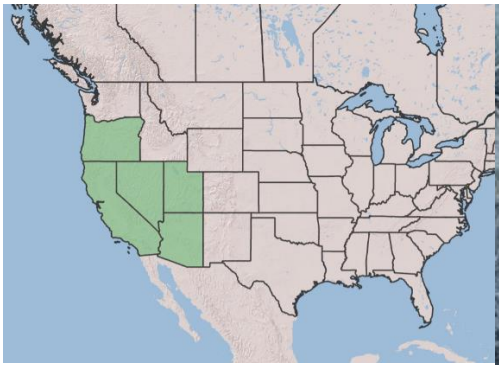
Plant Propagation Protocol for *Ephedra nevadensis*
ESRM 412 – Native Plant Production
URL: https://courses.washington.edu/esrm412/protocols/2022/EPNE.pdf



Left: Map of distribution of *E. nevadensis* [2]. Right: *E. nevadensis* [5].

TAXONOMY	
Plant Family	
Scientific Name	*Ephedraceae*
Common Name	Joint Fir, Mormon Tea Family
Species Scientific Name	
Scientific Name	*Ephedra nevadensis S. Watson*
Common Name(s)	Nevada Jointfir, Grey Ephedra, Mormon Tea
Species Code (as per USDA Plants database)	EPNE
GENERAL INFORMATION	
Geographical range	AZ , CA , NV , OR , UT [1]. See above for USDA map of distribution in USA [2].
Ecological distribution	Found commonly in deserts and rocky slopes [1] usually at elevations of 1,000 - 4,000 ft (305-1,220 m) [2]. Sometimes found in the desert grassland up to 5,000 ft. (1,524 m) [2].
Climate and elevation range	Occupies dry hills and slopes mostly below 4500ft elevation [3]. In the Mojave desert, *E. nevadensis* experiences severe annual droughts [4]. Most precipitation occurs in the winter and average precipitation in the desert ranged between 96 and 367mm/ year between 1998-2001 [4]. Air temperature in the Mojave desert ranges from -15°C in the winter to 47°C in the summer [4]. *E. nevadensis* is found in zone 6 and 7 in the USDA Plant hardiness zone map [5].
Local habitat and abundance	Prefers well-drained, loamy soil and slightly acidic, neutral, or basic soil [5]. Cannot grow in shade [5].

Plant strategy type / successional stage	Drought and lime tolerant [5].
Plant characteristics	*E. nevadensis* is a perennial Shrub [1]. It is also dioecious and a wind-pollinated gymnosperm [6]. In addition to seed propagation, *E. nevadensis* can propagate vegetatively, naturally, through rhizomes [7].
PROPAGATION DETAILS	
Graham: Propagation of *Ephedra nevadensis* [3]	
Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container
Stock Type	2 Gallon PVC Pipe containers
Time to Grow	12 months
Target Specifications	Root system: Firm root plug in container
Propagule Collection Instructions	Seeds collected in late spring
Propagule Processing/Propagule Characteristics	Allow seeds to dry for 4-6 weeks in paper bags in a warm, dry room. After seed cleaning, store in airtight containers at 7°C.
Pre-Planting Propagule Treatments	Seeds are soaked in a 1:4 beach/water solution for 1-3 hours then leached overnight to removed inhibitors and allow for full imbibition of seeds before sowing. Seeds are sown directly in open flats. Growing medium is a 2:1:2 ratio of sand/mulch/perlite.
Growing Area Preparation / Annual Practices for Perennial Crops	The Joshua Tree Native Plant Nursery utilizes two greenhouses, shade structures, mist propagation beds, and an outdoor growing compound for different stages of seedling growth.
Establishment Phase Details	Seedlings are germinated on flats in a germination chamber or under mist until establishment, approximately 2-3 weeks. They are then transplanted into polyvinyl food wrapped newspaper cylinders. The containers are 29 cm (11.5 in) tall and 7.5 cm (3 in) in diameter and each is filled with a growing medium of 2:1:1 sand/mulch/perlite.
Length of Establishment Phase	4 weeks
Active Growth Phase	Seedlings are transplanted into larger containers at 8-12 weeks. The PVC containers to be used are 37.5 cm tall(15 in) and are 15 cm (6 in)in diameter. The plastic wrap is removed before transplanting the units into PVC containers using the same medium used for the newspaper containers. 22 g per 6 L of Osmocote

	time release fertilizer (9 mo release rate) (13 N:13P2O5:13K2O) is mixed into the medium. After transplanting, seedlings are moved to an open growing compound with a 55% shade cloth that is used in the summer months. An automatic drip system is used and duration of irrigation varies by season.
Length of Active Growth Phase	9 months
Hardening Phase	While seedlings are hardening, about 4-8 weeks before out-planting, irrigation frequency and duration is reduced. The shade cloth in the growing compound is removed beginning in October.
Length of Hardening Phase	2 months
Harvesting, Storage and Shipping	Seedlings remain in the open growing compound for overwintering.
Length of Storage	Depends on out-planting date.
Guidelines for Out-planting/ Performance on Typical Sites	No information.
Graves et al.: Seed Treatment of Mojave Desert Shrubs [8]	
Ecotype	Seeds were collected from the west side of the Mojave Desert at about 900 m (3,000 ft) elevation.
Propagation Goal	Germinants
Propagation Method	Seed
Target Specifications	Germinants, 5-8mm radicle.
Propagule Collection Instructions	Seeds collected between December 1970 and October 1971 by a commercial seed collector. Samples were not obtained until March 1972.
Pre-Planting Propagule Treatments	Control seeds were placed in cold storage at 10°C for 30 days. Treatment 1 involved heat application, under which seeds were spread on metal platters and subjected to 4 hours of both 60°C and 80°C forced air heat. Treatment 2 involved stratification in moist sand at 2°C for 30 days. Treatment 3 was an activated carbon treatment. Seeds were mixed with 100g of moistened 12x50-caliber activated carbon in plastic bags. Plastic bags were sealed at the top, so that were was room for air expansion. Seeds were stored for 30 days at 2°C and were allowed to dry for 2 days before germination testing.
Growing Area Preparation / Annual Practices for Perennial Crops	Seeds were germinated on paper inside inclined plexiglass germination plates. Seeds were divided into

	four 100-seed lots, placed on each germination plate in 10 rows, and covered with wetted tissue paper. The lots were arranged upright on racks wicked in glass dishes filled with distilled water. Afterwards, the germination dishes were placed in a dark chamber for 48 hours at 12°C. After this period, temperature was increased to 21°C and the dishes remained in these conditions for 12 days.
Establishment Phase Details	76% of seeds that underwent the stratification in moist sand treatment had germinated with two weeks. 71% of seeds that underwent the activated carbon treatment had germinated within two weeks. 60% of seeds that underwent the 4 hour, 80°C or the 4 hour, 60°C heat treatment germinated within two weeks.
Length of Establishment Phase	14 days
Young et al.: Ephedra Seed Germination [9]	
Ecotype	Seeds were collected in the Western Mohave Desert at 975 m (3,200 ft) elevation in late summer,1974.
Propagation Goal	Germinants
Propagation Method	Seed
Target Specifications	Radicle length exceeds 1 cm.
Propagule Collection Instructions	Seeds were collected by hand in late summer of 1974.
Pre-Planting Propagule Treatments	Seeds were threshed by hand then stored in paper bag in the laboratory for 3 months at room temperature.
Establishment Phase Details	Four 100-seed lots were placed in dark germinators and were subjected to procedures of constant and alternating temperatures of 0, 2, 5, and increasing 5 degree increments up to 40°C. The alternating procedure included 16 hours at each constant temperature and 8 hours on higher temperature combinations. Germinants were counted every day for two weeks, then once a week for two more weeks. The highest germination numbers resulted from constant temperatures between 5-20°C and alternating temperatures of 20°C cold for 16 hours/25°C warm for 2 hours. Outside of this range, germination of seeds greatly declined.

	Another test included incubating four 100-seed lots in plastic boxes containing either 5g of ground polystyrene and 100ml of polyethylene glycol or NaCl solutions at varying osmotic potentials (-4, -6, -8, -12, -16) for two weeks at 15°C. Results showed that seeds were able to germinate at osmotic pressures as low as -12 bars but had higher germination rates at higher potentials.
Length of Establishment Phase	At 20°C, 68% of seeds had germinated within 2 weeks. At 5°C, 36% of seeds had germinated within 2 weeks. At 0 bars of osmotic pressure in both polyethylene solution and NaCl solution, 58% of seeds had germinated within 2 weeks.
INFORMATION SOURCES	
References	See below
Other Sources Consulted	See below
Protocol Author:	Alexandria Crabtree
Date Protocol Created or Updated	05/03/2022

References:

[1]TWC Staff. 2018. *Ephedra nevadensis*. Ladybird Johnson Wildflower Center. https://www.wildflower.org/plants/result.php?id_plant=EPNE#:~:text=Propagation,and%20can%20be%20easily%20transplanted. [Accessed May 3, 2022].

[2]USDA NRCS National Plant Data Team. *Ephedra Nevadensis S. Watson*. United States Department of Agriculture. https://plants.usda.gov/home/plantProfile?symbol=EPNE. [Accessed May 3, 2022].

[3]Graham J. 2004. *Propagation protocol for production of Container (plug) Ephedra nevadensis S. Wats. plants 2 Gallon PVC Pipe containers.* USDI NPS – Joshua tree Native Plant Nursery. https://npn.rngr.net/renderNPNProtocolDetails?selectedProtocolIds=ephedraceae-ephedra-2577

[4]Wilcox C. S., et al. 2004. Fine root growth dynamics of four Mojave Desert shrubs as related to soil moisture and microsite. Journal of Arid Environments, Vol. 56, No. 1, pp. 129-148.

[5]*Ephedra nevadensis - S.Watson*. Plants For A Future. https://pfaf.org/user/Plant.aspx?LatinName=Ephedra+nevadensis [Accessed May 3, 2022].

[6]Shryock, D. F., et al. 2017. *Landscape Genetic Approaches to Guide Native Plant Restoration in the Mojave Desert.* Ecological Applications, Vol. 27, No. 2, pp. 429–45. http://www.jstor.org/stable/44203418

[7]Land, W. J. G. 1913. *Vegetative Reproduction in an Ephedra*. Botanical Gazette Vol. 55, No. 6, pp. 439–45. http://www.jstor.org/stable/2467825.

[8]Graves W. L., Kay B. L., Williams W. A. 1976. *Seed Treatment of Mojave Desert Shrubs*. Agronomy Journal, Vol. 67, No. 6, pp. 773-777.

[9]Young J. A., Evans R. A., Kay B. L. 1977. *Ephedra Seed Germination*. Agronomy Journal, Vol. 69, No. 2 (Mar. - Apr., 1977), pp. 209-211.

Consulted sources:

[10]Friedman, W. E. 1990. *Sexual Reproduction in Ephedra Nevadensis (Ephedraceae): Further Evidence of Double Fertilization in a Nonflowering Seed Plant*. American Journal of Botany, Vol. 77, No. 12, pp. 1582–98. https://doi.org/10.2307/2444491.