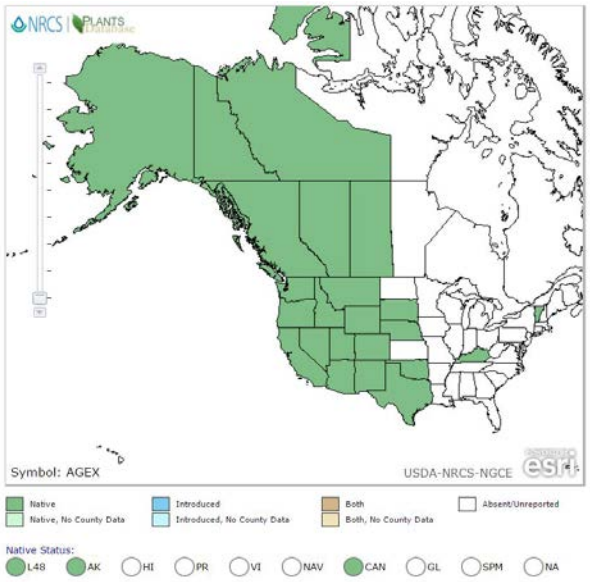
Plant Propagation Protocol for *Agrostis exarata*
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/AGEX.pdf



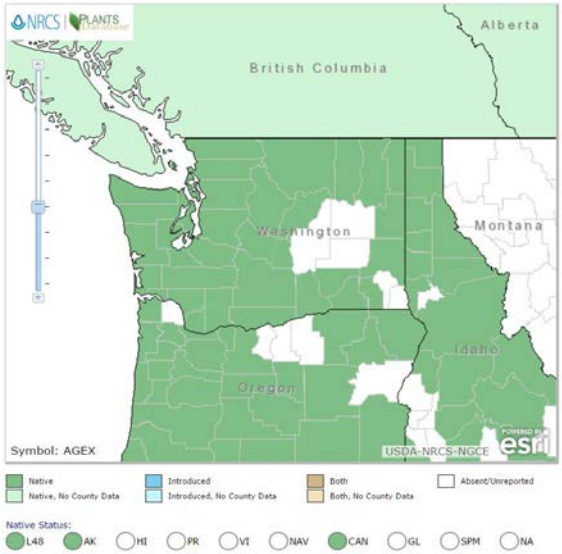


Figure 1 (left): AGEX distribution in North America[1]
Figure 2 (right): AGEX distribution in Washington State[1]

TAXONOMY[1]	
Plant Family	
Scientific Name	Poaceae
Common Name	Grass family
Species Scientific Name	
Scientific Name	*Agrostis exarata* Trin.
Varieties	*Agrostis exarata* Trin. var. *minor* Hook. *Agrostis exarata* Trin. var. *monolepis* (Torr.) Hitchc. *Agrostis exarata* Trin. var. *pacifica* Vasey *Agrostis exarata* Trin. var. *purpurascens* Hultén
Sub-species	*Agrostis exarata* Trin. ssp. *minor* (Hook.) C.L. Hitchc.
Cultivar	
Common Synonym(s)	*Agrostis aenea* Trin. *Agrostis alaskana* Hultén

	Agrostis ampla Hitchc. *Agrostis asperifolia* Trin. *Agrostis longiligula* Hitchc. *Agrostis longiligula* Hitchc. var. *australis* J.T. Howell *Agrostis melaleuca* (Trin.) Hitchc. *Agrostis microphylla* Steud. var. *major* Vasey
Common Name(s)	Spike bentgrass, spike bent, spike redtop, western bentgrass
Species Code (as per USDA Plants database)	AGEX
GENERAL INFORMATION	
Geographical range	Occurs in the western Canada and the western United States from Texas, Nebraska, and South Dakota through the west coast and Alaska.[1,2] See figures above for detailed distribution in North America and Washington State.
Ecological distribution	Occurs in a range of habitats including grasslands, shrub lands, forest openings, wet meadows, high tidal and freshwater marshes, riparian areas, lake margins, and rocky beaches.[2] Grows on disturbed sites and in a wide range of soil textures.[1,2] Tolerates a pH range of 5.5-7.5.[1]
Climate and elevation range	Habitat elevation ranges from alpine zones (max. 2,500 m) to sea level.[2,6] Commonly found in moist areas but can be found in drier habitats, including semi-arid grasslands.[3] Precipitation minimum is 15 cm and maximum is 76 cm.[1] Requires a minimum of 90 frost-free days, but can tolerate minimum temperatures of down to -38°C.[1]
Local habitat and abundance	Associated with a variety of local habitats including Douglas-fir (*Pseudotsuga menziesii*), pinyon-juniper (*Pinus-Juniperus* spp.), ponderosa pine (*Pinus ponderosa*), fir-spruce (*Abies-Picea* spp.), and lodgepole pine (*Pinus contorta*).[3] Widespread in California, western Oregon and western Washington.[1,2,5]
Plant strategy type / successional stage	Facultative seral species.[3] A stress-tolerator which is commonly found in disturbed habitats.[2] Shade intolerant.[1] May be considered weedy in certain areas due to its broad adaptability and abundant seed production.[2]
Plant characteristics	Perennial bunchgrass with a dense flower head (panicle) and stiff, slender stems (culms) 50-100 cm tall.[2] Produces yellow flowers.[1] Leaf blades are lacerate and smooth with open sheaths and flat blades, and are 5-20 cm long and 2-20 mm wide.[2,5] AGEX is more spike-like and narrow compared to other bentgrasses, but a botanical key may be necessary to definitively identify the species.[2] Considerable variability may be found within the species, ranging from

	tall forms in coastal regions to dwarf forms in alpine regions.[2] Blooms in June-September and produces abundant small seeds.[2,5] May occasionally produce small rhizomes in some areas.[2,3,4] Growth rate is moderate and lifespan is moderate.[1] Cannot resprout.[1] Foliage stays green throughout summer months and is considered a good forage source for livestock.[2,3] Has been utilized to stabilize soil in degraded sites.[3]
PROPAGATION DETAILS	
Ecotype	N/A
Propagation Goal	Seed increase
Propagation Method	Direct seeding
Product Type	Propagules (seeds)
Stock Type	N/A
Time to Grow	Seed production for a similar *Agrostis* species (*A. scabra)* is approximately 15 months, with initial seeding often done in spring and seeds harvested the following summer.[8]
Target Specifications	Harvest yields will vary due to local environment, but average annual seed production for the similar *A. scabra* is 142 kg/ha (127 lbs/ac).[8]
Propagule Collection Instructions	Seeds may be harvested beginning in mid-August.[10] Seeds are extremely small and easily shatter; cut seed heads with rice knives or clippers and collect in poly bags.[7,10] Collection may be time-consuming as the plants do not usually occur in large pure patches, but commonly as scattered clumps or individuals on the landscape.[2,7]
Propagule Processing/Propagule Characteristics	Seeds per pound: 5,600,000, +/- 20% (converts to approximately 2,520,000 seeds/kg).[2,7] Seeds are approximately 1.48 mm long and 0.45 mm wide.[10] For the similar *A. scabra*, newly collected seeds are spread out on a tarp in a sheltered dry environment for 3-5 days until no moisture is detected.[8]
Pre-Planting Propagule Treatments	A light debearding to remove the awn may be helpful to facilitate further seed cleaning and sowing.[2] Seeds can be cleaned using an air screen machine or air screen machine.[7] It may be difficult to distinguish unfilled from filled seeds.[7] No pre-planting treatments required; seeds have no dormancy and germinate readily in warm greenhouse conditions or outdoor fall/spring temperatures.[2,7]
Growing Area Preparation / Annual Practices for Perennial Crops	Sow seeds in moist loamy mineral soil in a firm seedbed with full sun.[2,10] For the general *Agrostis* genus, well-drained soil media is key to successful growth and mixtures of sand and organic amendments are commonly used.[9] Planting site should be free of weeds.[10]

	Seeds may be sown to a depth of 0.5-1.5 cm.[10] Row spacing may vary from 75-120 cm in dryland conditions and 30-90 cm with irrigation.[10] If growing area is prone to flooding, a thin layer of mulch may be applied to prevent seed migration.[2]
Establishment Phase Details	Utilizing a seeding rate of 1 lb/acre (PLS, or pure live seed) results in 125 live seeds per square foot.[2] Seeding rate is generally 1-3 lbs/acre, but rates from 3-5 lbs/acre up to 8 lbs/acre may be used to attain a full stand.[2] Sow seeds in spring or fall.[2] If the growing area is prone to flooding, sowing may be done in late summer-early fall.[2] Germination speed to first germination is approximately seven days, and to 50% potential is approx. 10 days.[10] Germination for untreated seeds at 30°/20°C is 99%, and for untreated seeds at 25°/15°C is 75%.[10] Germination for stratified seeds is 13% (stratification is not necessary and not recommended).[10]
Length of Establishment Phase	For the similar *A. scabra*, the establishment phase lasts for two growing seasons.[8]
Active Growth Phase	For the similar *A. scabra*, rapid growth occurs in the spring through fall. Broadleaf herbicide must be applied prior to flowering if desired, and fertilizer may be applied in September.[8,10]
Length of Active Growth Phase	For the similar *A. scabra*, the active growth phase lasts for two to three growing seasons.[8]
Hardening Phase	N/A
Length of Hardening Phase	N/A
Harvesting, Storage and Shipping	Seeds may be harvested beginning in mid-August.[10] Seeds may be hand-harvested as with wild collections or with a combine/thresher.[10] Seeds should be stored in cloth bags at a cool room temperature.[10]
Length of Storage	Seeds have been shown to remain viable after three years, and may be stored for longer (although no literature has tested germination after longer storage periods).[10]
Guidelines for Outplanting / Performance on Typical Sites	Specific information on seed performance at a typical site is unavailable, but one may expect the species to do relatively well due to its high germination rate under outdoor conditions and its ability to thrive in a variety of environments.
Other Comments	As an alternative to direct seeding, seeds may be sown for container stock (plugs) and roots can be expected to fill the container soil profile in weeks, at which time the plugs can be outplanted.[7]
INFORMATION SOURCES	
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