Plant Propagation Protocol for *Artemisia rigida*

ESRM 412 – Native Plant Production

Protocol URL: https://courses.washington.edu/esrm412/protocols/ARRI2.pdf

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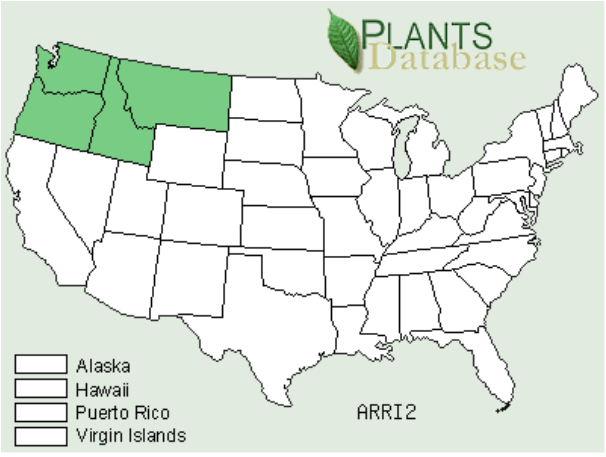

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TAXONOMY	
Plant Family	
Scientific Name	Asteraceae
Common Name	Aster Family
Species Scientific Name	
Scientific Name	*Artemisia rigida* (Nutt.) A. Gray (1)
Varieties	
Sub-species	
Cultivar	
Common Synonym(s)	*Artemisia trifida* Nutt. var. *rigida* *Seriphidium rigidum* (Nutt.) W.A. Weber (1, 2)
Common Name(s)	Stiff sagebrush, rock sagebrush, scabland sagebrush (1, 2, 6, 10, 11, 12)
Species Code (as per USDA Plants database)	ARRI2
GENERAL INFORMATION	

Geographical range	North America- Washington, Oregon, Idaho, Montana (listed as rare in Montana by some, an error by others) Washington- East of the Cascades (1, 2, 6, 12, 15)
Ecological distribution	Shrub steppe, sagebrush steppe, grasslands, dry forests, woodland, Columbia plateau, Columbia and Snake River basins (6, 10, 11, 12)
Climate and elevation range	Two sources note that it can grow at 755-7,000 feet (11, 12); most other sources note that it can grow at elevations of 3,000-5,000 feet (1, 6, 10) Prefers dry, rocky climates Occurs in more arid climates that usually have severe moisture saturation in the winter and requires that there be at least seventy days that are frost free (3, 5, 8, 12)
Local habitat and abundance	Occurs primarily in basaltic bedrock with shallow soil Low sagebrush and grassland communities Harsh, unproductive sites Some associated species: • *Artemisa arbuscular* • *Koeleria cristata* • *Agropyron spicatum* • *Danthonia unispicata* • *Pinus ponderosa* • *Pseudotsuga menziesii* • *Cercocarpus ledifolius* • *Juniperus occidentalis* • *Purshia tridentata* • *Poa secunda* • *Trifolium macrocephalum* (5, 9, 14)
Plant strategy type / successional stage	Climax and edaphic climax community Late successional species that takes many years to become dominant (5, 8, 12)
Plant characteristics	Perennial shrub Most *Artemisia tridentata* live to be 40 – 60 years old but it can reach ages older than 100 years particularly in "unfavorable sites" where most other plants do not thrive (similar species) (3, 9, 12, 14)
	As propagation details were not readily available for *Artemisia rigida* specifically, I included details for *Artemisia tridentata*, the most closely related sister group for which information was plentiful. These may be used in order to try to propagate *Artemisia rigida*.
PROPAGATION DETAILS (for *Artemisia tridentata* seeds by Tara Luna, USDI NPS, Glacier National Park, MT) (7)	
Ecotype	Idaho fescue grassland

Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container (plug)
Stock Type	172 mL conetainers
Time to Grow	10 months
Target Specifications	Height: 6 to 10 true leaves, 6 cm Caliper: 1.7 mm Root System: firm plug in 172 ml conetainer
Propagule Collection Instructions	Seeds are collected in October. Seeds are collected when the seeds turn brown and are easily pulled from the receptacles. Seeds must be collected as soon as the seeds ripen fully; too early or too late collection often results in the collection of non-viable or aborted seeds. Seeds are collected in paper bags and kept in a well ventilated drying shed prior to cleaning. Collections should be spread evenly over a tarp to dry for 3 to 5 days.
Propagule Processing/Propagule Characteristics	Small seed lots are hand cleaned by screens. Seed longevity is at least 2 years in sealed containers at 1C. Seed dormancy is classified as non-deep physiological dormancy. Seeds/Kg: 5,500,000 /kg % Purity: 100% % Germination: 50%
Pre-Planting Propagule Treatments	5 month outdoor winter stratification. Seed germination is reported to be higher when seed is collected late in the season, germinated under fluctuating temperatures, and when seeds are surface sown. Some populations have seed dormancy while others are reported to be non-dormant. Testing of individual lots will determine the need or duration of pre chilling for optimum germination.
Growing Area Preparation / Annual Practices for Perennial Crops	Outdoor nursery growing facility Sowing Method: Direct Seeding. Seeds are surface sown; needs light for germination. Growing media used is milled sphagnum peat, perlite, and vermiculite with Osmocote controlled release fertilizer (13N:13P2O5:13K2O; 8 to 9 month release rate at 21C) and Micromax fertilizer (12%S, 0.1%B,0.5%Cu,12%Fe, 2.5%Mn, 0.05%Mo, 1%Zn) at the rate of 1 gram of Osmocite and 0.20 gram of Micromax per 172 ml conetainer. Conetainers are filled and sown in late fall and irrigated thoroughly prior to winter stratification.

Establishment Phase Details	Medium is kept slightly moist during germination. Initial germination appeared uniform and occurred following 2 weeks of temperatures at 22C or above during in early spring. 2 to 4 true leaves were evident 3 weeks after germination. Careful attention to irrigation frequency is needed during the establishment phase and should be done in early morning so foliage can dry during the day. Once established, seedlings should dry down between irrigations.
Length of Establishment Phase	4 weeks
Active Growth Phase	Root and shoot development occurs rapidly following germination. Plants were occasionally fertilized with 20-20-20 NPK liquid fertilizer at 100 ppm during the growing season. Plants were fully root tight 12 weeks after germination. Plants were 2.5 cm in height with 10 to 12 true leaves.
Length of Active Growth Phase	12 weeks
Hardening Phase	Irrigation is gradually reduced in September and October. Plants are flushed with clear water and fertilized with 10-20-20 NPK liquid fertilizer at 200 ppm once before winterization.
Length of Hardening Phase	4 weeks
Harvesting, Storage and Shipping	Total Time To Harvest: 10 months using a 5 month cold, moist stratification. Production time can be shortened if using a shorter stratification period. Harvest Date: September Storage Conditions: Overwinter in outdoor nursery under insulating foam cover and snow.
Length of Storage	5 months
Guidelines for Outplanting / Performance on Typical Sites	
Other Comments	

PROPAGATION DETAILS

(for *Artemisia tridentata* seeds by Greg Fenchel, USDA NRCS, Los Lunas Plant Materials Center, NM) (4)

Ecotype	Arizona high desert
Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container (plug)
Stock Type	Container Type and Volume: Ray Leach Super Cell - 10 cubic inch volume, 1.5-inch diameter, and 8.25-inch depth.

Time to Grow	
Target Specifications	Stock Type: One-Gallon Tree Pot, 4"x4"x14" Root System: Consolidated root mass sufficient to prevent root ball disintegration during outplanting.
Propagule Collection Instructions	
Propagule Processing/Propagule Characteristics	
Pre-Planting Propagule Treatments	Stratification: None required. Soaking/Leaching: A number of species may benefit from a rigorous imbibition treatment and/or leaching of germination inhibitors. These seed are put in rubber-lined rock tumbler jar along with tap water to undergo a wet tumbling which agitates the seed allowing easy oxygen and water entry into the seed. The water in the tumbler is changed daily to remove any inhibitors that may have leached out. The duration of tumbling is a guess based on the appearance of the seed and the leach water.
Growing Area Preparation / Annual Practices for Perennial Crops	Propagation Environment: Greenhouse 70 degrees F day, 55 degrees F night during winter, maximum summer temperature 85 degrees F. A watering bench with mini-sprinklers automatically waters plug trays once a day in early morning. In extremely hot periods during the summer, twice a day watering is programmed. The watering bench is covered with a copper-coated fabric (Texel Forestry Fabric) to reduce root egress from the plug cells; this fabric covers a filter fabric (Dewitt Filter Fabric) which acts to pull excess water out of plug cells via capillary water movement. Seed Propagation Method: Dry or pretreated seed are sown in plug flats with square deep cells (288 or 512 cells per flat). Media is a commercial soilless mix (Sunshine #1); plug trays are loosely filled with dry to slightly moist media, leveled off, and then compressed with an empty plug tray. The number of seed sown depends on size and estimated germination. Small or fluffy seed are dispersed as evenly as possible. Seeds of Big Sagebrush are not covered. Growing Media: Mix of 2 parts Sunshine #1 or #2 with 1 part perlite. 2 to 4 kg of controlled release fertilizer (CRF) Osmocote Plus 15-9-12 incorporated per cubic yard of mix. For plants started in the greenhouse during winter, 8-9 month release CRF is used, but for spring grown material 3-4 month release CRF is used.
Establishment Phase Details	Sowing/Planting Technique: The filled Super Cells are

	dibbled to provide a hole for the plug seedling. The plug seedling root ball is removed using a flat powder spatula with a blade about 6 mm wide and 30 mm long attached to a handle. The blade is plunged along the side of root ball and the seedling plug is levered out of the cell. The plug is dropped into the dibbled hole. Top watering firms and fills any voids around the plug. If excessive numbers of seed have germinated, excess seedlings are cut off during the plug transplanting process. Must be transplanted soon after germination before radicle elongates. Seed Treatment: No cover for seed. Establishment Phase: The Super Cell seedlings in the greenhouse are watered with soluble fertilizer at every other watering. The fertilizer solution is Peters Peat Lite Special 20-10-20 at a rate of 200-mg/l nitrogen. Thinning of seedlings down to one per container occurs during this phase, usually when the seedlings are 2 to 4 cm tall.
Length of Establishment Phase	
Active Growth Phase	Rapid Growth Phase: Fertigation continues as described in Establishment Phase.
Length of Active Growth Phase	
Hardening Phase	The goal is to have the Super Cell seedlings ready to move outside in early May after the last freeze but before excessively hot outdoor temperatures. In the outdoor nursery, larger seedlings may require watering every day, smaller seedlings generally every other day. The seedlings are fertigated about once a week with Peters Peat Lite Special 20-10-20 at a rate of 200-mg/l nitrogen.
Length of Hardening Phase	
Harvesting, Storage and Shipping	Total Time to Harvest: The time required to produce a seedling ready for transplanting into a one gallon tree pot is very dependent on species and the time of year in the greenhouse. Fast growing species can be ready in 3 to 4 months from germination. Slow growing species can take over a year.
Length of Storage	
Guidelines for Outplanting / Performance on Typical Sites	
Other Comments	Moderate seedling growth, moderate later growth, moderate water requirement, evergreen (needs more frequent winter watering). Have encountered catastrophic losses from unknown fungal pathogen.

PROPAGATION DETAILS (for *Artemisia tridentata* cuttings by Lindsay Springer, USDI NPS, Rocky Mountain National Park, CO) (13)	
Ecotype	Colorado, Hollowell Park
Propagation Goal	Seeds
Propagation Method	Vegetative
Product Type	Propagules (seeds, cuttings, poles, etc.)
Stock Type	
Time to Grow	
Target Specifications	Stock Type: One-Gallon Tree Pot, 4"x4"x14" Root System: Consolidated root mass sufficient to prevent root ball disintegration during outplanting.
Propagule Collection Instructions	
Propagule Processing/Propagule Characteristics	
Pre-Planting Propagule Treatments	Rooting hormone treatment.
Growing Area Preparation / Annual Practices for Perennial Crops	Growing media: Fafard Growing Mix 2.
Establishment Phase Details	
Length of Establishment Phase	
Active Growth Phase	
Length of Active Growth Phase	
Hardening Phase	
Length of Hardening Phase	
Harvesting, Storage and Shipping	
Length of Storage	
Guidelines for Outplanting / Performance on Typical Sites	
Other Comments	

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Note: This propagation protocol template was modified by J.D. Bakker from that available at: http://www.nativeplantnetwork.org/network/SampleBlankForm.asp