

persist long-term, but seed production will decline to a point that's no longer cost-effective, even with continued tillage between rows. In fact, tillage at this point can sever lateral roots. At this stage of stand life, some species may respond to chisel plowing, plug-type soil-aeration, or aggressive tillage to reduce in-row width back to a single plant width. Other species will require transplanting into new production beds, or regenerating from seed. To conserve the initial genetic diversity of a seed source, replant seed from the original collection, if possible, or at least an earlier generation of that seed source. By conserving generations in this way, it will minimize genetic selection and genetic drift specific to production field soils, climate, and cultural practices that otherwise would tend to narrow genetic diversity over successive regenerations of the seed source.

HARVESTING

Refer to Appendix B, Table 1B for recommendation on harvesting methods and timing

General Indications of Seed Ripening

Grasses

Seed ripening and timing of harvest varies by species, source of parent material, and environmental conditions. For example, cool-season grasses begin growth early in the growing season and consequently ripen earlier, as compared to warm-season grasses. In grasses, there are roughly four stages of seed maturity: milk, soft dough, medium dough, and hard dough. Firm thumbnail pressure on the caryopsis, or germ, will help determine maturity. Grasses should be harvested at the hard dough stage, when firm thumbnail pressure slightly dents the caryopsis. Many grasses ripen about a month after flowering, and some do not hold seed long after maturity. Test ripeness by firmly striking the seed head against palm; if some shattering occurs, the seed is ready to be harvested. If it shatters with only gentle striking, harvest immediately.

Forbs

Generally, the seed head itself or the stalk immediately below the seed head will begin to appear dry or discolored as the seed ripens. If the seed is easy to strip off or shatters out when the seed head is gently thrashed into the palm, seed ripening has begun. Notable exceptions are the spiderworts (*Tradescantia*), members of the day-flower family. These species will drop seed from individual flower heads as they ripen even while the bracts remain green and other flowers in the same cluster are in bud or blooming. Species with dispersal apparatus such as awns or hairs will appear dry and fluffy at maturity.

Environmental Factors Affecting Seed Maturity and Dispersal

Most species ripen gradually, so not all seed will be at the same stage of maturity at any given time. Seed maturity usually progresses from top to bottom of the seed head in grasses and many prairie forbs. Mature seeds may be quickly dispersed either by gravity, wind, water, or animals, so it's important not to delay harvesting. Immature seed stores poorly, losing viability more quickly than mature seed. Likewise, some species forcefully eject seed at maturity (phlox and violets, for example), and must be checked and harvested daily or bagged loosely with a tightly woven mesh or cloth bag. In terms of the plants' environment, cold, moist conditions will tend to delay seed maturity, while hot, dry conditions may hasten it. Latitude will also affect ripening since many plants flower and set seed in response to photoperiod. Flowering and seed set may be delayed if plants are grown northward from their origin, or hastened if moved southward. If moved a great enough distance north or south of their origin (greater than 300 mi) they may fail to set mature seed.



Plastic combs are inexpensive and efficient tools for stripping grass seed. Good quality scissors or pruning shears are handy for clipping seedheads of many forb species. Both hands are kept free for collecting by strapping plastic milk jugs around waist to hold and protect paper lunch-size collecting bags.



Use small-comb teeth Little bluestem, larger teeth for Big bluestem, Indian grass.

Harvesting Techniques

Hand harvest

Hand harvesting is time- and labor-intensive and not practical for large projects, but it is an important way to collect the seed of native species that otherwise are commercially unavailable and/or inaccessible through machine harvesting. Such species may be low or high growing species, early or late ripening species, or uncommon or patchy species in native prairie. Efficiency can be improved by keeping both hands free to harvest by fastening collection bags and containers around the waist.

Hand harvesting is also an important way to obtain a sample of seed from populations for use as foundation material for seed increase and seed production plots. Keep in mind, however, that a seed collection is only a sub-sample of the seed available in a population. How and when the seed is collected and propagated for increase can influence the genetic potential of the resulting population. Annual variation in rainfall and temperature can affect total seed production, quality, maturity, and dormancy. To optimize the capture of genetic diversity present in a population, approximately equal amounts of seed should be collected from several widely spaced individuals (minimum of 30) throughout the site and over multiple years. If collecting from multiple sites, attempt to equalize the contribution of seed from each site, particularly when planting a seed nursery production plot to generate seed for other reconstructions. To sample larger, evenly distributed populations, walk line transects at parallel intervals throughout the population, sampling seed at predetermined intervals (perhaps every 10 steps, for example). Populations grown and re-grown in a production field can become adapted to site conditions and nursery management practices. Therefore, it is important to save seed from the original collections or earlier generations for replanting production fields.

Mechanical Harvest

Refer to Appendix B, Table 2B for combine settings.

Combine harvest

As already established, not all seeds ripen at the same time; with any given species, a determination has to be made as to when **most** seeds present are at or nearing maturity (Figure 1). Grasses are generally harvested at maturity (hard dough stage) with some exceptions. Test ripeness by firmly striking the seed head against palm; if shattering occurs with only gentle striking, the stand should be combined **immediately**. Since most grasses ripen from the top down, some shattering of the tops of the seed heads may have already occurred. If a species' seed shatters very easily, harvest in the early morning when humidity is high and wind speeds are less, as a strong wind can reduce the harvest significantly in a single afternoon. Windrowing or swathing during

the medium- to hard-dough stage – in grasses that otherwise shatter easily at maturity – can be effective, since seed will after-ripen for several days after cutting. For this method, however, it's important to be sure no rains are in the forecast for the next few days after cutting. Swaths can then be picked up with a combine after the material has dried at the site for a few days. Combines may require significant modifications to make them suitable for

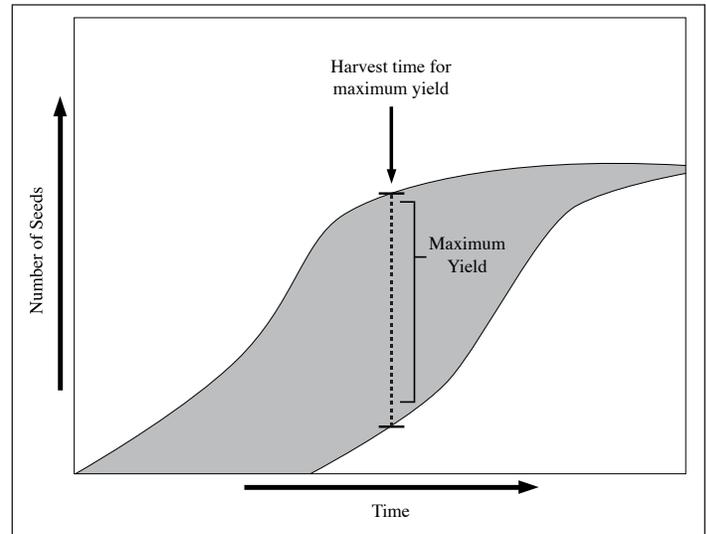


Figure 1. Conceptual diagram illustrating optimal harvest time for capturing maximum mature seed yield (single point in time mechanical harvest). As seed ripens, seed shattering soon follows, and the rate of both processes increases through time. Time of harvest is critical for capturing optimum mature seed yield.

harvest of native grasses and forbs.

Species with fluffy seed (asters, goldenrods, etc.) should be harvested when seed is mature, but just prior to the dry-fluff stage. If the seed is dry-fluffy, the combine will become a super seed dispersal machine. Reducing or shutting off airflow in a combine is a must for native species with lightweight seeds. Plugging of shaker sieves and augers is a constant issue, particularly with fluffy seed or seed with long awns. The long twisty awns of Canada wildrye can be a combine's bane. Deawner bars can be installed into the cylinder surrounding the concaves to increase the threshing action of the concaves.

Seed strippers

Commercial seed strippers are available as handheld, implement pull-type, or tractor-mounted equipment. They all use a rotating brush or bristles to “strip” the seed from stems and stalks of plants. While perhaps not as efficient as combines, strippers can be used for the successive harvest of species that ripen gradually or at different times. Handheld strippers and pull-types light enough to be pulled with an ATV allow harvest of otherwise inaccessible native sites.



1977 Hege 125B plot combine modified for harvesting native species. Harvesting Rigid goldenrod in this photo.

Ethics of Harvesting from Remnant Sites

Repeated, annual harvesting of seed from remnant prairies for the commercial market is not encouraged. First, seed production and seed quality from ‘wild’ stands will never be as high as can be produced in nursery plots, and second, there is a temptation to then manage such remnants solely for maximal seed production. Manipulation of a remnant prairie to maximize seed production – such as whole-site, repeated annual burns, herbicide treatments, or fertilizing – is inappropriate and unethical. A remnant prairie is a diverse, biotic community (both above and below ground) of microbes, fungi, plants, and animals (vertebrate and invertebrate) interacting in complex relationships. Any management applied indiscriminately and repeatedly will be detrimental to some of these associations.

Burning should be limited to only a portion of a remnant any given year, and each portion should be burned on rotation and at different times of year, at varying intervals of time. Bulk harvest from remnants may be appropriate when the seed is intended for planting on adjacent or nearby land to buffer and expand the native prairie. Finally, any mechanical harvesting occurring in remnant sites should include a careful inspection and cleaning of equipment prior to use, including vehicles, to avoid introducing exotic/invasive species that may contaminate the

equipment and lead to the degradation of the remnant or create long-term management issues.

Be mindful of other ethical considerations when collecting seed from prairie remnants. Federal and state endangered and threatened species cannot be collected without proper permits. Of course, it’s essential to ask permission of the landowner before collecting seed on private property. Some seed growers will lease native prairie from the owners to exclude grazing over the summer so seed can be harvested from the site. Likewise, removal of any plant or plant part from preserves, natural areas, and parks may be restricted. Check with the proper agency before harvesting seed in these areas. Harvesting from roadsides may also be restricted in some states and counties. Contact the county engineer’s office or state department of transportation before harvesting from county and state roadsides.