full bloom do not have mature seeds. Collectors must plan ahead, mark the attractive plant in full bloom, and return when the seeds are mature.

Collection of immature seeds results in low seed viability or dormancy. The danger of delaying collection is that the fruits of many wildland plants dehisce (fall from the seedhead) very rapidly, so seeds are lost if collection is delayed. Collection of seeds from the soil surface may be possible, but it usually results in low-quality seeds and excessive cleaning cost.

Most crop plants bloom in sequence, beginning with the uppermost or central flower. Crop plants have been selected to have this type of flowering so the seeds will mature at the same time to aid in harvesting. These crop plants are said to have determinate inflorescences or flower arrangements. In contrast, many wildland
plants have indeterminate inflorescences where the flower stalk continues to grow with prolonged flowering and many different stages of seed maturity on the same flower stalk. This makes uniform seed collection difficult. If the seed collector is able to selectively harvest on the ripe portions of the seed stalk, the indeterminate inflorescence is no great problem.

A major factor that influences the collectors’ approach to collecting seeds in the wild is: how many seeds do you want? If you are a commercial dealer with an unlimited market, obviously you want all the seeds you can get. A private gardener who only wants to try a new plant in the rock garden may only want a few seeds. How many seeds are enough for a new species? If you have no idea of what the germination of the plant’s seeds will be, it is a good idea to have at least 5,000 seeds. In a section on germination, we will explain why these 5,000 seeds are necessary.

Sources of Information

There is no substitute for experience in judging when to collect seeds of wildland species. To start a collection program for a species with which you have no previous experience is difficult. Essentially, the collector must investigate the phenology, or sequence of events in the life history of the species to be collected. The stages in phenology in which the seed collector is interested include: (1) flowering, (2) seed formation, and (3) seed maturity. Guides to flowering can be obtained from regional floras (Table 1). More detailed information can be obtained from the few specialty manuals available or articles that deal with the life histories of individual native plants.

If you understand the biology of the species from which you are planning to collect seeds, it may be possible to partially predict the current year’s seed production. This knowledge will pay additional dividends when the collector attempts to propagate the species. A good example of this type of knowledge is provided by the native shrub Bitterbrush (Purshia tridentata). Bitterbrush is a member of the rose family and is one of the most important browse species for big-game animals, especially mule deer. With showy flowers and a variety of growth forms, it is a potential wildland plant for ornamental plantings. We probably know more about the life history of Bitterbrush than any other native shrub. It has been studied on wildlands for 50 years. The seeds of this species that are collected from wildlands stands for sale in the commercial seed trade constitute a several hundred thousand dollar trade annually.

Bitterbrush flowers on second-year twigs. The current year’s twig growth elongates from 2–10 inches during the growing season, depending on the site potential and the condition of the shrub. The next growing season these twigs will support flowers. Older twigs on the Bitterbrush plants do not have flowers. Good Bitterbrush seed crops
generally follow years where average or better effective moisture produces stem elongation averaging at least three inches.

If you examine potential sites for Bitterbrush seed collection in the autumn and observe the current year’s leader growth of the twigs to average 3 inches or more, then the potential exists for good flower production on the plants occupying the site the next spring. Note this is potential, not absolute seed production. Factors that might interfere with this flowering and seed production are: (1) biological, such as deer or cattle browsing the potential flower-supporting twigs during the winter and (2) physical, such as the occurrence of a killing frost during the critical spring flowering period. Obviously, the prediction of production from native plant species is a high-risk business.

Flowering is the first phenological stage of which the would-be seed collector must be cognizant. Flowering is obvious for many species with colorful petals, sepals, or bracts; but careful attention is required to note anthesis (shedding of pollen) with many grasses. After flowering, the sequence of phenology is as follows:

1. Soft-dough stage. This stage is indicated by the excretion of dough from seeds when squeezed between the thumb and forefinger. Seeds collected at this stage generally have low viability, if they will germinate at all.

2. Hard-dough stage. The hard-dough stage can be judged by biting the grain, once the dough stage is completed. In other words, if you cannot squash the seed between thumb and forefinger, try biting it. Once the seed is fully mature, it is usually too hard to bite. Seed collection should start with the transition from soft to hard dough. The time interval between soft and hard dough is a good indication of how soon to repeat the collection. With these first collections, the chance of obtaining plump, fully matured seeds can be increased by not stripping the seed from the plant, but rather by cutting considerable plant material and allowing the seeds to dry on the plant material. In most species this procedure will allow the seeds to reach full maturity. Care must be taken to insure that the mass of plant material dries uniformly and does not mold. The collection of additional plant material to help insure full maturity of the seeds is one of the most important techniques to develop in order to be a successful seed collector.

3. Maturity. Obviously, the goal of wildland seed collectors is to harvest mature seeds. Unfortunately, maturity and seed dehiscence may occur at the same time. To make sure some seeds will be obtained, repeated collections are necessary. The collections should extend from the latter part of the soft dough stage until all seeds are lost. Each collection must be clearly labeled with the collection date, location, species, and stage of phenology based on physical appearance. Descriptive notes on associated plant or site factors that may aid in reidentification of the stage of maturity are valuable. The seed collector must keep records.
Moisture Content of Seeds

For seed collectors who are more analytically inclined, seed moisture curves can be used to estimate the optimum date for harvest. Moisture is high in immature seeds, usually about 60 percent, but drops to about 10 percent as the plants mature. In a later section under seed storage, we will present methods of measuring seed moisture content. If repeated measurements are made over time, a seed maturity-moisture curve can be constructed. The seed-moisture curve for each species will show a characteristic shape because of differences in the slope, or drying rate. The rate of seed moisture change varies with climatic conditions, but averages about 3 percent per day during the seed maturity period. With above-average hot weather, the slope of the curve temporarily increases; whereas during cooler rainy weather, the curve flattens. For many crops, the seed maturity-moisture curves are known and are used as guides to harvesting seeds.

Seed maturity-moisture curves obviously require more effort than the ordinary gardener is willing to expend to obtain seeds of one or two species. However, the principle of seed maturity and decreasing seed moisture content should be understood by all wildland seed collectors. Commercial wildland seed collectors often judge seed maturity-moisture curves by the appearance of intact and squashed seeds. Objectivity can be given to these judgment determinations by taking actual seed moisture percentages.

Germination Tests and Seed Maturity Curves

Germination tests on each collection, made over a period of phenological development, provide the ultimate basis for judging the correct time of harvest. Careful records of the phenological stage of development at the time of seed collection must be kept because seed germination must be related back to these conditions. You cannot collect the seeds and immediately conduct the germination tests because the seeds of many species will not germinate when freshly harvested. Often a period for additional maturity, called afterripening, is required after harvest before the seeds will germinate. Therefore, germination tests are run on seeds from a succession of collection dates the winter following harvest, and the results of the tests related back to the phenological development of the species at the time the seeds were collected. This information is used to judge the timing of collection for the next season. Remember that optimum germination may occur in the most mature seeds, whereas optimum seed yield may occur at an earlier stage of maturity before seeds are lost by shattering.

Because of year-to-year variation in growing conditions, no method provides an absolutely accurate prediction of the specific date for seed collecting. There is no substitute for common sense, based on biological knowledge, to guide the collection of seeds of wildland plants.
Extending Collection Period

The period of optimum seed collection can be extended by starting collection at low elevations and following maturation upslope. The same procedure can be applied to species that produce tillers that mature later than the main inflorescence. There are some exceptions to the follow-the-seeds-up-the-slope rule. Fall-blooming species of Rabbitbrush (Chrysothamnus spp.) flower first at high elevations and last on lower slopes.

Often the seed collector can take advantage of micro-environmental differences at a given location to aid in collecting mature seeds. If seeds are immature on north-facing slopes, plants of the desired species growing on south slopes will generally be at a more advanced stage of maturity. Plants growing in swales or along drainage bottoms may produce more seeds than the same species on arid south slopes.

There is a danger in this practice. The Wyoming subspecies of Big Sagebrush (Artemisia tridentata) dominates large areas in the semi-arid portions of the Intermountain Area, but in average or drier years it seldom flowers. In drainage ditches alongside roadways passing through Wyoming Big Sagebrush stands, sagebrush plants are often found with abundant seed. It is tempting to assume the seeds are produced on Wyoming Big Sagebrush plants that took advantage of the extra environmental potential of the roadside ditch. Close examination often reveals the seeds are produced on plants of the Basin subspecies of Big Sagebrush, which out-competes Wyoming Big Sagebrush for the choice habitat.

Taking Advantage of Wildfires

Collectors of wildland seeds, especially seeds of herbaceous species, should learn to take advantage of plants growing in areas burned in wildfires. The reduced population density of plants that reinvaded burned areas, plus the availability of nutrients, makes for excellent seed production. In later years, the burned areas will often support stands of successional shrubs, making for good seed collection sites for these species.

Seed Caches

Rodents, birds, and insects, especially ants, are voracious collectors of some seeds. For some species (e.g., juniper berries and Pinyon Pine nuts), the seed collector must race the natural predators in order to obtain any seeds unless productive bagging or screening is used. Some seeds, especially conifers and Bitterbrush, can be obtained from rodent caches. Seeds of warm desert annuals have ant-attracting glands. Such seed can be recovered from the refuse dumps of ant nests. Some species of ants store the viable seeds in the nest, and only chaff is left on the soil surface. The droppings of many animals contain viable seeds or seeds that have improved germinability after passing through the digestive
tract. The difficulty with any of these collection methods from caches or droppings is that the quantity of seeds obtained is small, and often contaminated with pathogens.

COLLECTION METHODS

Collection methods are largely hand methods because the desired wildland species do not grow in pure stands, and the topography often limits use of mechanical equipment.

Grass Species

The seeds of grasses can often be collected by stripping. The stripper may be the collector’s fingers or mechanical fingers on a truck-mounted or towed implement. The process consists of allowing the grass stems (culms) to collect between the fingers and the seeds to be scraped from the terminal inflorescence as the stripper moves forward. A simple seed stripper made from sheet metal and a gallon can may be a valuable tool for hand stripping. The culms of the grass plant fit between the teeth of the stripper, and the inﬂorescences are pulled loose to drop into the container. In actual practice, it is never this simple. The collector using a tin can collector should wear gloves and be prepared to guide and stuff the stripped seeds into the container.

The seeds of tall grasses can be harvested with a homemade stripper attached to a light truck. The stripper attaches to the front bumper of the truck. It should be slightly flexible to absorb bumps, but constructed of strong enough metal to prevent bending out of shape. Flail bars are necessary to knock seeds from the grass heads. The height of the flailing bars is important and must be adjusted for different height grasses.

In dense stands of annual grasses, a garden rake can be used to strip the seeds of some species. For large-scale mechanical harvest, the seed stripper is a very inefficient way of collecting seeds. Despite the inefficiency of strippers, a number of native grass species cannot be harvested satisfactorily by any of the conventional mechanical means, such as field combines, making it necessary to strip. If wildland grass species occur in large enough stands or on topography that permits use of mechanical equipment, it is far more efficient to use a header or a forage harvester to collect the material for threshing than to attempt to strip the seeds. Headers are machines that clip the plants just under the seed head. Seeds are cured in piles and later threshed.

For the novice seed collector, the seeds of Thurber’s Needle Grass (Stipa thurberiana) provide good practice in how to collect and process seeds of a grass species. Thurber’s Needle Grass is also a good example of a species in which it is advantageous to pull the culms to allow the seeds to fully mature.
Forage harvesters can be used to chop mature grass stands. To those unfamiliar with agricultural equipment, a forage harvester is similar to a giant rotary lawnmower that is normally used to harvest forage crops, and conveys the mature grasses into a wagon for transportation. The chopped material is either cured for later threshing, or the herbage and seeds are broadcast together at the time of planting. This can be a highly satisfactory technique in local areas where long-distance transportation is not involved. The herbage provides a mulch to help establish the desired seedlings. A word of warning: make sure the harvest material is free from weed seeds.

Many highly-specialized harvesters, such as pneumatic-type strippers, bluegrass cylinder strippers, and suction seed reclaimers, are used commercially in the crop seed industry. Grass fields can be repeatedly harvested during the same growing season by simple modification of a standard grain combine. The cutter bar is covered with a section of split tubing or pipe so the grass stems are not cut, but slide under the combine before the grass stems slide under the covered cutter bar. Extra-large bats on the combine reel swat the seed heads, knocking mature seeds into the combine. Immature seeds remain in the seed heads and pass under the combine. The speed of the rotation of the reels should be increased four or five times over normal operating speeds for this system to work. If you have never operated a grain combine, the above description will seem like nonsense. It was included to illustrate what can be done with existing farm equipment to harvest seeds of wildland species.

If large-scale collection of a suitable abundant wildland species is being contemplated, it may be worthwhile investigating some of the sophisticated equipment. If you are interested, a good place to start is the Equipment Development Committee maintained by the major public land management agencies. They have compiled a review of the available literature on high-production grass seed collectors. This publication provides domestic and foreign sources of small combines and grass strippers. It also lists research organizations active in research and development of grass seed collection equipment and has a reference section for pertinent literature.

**Broadleaf Herbaceous Species**

For the average collector interested in landscaping with native species, herbaceous broadleaf species are of special importance. The seeds of many herbaceous perennial species can be collected by holding a tray or box under the inflorescence while shaking or flailing the mature seeds into the receptacle. Fiber glass trays used in photographic darkrooms are excellent receptacles for this purpose. They are light, strong, and have a curled lip that can be conveniently gripped. These are available at most photo stores. An ordinary flat cake pan from the kitchen is a satisfactory substitute. In using the pan or tray, a good pair of
gloves is the collector's best friend. For very small herbaceous annuals, the simplest method of collection may be pulling the entire plant and bagging the material in paper sacks. Leave the bags open in a dry, well ventilated location; and the seeds will mature in place.

Herbaceous species with capsules or other fruits that explosively present a special problem. A good example of this type of plant is the Common Oxalis (Oxalis corniculata), which becomes a terrible weed in greenhouses. When the slender capsules are ripe, they look like upright fingers of green bananas. If you touch these capsules at the right stage of maturity, you are treated to an explosion of surprising violence. This explosion distributes sticky seeds through the greenhouse. The only way to collect seeds of this type is to carefully collect the fruits while they are immature and allow them to ripen in mesh bags.

Collecting the entire plant is the only way to harvest seeds from spiny annuals such as Russian Thistle (Salsola iberica), where seeds are produced axillary over all the plant. When the entire plant is harvested, care must be taken to insure that the material dries without molding. A large burlap bag, such as a wool sack, provides a convenient container for plants like Russian Thistle. You might wonder why anyone would desire to collect seeds of a weed such as Russian Thistle. Weed seeds are used by research scientists to develop new weed-control methods. Seed collectors should be aware of this small but potentially lucrative market. We use Russian Thistle to illustrate total plant collection of herbaceous species.

For herbaceous species that have spike-type inflorescences, pods can be stripped from the spike as with grasses. Lupines are a good example of a broadleaf plant where stripping is possible. Remember that pods of legumes such as lupines have a much higher moisture content than grass flower parts and must be given special care in drying. The pappus seeds (achenes) of many of the species of the sunflower family can be lightly brushed or swept into bags if the collector times seed fall perfectly. For large seeded species like Arrowleaf Balsam Root (Balsamorhiza sagittata), a 16-pound grocery bag makes a good-sized collector. Again, a good pair of gloves is necessary equipment. Some members of the sunflower family, especially those classed as thistles, have large heads or inflorescences that are subtended or surrounded below by armed bracts or spines. It is impossible to strip these heads, even with heavy gloves. The best policy with spiny thistles is to clip the heads with pruning shears and carefully drop them in a bag for later threshing.

Shrub Species

The seeds of many shrubby species can be collected by holding a tray or box under the outstretched branches while flailing the bushes with a stick or paddle, or by sweeping the arms across the upper
branches to loosen the seeds, which then shower into the receptacle.

For collecting Bitterbrush seeds by hand, the Inyo tray was developed on the Inyo National Forest, located on the east side of the Sierra Nevada Mountains in California. It consists of an aluminum tray 20 inches long, 30 inches wide, and rounded at the bottom to a depth of 8 inches. A handle is inserted along the long axis. For limited collections, a cardboard box serves the same purpose as will baskets and canvas bags. A lightweight, 20-gallon barrel provides a ridged lip over which to bend shrub branches for removing fruits. This procedure is effective with spiny shrubs such as Desert Peach (*Prunus andersonii*), where the fruits must be physically stripped from the branches.

Collecting shrub seeds by catching them in containers requires very careful timing and cooperation from the weather. Strong winds can cause a crop of Bitterbrush seeds to fall to the ground in a very short period of time. Speed in collection of shrub seeds is of utmost importance. Canvas or plastic sheeting spread on the ground to collect seeds loosened from branches is of limited value because of the time and difficulty required to spread the sheeting under low branches and over rocks.

Shrubby species with explosive capsules, such as *Ceanothus*, must have the capsules stripped before maturity and must be ripened in mesh bags or on tarps to avoid seed loss.

Seeds of some semi-herbaceous shrubs, such as Four-wing Saltbush (*Atriplex canescens*), can be stripped by tractor-drawn seed strippers. Combines (combination of headers and threshers) have been used to harvest Winterfat (*Ceratoides lanata*) seeds. Field trials of vacuum harvesting, either vehicle-mounted or a backpack model, have shown promise for harvesting seeds of several shrubs.

**Tree Species**

Trees are usually of sufficient size to permit mowing grass, clearing brush, and otherwise enhancing the environment to aid in seed collection. Most of these elaborate preparations are confined to plantations or seed orchards. In these situations, it is feasible to spread canvas or plastic sheeting under the trees to expedite the gathering of fruits. A suspended net or fiber glass screen with a catching pocket at the bottom is useful for trapping light seeds of Ash (*Fraxinus*), Elm (*Ulmus*), and Mountain Mahogany (*Cercocarpus*) species as they are shaken or flailed from the crown.

Small fruits of trees are often stripped or picked by hand by collectors on ladders. Simple hand tools such as wire hooks to pull limbs closer, shaking poles, shears, flails, and rakes are valuable aids for collection of tree seeds. Large fruits or cones are often knocked or shaken off, and gathered from the ground beneath the trees.

Prompt collection of fallen fruits will reduce losses to fungi, insects, animals, and birds. Conifer cones exposed to high soil surface
temperatures may open in several days and shed seeds. Acorns of some Oaks (Quercus spp.) and seeds of several other species may either dry out or germinate when left on the soil surface.

The obvious difference between trees and native plants of other growth forms is the height of trees. Many conifers such as the true Firs (Abies spp.) fruit on their upper branches. For mobility and handling ease, long extension ladders, picking platforms, or scaffolds have been mounted on trailers, trucks, or rough-terrain vehicles. Collection capabilities are materially improved, but the investment costs are substantial. Safe operation requires careful attention to positioning of the vehicle and to horizontal-reach limitation of the elevated ladder or boom. Higher crowns can be reached by using climbing irons or sectional ladders. Climbing irons are simple and easy, so the books say, but the spurs cause severe damage to some tree species.

Sometimes limbs, tops, or entire trees may be cut to collect seed. Efficiency of seed collection may be improved by removing the cone-bearing tops of Spruce (Picea spp.) and by clipping selected branches of Poplar (Populus spp.).

Cone collectors often visit logging shows to recover cones from recently felled trees. Care must be taken to make certain that the seeds were sufficiently ripe when felling occurred.

As is the case with all seed collection, the cones of conifers should be stored in bags with good aeration after harvest. Burlap bags placed on divided racks provide good temporary storage for cones.

SUGGESTED ADDITIONAL READING


Table 1. Regional floras and other books useful for the seed collector.


Figure 5. Seed collecting and threshing equipment. (A) Simple seed stripper made from gallon can and sheet metal, (B) Seed stripper made from wood and sheet metal, (C) Rubber-mat-covered paddles for threshing, and (D) Rubber-mat-lined threshing box and paddle. (From Young et al. 1981. Collecting, Processing and Germinating Seeds from Western Wildland Plants. U.S. Dept. Agric., ARM-W-3).
Figure 6. Steps in collecting, threshing, and cleaning seeds of Thurber's Needle Grass (*Stipa thurberiana*). (From Young et al. 1981. *Collecting, Processing and Germinating Seeds from Western Wildland Plants*. U.S. Dept. Agric., ARM-W-3).
Figure 7. Steps in collecting, threshing, and cleaning seeds of Russian Thistle (Salsola iberica). (From Young et al. 1981. Collecting, Processing and Germinating Seeds from Western Wildland Plants. U.S. Dept. Agric., ARM-W-3).
Figure 8. Steps in collecting and cleaning pits of Desert Peach (Prunus andersonii). (From Young et al. 1981. Collecting Processing and Germinating Seeds from Western Wildland Plants. U.S. Dept. Agric., ARM-W-3).