Plant Propagation Protocol for *Iris missouriensis*
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/IRMI.pdf




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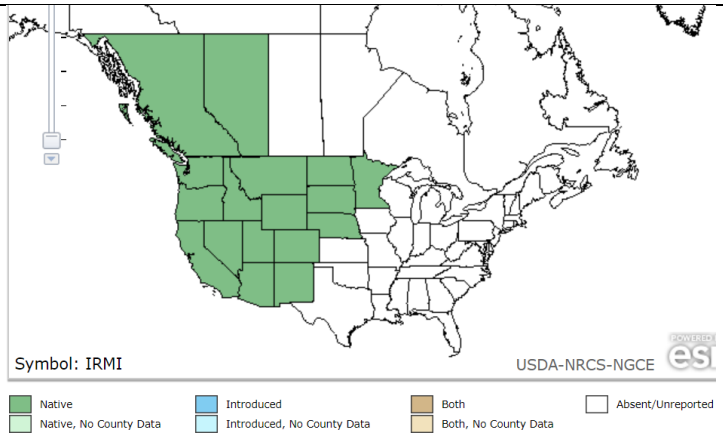
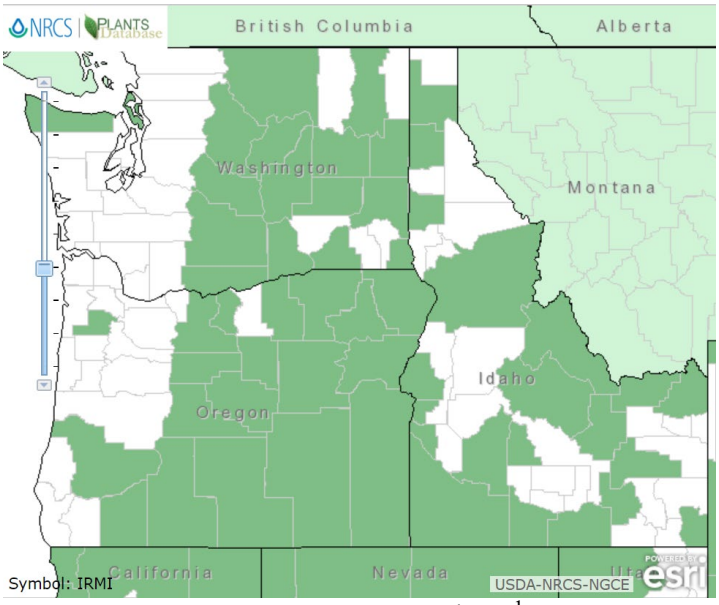
TAXONOMY	
Plant Family	
Scientific Name	*Iridaceae*
Common Name	Iris family
Species Scientific Name	
Scientific Name	*Iris missouriensis* Nutt.
Varieties	n/a
Sub-species	n/a
Cultivar	n/a
Common Synonym(s)	*Iris longipetala* Herb. *Iris missouriensis* Nutt. var. arizonica (Dykes) R.C. Foster *Iris missouriensis* Nutt. var. pelogonus (Goodding) R.C. Foster *Iris pariensis* S.L. Welsh *Iris tolmieana* Herb.
Common Name(s)	Rocky Mountain Iris, Western Iris, Missouri flag, western blue flag, wild iris
Species Code (as per USDA Plants database)	IRMI

GENERAL INFORMATION	
Geographical range	  Map source: USDA PLANTS Database[1]
Ecological distribution	*Iris missouriensis* is distributed in wet meadows, seeps, dry steppes, and open woodland.[2] *Iris missouriensis* is found in western and mid-west region of United States, as well as in British Columbia and Alberta in Canada. In the Pacific Northwest, *Iris missouriensis* is mostly found east of the Cascades and occasionally west of the Cascades.[1]
Climate and elevation range	In mild summer climates, *Iris missouriensis* performs best in medium to wet, well-drained soils in full sun. In hot summer climates, *Iris missouriensis* appreciates some afternoon shade.[3] Lowest temperature tolerance is reported to be -28 °F. In terms of moisture, *Iris missouriensis* only needs moisture in spring and will tolerate most droughts.[2] *Iris missouriensis* grows various elevations: high elevations (~3000m) in mountains in Montana

	and Wyoming, alpine meadows, and near sea level in California.[4]
Local habitat and abundance	In Washington state, *Iris missouriensis* is distributed east of the Cascades, with some spots west of the Cascades. *Iris missouriensis* is common in Washginton state's moist meadows, especially in sagebrush and Ponderosa pine forests.[5]
Plant strategy type / successional stage	*Iris missouriensis* has rapid growth rate and a colonizing growth form, which means that the plant's strategy type/successional stage is weedy/colonizer.[6]
Plant characteristics	*Iris missouriensis* a perennial forb that forms thick rhizomes and simple leafless flowering stems. *Iris missouriensis* produces purple flowers between May and July and produces spindle shaped fruits that are 3 to 5 cm long.[5]
PROPAGATION DETAILS: by Skinner, David M., 2005[7] and by Luna, Tara et al., 2008[8]	
Ecotype	Paradise Creek drainage near Pullman, WA
	East Glacier Park, MT
Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container (plug)
Stock Type	n/a
	300 ml Deepots
Time to Grow	2 years
Target Specifications	Tight root plug in container
	Stock Type: Container seedling Height: 6 to 10 true leaves; 30 cm Caliper: n/a Root System: firm plug with developed rhizome in container
Propagule Collection Instructions	Fruit is a capsule. Seed is dark brown in color. Seed is collected when the capsules begin to split in early to mid August and should be cleaned and planted immediately. Seed can be shaken into envelopes or bags, or the entire capsule can be cut from the stem.
	Collect mature capsules when they begin to split and turn light tan in color. Seeds are red to brown at maturity. Capsules are collected in paper bags and kept in a well-ventilated drying shed prior to cleaning.
Propagule Processing/Propagule Characteristics	Seed shaken from capsules needs no cleaning. Capsules can be crushed to release seed. Seed is cleaned with an air column separator. The seeds are large and dense and are easily cleaned. The USDA seed density is 19, 958 seeds/lb for this species.[1] The seed density for the ecotype is 23, 349 seeds/lb.

	Seeds are easily removed from open capsules and screened to remove chaff. Seed longevity is unknown. Seed dormancy is classified as physiological dormancy. Seeds/Kg: 44,000/kg % Purity: 100% % Germination: 50%
Pre-Planting Propagule Treatments	Germination is highest with fresh seeds are planted immediately after harvest. Extended cold, moist stratification is needed. In trials at the PMC with dry stored seed, no germination occurred without stratification and no seed germinated after 30 days cold, moist stratification. Seed left outside to germinate began emerging in late March. Germination after cool, dry storage and after warm, dry storage was equally low. Fresh seed sown covered in August and left outdoors germinated at 60% the following spring. A few seedlings emerged late in the same fall. Some germination will also occur after the second winter. Surface sown seed germination was uniformly low across all treatments, indicating light is not a factor in germination. Cool spring temperatures may also be necessary. Seedlings germinated outdoors and moved to the greenhouse did not survive. There may be large dissimilarities in germinability of seed collected from the same site in different years, probably due to variation in climatic conditions.
	Seeds are placed in a 5-month outdoor cold, moist stratification. A second seed lot was artificially cold, moist stratified for 120 days at 2C. Germination began at 100 days during stratification. Germinants were planted into containers and grown under cool temperatures (15 to 19 C) in a greenhouse.
Growing Area Preparation / Annual Practices for Perennial Crops	In mid-August fresh seed is sown in 10 cu. in. Ray Leach Super cell conetainers filled with Sunshine #4 and covered lightly. A thin layer of pea gravel is applied to prevent seeds from floating. Conetainers are watered deeply and placed outside in the lath house. They remain there throughout the fall and winter.
	Outdoor Nursery or under temperature-controlled greenhouse. Sowing Method: Direct Seeding. Seeds were covered with medium. However, Deno indicates that fresh seeds have a light requirement and must be surface sown following stratification. Growing medium used is 6:1:1 milled spaghnum 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 3 grams of Osmocote and 1.5 gram of Micromax per conetainer.
Establishment Phase Details	Containers remain outside. They are watered enough to keep the planting medium moist. Germination will begin as daytime temperatures warm in March and may occur over 2-4 weeks.
	Seeds that were fall sown germinate in early spring under cool, fluctuating outdoor temperatures. Seeds that were artificially stratified were planted as germinants. Seeds germinated while in stratification at 2C. Germinants were planted into containers and grown under cool greenhouse temperatures. Medium is kept slightly moist during germination. Germination was very non uniform and continued over 4 weeks. Germination ceased when temperatures were higher than 21C during the day. Seedlings had developed 1 true leaf 3 weeks after germination. Seedlings are irrigated with Rainbird automatic irrigation system in early morning until containers are thoroughly leached. Average growing season of nursery is from late April after snowmelt until October 15th.
Length of Establishment Phase	7-8 months
	4 weeks
Active Growth Phase	Plants are watered as needed while outside and fertilized once a week with a water soluble, complete fertilizer. Growth is slow and plants will usually only produce 2-3 leaves during the first growing season. They must be overwintered and allowed to grow a second year in the containers to develop a tight root plug.
	Root and shoot development occur at a moderate rate following germination. Seedlings were fertilized with liquid 20-20-20 NPK weekly during active growth. Seedlings begin to go dormant in late summer. During this time, seedlings receive less frequent irrigation. Seedlings had developed 4 to 6 true leaves and were root tight by the end of the 2nd growing season.
Length of Active Growth Phase	2 years
	16 weeks
Hardening Phase	Fertilizer is withheld in September and water decreased to harden the plants for winter. Since the plants are grown outside, cold hardening is not needed.
	Seedlings naturally become dormant by late summer. During fall months, seedlings are fertilized with 10-20-20 liquid NPK at 200 ppm once every 2 weeks. Seedling were given one final irrigation prior to winterization.
Length of Hardening Phase	n/a

	4 weeks
Harvesting, Storage and Shipping	Plants are stored in the lath house over winter with no protection except snow cover. Plants exposed to extreme low temperatures with no snow cover should be afforded some insulation. Regrowth will begin in early March as soon as temperatures begin to warm.
	Total Time to Harvest: 2 years Harvest Date: September of the second year. Storage Conditions: Overwinter in outdoor nursery under insulating foam cover and snow.
Length of Storage	Depends on weather conditions for outplanting (see Guidelines for Outplanting).
	5 months
Guidelines for Outplanting / Performance on Typical Sites	If there is sufficient soil moisture, survival of transplants is higher with late fall plantings. Under very dry fall conditions, planting should be postponed until early spring. Transplanting is done using a dibble to punch holes in wet soil. On less wet sites an electric drill and portable generator can be used to drill 1.5-inch diameter holes. Electrical equipment should not be used around water or on very wet sites. Survival in seed increase plantings without competing vegetation averages 95%. Transplanting into sites with existing vegetation reduces survival and vigor depending on weather conditions following planting. A few plants will flower the year following outplanting, but most require 2-3 years to produce seed.
Other Comments	Seed predation by insect larva has been observed. Plants may be propagated by division of the thick rhizome.[9] This method should only be used for plants growing in cultivation. Plants should not be dug up from stands in the wild. It is considered a C-list noxious weed in state of California and potentially a weedy or invasive problem according to certain sources or states that view it as a potential problem.[10] May outcompete grasses and be toxic to cattle.[11]
	Vegetative Propagation Method: Rhizomes can be divided to increase nursery stock.
PROPAGATION DETAILS: by Love, Stephen L., and Akins, Candace J.[12] *This is not a propagation protocol specifically for *Iris missouriensis*, but the study includes information on germination of *Iris missouriensis.*	
Germination	Germination rate for different temperature and light conditions 70°F [light] (22% in 7–10 wk) 70°F [dark] (0%)

	40°F→70°F [light] (33%) 40°F→70°F [dark] (0%) This result suggests a light requirement. Another sample germinated 10% after over 2 years of alternating cycles and 4% after 2 years of outdoor treatment. Both samples had been subjected to at least 6 months of dry storage. Treatment with GA3 has not initiated germination yet.
INFORMATION SOURCES	
References	[1] USDA. "Iris missouriensis Nutt." USDA PLANTS Database. Accessed April 27, 2020. https://plants.usda.gov/core/profile?symbol=IRMI [2] USFS. "Iris missouriensis: Western Blue Flag Iris." Our Native Irises: Blue Flag Irises. Accessed May 4, 2020. https://www.fs.fed.us/wildflowers/beauty/iris/Blue_Flag/iris_missouriensis.shtml [3] "Iris Missouriensis" Missouri Botanical Garden. Accessed May 8, 2020. https://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?taxonid=281159&isprofile=0&gen=Iris. [4] Journal of the Academy of Natural Sciences of Philadelphia, no. 7 (1834): 58. [5] Knoke, Don and Giblin, David. "Iris missouriensis." Burke Herbarium Image Collection. Accessed April 27, 2020. https://biology.burke.washington.edu/herbarium/imagecollection/taxon.php?Taxon=Iris%20missouriensis [6] USDA, "Iris missouriensis Nutt." USDA Germplasm Resources Information Network (GRIN-Taxonomy). Accessed June 1, 2020. https://npgsweb.ars-grin.gov/gringlobal/taxonomydetail.aspx?id=20363. [7] Skinner, David M. "Propagation protocol for production of container Iris missouriensis Nutt. plants; Pullman Plant Materials Center, Pullman, Washington." USDA, Forest Service, National Center for Reforestation, Nurseries, and Genetic Resources. 2005. https://npn.rngr.net/renderNPNProtocolDetails?selectedProtocolIds=iridaceae-iris-2962 [8] Luna, Tara, Cox, Robin, Evans, Jeff, and Wick, Dale. "Propagation protocol for production of Container (plug) Iris missouriensis Nutt. plants 300 ml Deepots" USDA, Forest Service, National Center for Reforestation, Nurseries, and Genetic Resources. 2008. https://npn.rngr.net/renderNPNProtocolDetails?selectedProtocolIds=iridaceae-iris-94 [9] Kruckeberg, Arthur R. *Gardening with Native Plants of the Pacific Northwest*. 2nd ed. (Seattle, WA: University of Washington Press, 1996), 282. [10] USDA, NRCS. 2004. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA. [11] Whitson, Tom D., Larry C. Burrill, Steven A Dewey, David W. Cudney, B.E. Nelson, Richard D. Lee, and Robert Parker. 1996. Weeds of the West. 5th ed. Western Society of Weed Science. Newark, CA. 630. [12] Love, Stephen L, and Candace J Akins. "Third Summary of the Native Seed Germination Studies of Norman C Deno: Species with Names Beginning with Letters F through K." *Native Plants Journal* 20, no. 2 (2019): 140.
Other Sources Consulted	
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