

Seed production and field establishment of hoary tansyaster (*Machaeranthera canescens*)

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ABSTRACT

The USDA NRCS Aberdeen Plant Materials Center (PMC) produces certified early generation seed of hoary tansyaster (*Machaeranthera canescens* (Pursh) A. Gray [Asteraceae]), a late summer and fall blooming forb native to the Intermountain West region. Hoary tansyaster is an excellent forb candidate for restoration efforts in arid to semiarid sites. It is relatively easy to manage in a seed production system, establishes quickly in a rangeland situation, and provides blooms in late summer during the establishment year. Propagation methodologies including establishment, weed control, harvest, and seed processing are herein discussed. We have grown seed production fields of hoary tansyaster in 2 different field systems, one using weed barrier fabric and the other in open drill-seeded fields. Seed can be collected by hand, combine, Flail-Vac, or vacuum-type harvester and can be processed with brush machine and air-screen type cleaning equipment. Seed yields at Aberdeen, Idaho, range between 2 and 8 kg pure live seed (PLS)/ha (2–7 lb/ac).

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forb, harvest, management, seed cleaning, rangeland, restoration, Asteraceae

NOMENCLATURE

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Animals: ITIS (2015)

The past decade has seen a large increase in demand for native forbs for use in rangeland enhancement and restoration plantings (Shaw and others 2005; Walker and Shaw 2005). This change in demand has been driven, in large part, by increases in frequency and size of wildfires in the Intermountain West, a phenomenon driven by the spread of introduced annual grasses such as cheatgrass (*Bromus tectorum* L. [Poaceae]). Historically, post-fire restoration has been dominated by low-diversity grass seedings. Better understanding of range ecology suggests that native forbs and the insects they attract are an important component of wildlife habitat. Of critical importance, flowering forbs are desirable for the conservation and recovery of sage grouse (*Centrocercus urophasianus* Bonaparte [Phasianidae]) (Connelly and others 2000), and for providing pollen and nectar for native pollinator species (Mader and others 2011).

The greatest need in the Intermountain West is for native forbs that are adapted to arid and semiarid habitats, particularly species that blossom during the first growing season (Ogle and others 2011). Species that flower during the first growing season are necessary to sustain pollinators under post-disturbance conditions until other perennial forbs reach flowering maturity (Cane 2008). First-season blooming forbs provide a valuable supply of nectar and pollen to native pollinators that may be unable to travel the distance necessary to reach undisturbed food sources. Forbs that flower in late summer and early fall also provide nourishment that carries pollinators through the winter. Hoary tansyaster (*Machaeranthera canescens* (Pursh) A. Gray [Asteraceae]) is an excellent forb candidate for restoration efforts. It is relatively easy to manage in a seed production system, establishes quickly in a rangeland situation, and provides blooms in late summer during the establishment year. This article provides a detailed description of hoary tansyaster and details our seed production experience and success at the Aberdeen, Idaho, USDA NRCS Plant Materials Center.

PLANT DESCRIPTION

Hoary tansyaster is a short-lived perennial forb with pale to dark purple flowers. Plants are 15 to 75 cm (6 to 30 in) tall with indeterminate flowering habit. Each flower head supports 15 to 25 purple ray flowers and numerous yellow disk flowers, each sitting atop a seed-bearing achene (Welsh and others 2003). The achenes are 3 to 4 mm (0.12 to 0.16 in) in length (Cronquist and others 1994) with a pappus of dirty white and hairlike bristles. Seed heads contain approximately 2.0 million seeds/kg (1.3 million seeds/lb) based on seed counts conducted by Aberdeen PMC.

Hoary tansyaster occurs throughout western North America from British Columbia to Saskatoon, south to California, Arizona, and Colorado. It is common in salt desert shrub, mixed desert shrub, pinyon-juniper, mountain brush, aspen-

sagebrush, and mountain conifer plant communities (Welsh and others 2003). This species is highly valuable as a pollinator food source in late summer and early fall. Production fields at Aberdeen are visited by sweat bees (*Halictus* Latreille spp. [Halictidae]), green sweat bees (*Agapostemon* Guérin-Méneville spp. [Halictidae]), and European honey bees (*Apis mellifera* L. [Apidae]) (Figure 1). We have also observed visitation by bee flies (Diptera: Bombyliidae) and western white butterflies (*Pontia occidentalis* Reakirt [Lepidoptera: Pieridae]).

PRODUCTION SITE

Seed production has been limited to the Aberdeen USDA NRCS Plant Materials Center. The Aberdeen PMC farm is located in Major Land Resource Area (MLRA) B11, Snake River Plains, at 1310 m (4300 ft) elevation. Soil at the site is a Declo silt loam with a pH of 7.4 to 8.4, and average annual precipitation is 23.9 cm (9.4 in) (USDI BOR 2010). The average growing season is approximately 110 d, with spring last frost in early June and fall first frost in mid-September. Mean annual temperature is approximately 8 °C (46 °F), with an average high temperature of 37 °C (98 °F) and average low -26 °C (-15 °F) (USDA NRCS 1973).

Field Preparation

We have grown hoary tansyaster in 2 different field systems, one employing weed barrier fabric and the other in open drill-seeded fields. Prior to seeding, our fields are plowed, disked, and



Figure 1. Hoary tansyaster is highly attractive to pollinators. A green sweat bee forages on hoary tansyaster pollen. Photo by Derek J Tilley

finally packed with a roller cultipacker. For production on fabric, a 1.8 m (6 ft) wide strip of woven weed barrier fabric is laid down with a tractor-pulled fabric layer as described by Simonson and others (2006). At the time of planting, 7.6 cm (3 in) diameter holes are burned into the fabric using a steel spacing jig and an acetylene or propane torch. We have successfully planted in either single rows or double rows down the center of the weed barrier fabric at 23 to 46 cm (9–18 in) plant spacing.

Planting

Planting timing is important with hoary tansyaster. We have found that late summer (August) seeding is optimal because of reduced annual weed competition, tendency for plants to produce multiple bloom cycles, and better overall seed yield. Fields planted in the fall produced crops the following 2 y. In contrast, fields planted in spring or early summer did not produce a significant crop during the first year but did produce the following year and then died during the subsequent winter.

Seed of hoary tansyaster has no dormancy issues. Seed is sown into weed barrier fabric into slightly roughened soil and then lightly packed. Each hole is seeded at a target rate of 5 to 20 seeds using a drop tube seeder, a 7.6 cm (3 in) diameter tube with a spur at the bottom (Figure 2). The spur is used to roughen the soil, seed is dropped through the tube into the roughened area, and the soil is compacted by foot. We also seed strips of low-growing perennial grass cover on the edges of the weed barrier fabric. This step allows us to manage seasonal weeds with mowing, which reduces herbicide use and cultivation and prevents disturbance to ground-nesting pollinators.

Drill-seeded fields are seeded on 91.5 cm (36 in) row spacing at a rate of 0.39 kg PLS/ha (0.35 lb/ac) with Planet Jr seeders at a depth of 0 to 6 mm (0 to 0.25 in). This provides a target rate of 113 seeds/linear m (35 seeds/linear ft) of row. Drill-

seeded fields received 10 cm (4 in) supplemental irrigation in late April and again in mid-May.

MANAGEMENT

Hoary tansyaster is very competitive against weeds and establishes well despite moderate weed pressure. Prostrate pigweed (*Amaranthus albus* L. [Amaranthaceae]) and redroot pigweed (*A. retroflexus* L.) are often our worst competitive weed species. These are controlled primarily with between-row cultivation using a Lilliston cultivator. Planting into a weed-free seed bed, or using weed barrier fabric, greatly reduces management inputs. Weed control efforts begin prior to planting. Weeds coming up in the holes of the fabric can be controlled by hand-roguing or with wick applications of glyphosate. Weeds along the fabric edges can be controlled by mowing.

Plants grown in the weed barrier fabric at Aberdeen, Idaho, require little if any supplemental irrigation because of the reduced evaporation caused by the fabric. Drill-seeded fields receive supplemental irrigation to approximate 30.5 cm (12 in) annual precipitation. Under good conditions, hoary tansyaster blooms indeterminately in late summer with plants still blooming and attracting pollinators into mid-November.

Moth caterpillars from the genus *Cucullia* Schrank spp. (Lepidoptera: Noctuidae) were observed on observational plots at the Aberdeen PMC (Figure 3). These insects were seen eating on flower heads, but did not appear to do extensive damage or significantly decrease seed production and no control strategies were required.



Figure 2. Seeding hoary tansyaster into weed barrier fabric rows with a drop tube seeder. The hole-spacing jig can be seen in the background. Photo by Loren St John



Figure 3. A *Cucullia* caterpillar feeding on hoary tansyaster flower heads. Photo by Derek J Tilley

HARVEST

Late summer and fall seedings can be harvested the following year. Spring plantings will flower the first season but seed production is low. Seed can be collected by hand, combine, Flail-Vac, or vacuum-type harvester. For harvesting on weed barrier fabric rows, we use a "Jet Harvester" as described by Tilley and Bair (2011) with the fan running at approximately 1900 rpm (Figure 4). This approach ensures that only ripe seed is harvested and allows for multiple harvests during the season. Seed readily disarticulates from flower heads when ripe. A significant advantage of the Jet Harvester is the limited amount of trash and other inert matter being collected, which makes post-harvest cleaning significantly easier. Harvesting by other methods adds to the inert matter that can be difficult to clean out. It takes the PMC crew approximately 90 min to vacuum harvest 150 m (500 ft) of row, up and down both sides. We typically conduct 3 to 5 harvests per season using the Jet Harvester.

In 2013, we harvested the drill-seeded field using a Flail-Vac seed stripper with a brush speed of 400 rpm and a tractor speed of 6 to 7 mph (Figure 5). The Flail-Vac was set to harvest approximately the top 20 to 30 cm (8–12 in) of the plants. We were able to complete 2 harvest cycles using the Flail-Vac, the first occurred on September 3 and the second took place on September 23. Flail-Vac harvesters gather significantly more material than hand harvesting or vacuum harvesting, and the material collected requires considerably more processing during cleaning. Flail-Vac harvesting also collected more weed seed than did more discriminatory methods.

Seed Cleaning

Harvested material is laid on a clean shop floor to air-dry for several days. The material is sifted and turned with hay forks twice each day to facilitate drying and to remove sticks.



Figure 4. PMC farm technicians Derek Jolley and Boyd Simonson harvest hoary tansyaster seeded into weed barrier fabric using the Jet Harvester. Photo by Derek J Tilley

Once dried, seed is first processed through a Westrup laboratory brush machine with a number 7 mantle and a brush rotation speed of 3. The gate is closed to allow the brushed seed to fall through to the catch pan below. The brushed material is then cleaned using a multi-deck air-screen cleaner with 6×30 and 6×32 screens. The air is set at a low setting (1 to 2) to remove dust, pappus, and unfilled seed. Flail-Vac- and combine-harvested material contains a large amount of inert matter and needs to be run through the air-screen process 6 to 10 times for adequate cleaning. Following the air-screening, we use an indent cleaner with 1.8 mm indents to remove small weed seed, such as witchgrass (*Panicum capillare* L. [Poaceae]) and redroot pigweed.

The described cleaning method yields seed with approximately 60 to 90% purity and 60 to 90% viability (Figure 6). Hand-harvested and vacuum-harvested seed are much easier to process, and higher purity levels (80 to 90%) are obtained because of the reduced amount of inert matter collected. Sowthistle (*Sonchus* L. spp. [Asteraceae]) and prickly lettuce



Figure 5. Harvesting a drill-seeded field of hoary tansyaster using a Flail-Vac harvester. Photo by Derek J Tilley



Figure 6. Hoary tansyaster seed cleaned to high levels of purity using the proper equipment. Purities approaching 90% are attainable using a brush machine, air screen, and indent cleaner. Photo by Derek J Tilley

(*Lactuca serriola* L. [Asteraceae]) seed are similar in shape and weight to hoary tansyaster and are very difficult to remove during seed cleaning. These impurities are best handled by exclusion in the field through hand-roguing.

Yields range between 2 and 8 kg PLS/ha (2–7 lb PLS/ac). Hoary tansyaster is relatively short-lived (2–3 y) and volunteers readily from shattered seed. We remove our seed fields after 2 full growing seasons and harvests.

RANGELAND SEEDING

We recommend that seed be drilled or broadcast-seeded during late fall into a firm, weed-free seedbed at a depth of 0 to 6 mm (0 to 0.25 in). The full seeding rate, with a target delivery of 480 to 540 PLS/m² (45–50 PLS/ft² is 1 kg (2 lb) PLS per acre. If seeding as part of a mix, adjust seeding rate to the desired percentage of the mixture. Broadcast plantings should be seeded at double the drill seed rate and be followed with a cultipacker to provide a shallow covering of soil with firm seed-to-soil contact.

SUMMARY

Hoary tansyaster is a competitive short-lived native forb that acts as an early colonizer of rangelands and disturbed sites. It flowers during the first growing season after dormant fall seedings, making it a valuable restoration species for post-fire applications where pollinator habitat requires a quick source of forage. The species is readily visited by a variety of native pollinators that have been shown to be important in the life cycle of sage grouse and other upland birds. Seed of hoary tansyaster is grown at the Aberdeen, Idaho, Plant Materials Center in fab-

ric rows or in direct-seeded fields. Summer planting is recommended to decrease weed pressure and to increase field longevity. The Idaho PMC has used several methods and devices to harvest seed. Hand- and vacuum-harvesting methods are more precise and easier to process, while larger, less discriminate harvesting methods require additional processing.

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