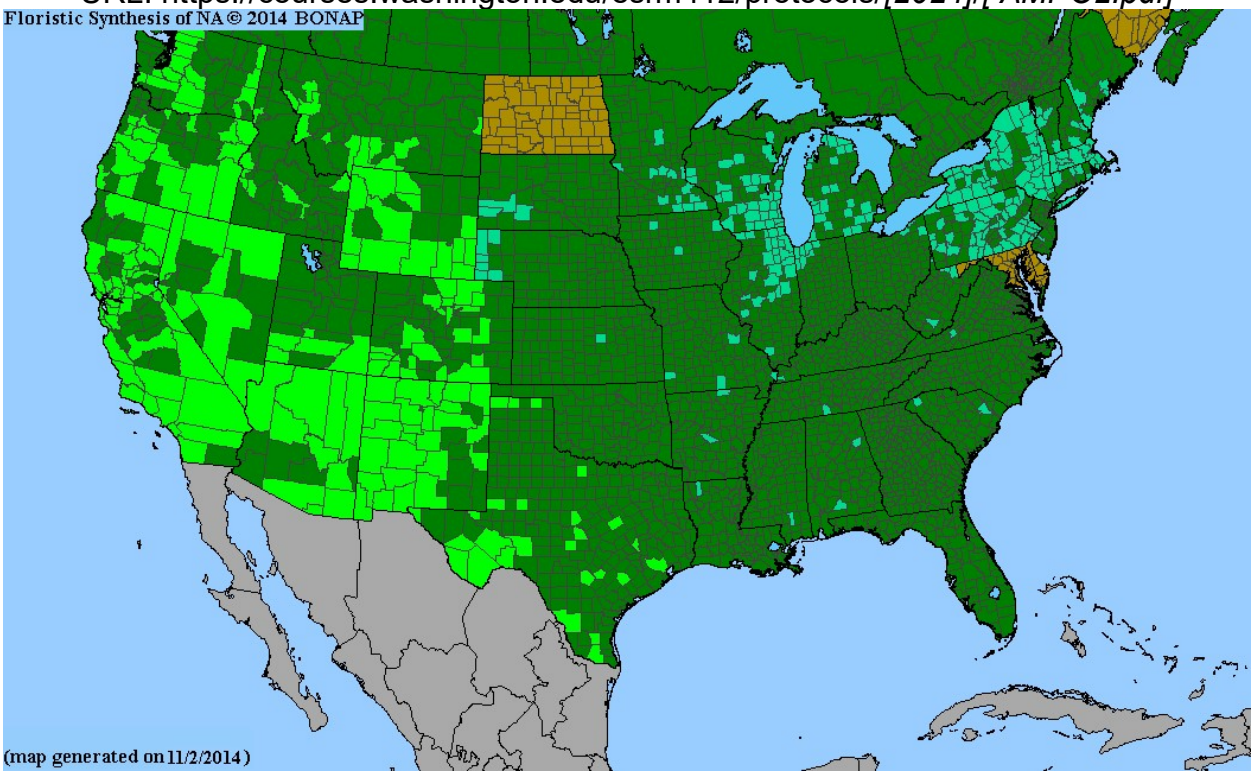
Plant Propagation Protocol for *[Amaranthus powellii]*
ESRM 412 – Native Plant Production
URL: https://courses.washington.edu/esrm412/protocols/*[2024]/[AMPO2.pdf]*



Map from Kartesz, J.T(2015)
Key: dark green:native in state but not common in county, light green:native in state and common in county, blue-green:Native but adventitive

TAXONOMY	
Plant Family	
Scientific Name	*Amaranthaceae*
Common Name	Amaranth family
Species Scientific Name	
Scientific Name	*Amaranthus powellii* S. Watson
Varieties	
Sub-species	*Amaranthus powellii* S. Watson ssp. *powellii*, *Amaranthus powellii* S. Watson ssp. *bouchonii* (Thell.) Costea & Carretero
Cultivar	
Common Synonym(s)	*Amaranthus bracteosus* Uline & Bray, *Amaranthus retroflexus* L. var. *powellii* (S. Watson) B. Boivin, *Amaranthus bouchonii* Thell., *Amaranthus bracteosus* Uline & Bray, *Amaranthus viscidulus* Greene
Common Name(s)	Powell's Amaranth, Green Amaranth, Powell's Smooth Amaranth, Green Pigweed

Species Code (as per USDA Plants database)	AMPO2
GENERAL INFORMATION	
Geographical range	Native to SW North America and naturalized to much of N. America, S. America, Europa, Asia, and Australia(4)
Ecological distribution	Disturbed areas, agricultural fields, roadsides, riparian areas, and lakeshores(2)
Climate and elevation range	Prefers 0-8200ft elevation(2) and prefers well drained hot and sunny sites(3), but can acclimate and adapt to a variety of conditions(1)
Local habitat and abundance	Often found growing in disturbed sites and agricultural fields, less common in disturbed sites with high competition like pastures(5)
Plant strategy type / successional stage	Weedy colonizer of disturbed sites(1). More competitive in warm dry conditions due to C4 photosynthesis(1), but still more cold tolerant then other similar *Amaranthus* species(6)
Plant characteristics	3-6ft frost sensitive annual forb.
PROPAGATION DETAILS	
Propagation Goal	plants
Propagation Method	Seed
Product Type	plug
Time to Grow	Based on propagation of domesticated *Amaranthus* species it should take 5 weeks from seed to transplanting(7). If germination occurs within the first 7 days it could be 4 weeks from seeding to transplanting
Target Specifications	Young seedlings that are established enough to outcompete other weedy plants at the target site
Propagule Collection Instructions	Plants for seed collection should be located in late summer to early fall. Seeds mature 30 days after flowering with flower timing depending on a variety of factors and often depends on location and recent weather conditions(7). Domestic *amaranthus* seeds are mature if they fall off the flower head when gently rubbed between two fingers(8). At this stage seed heads/inflorescences can be cut off and placed upside down into bags to dry. Once dry rubbing the seed heads with your hands should remove the seeds(8). *Amaranthus powellii* dormancy is dependent on when in the season seeds are produced. Earlier infloresences produce less dormant seeds which may be better suited to seeding within the next year while later infloresences produce more dormant seeds which may be better suited for longer term storage(1).
Propagule Processing/Propagule Characteristics	Longevity in the field is often 6-10 years for closely related species(1) and is likely much longer when stored under cool dry conditions. Seed density, seeds per plant, and seed longevity can all vary greatly with growing conditions and differences between populations(1,9,10)
Pre-Planting Propagule Treatments	Amaranth seeds can be easily separated from the flower at the harvesting stage(8), but may need to be separated from chaff. This

	process will likely depend on seed size and density in the target planst for seed collection. Seeds should be stored in cool dry conditions
Growing Area Preparation / Annual Practices for Perennial Crops	Seed starting plugs should be filled with a sterile seeding mix based on procedures for domestic *Amaranthus* species(7) and seeds should be buried ¼-1/2" deep(1). optimal seed depth may be variable and depend on seed size
Establishment Phase Details	Oryokot, Joseph O. E. et al. 2017 saw germination with mean temperatures in the range of 55-90°F and hypothesized that germination may occur with temperatures as low as 46°F, but optimal germination was observed with mean temperatures in the range of 77-90°F. Some populations benefit from germination in alternating light and dark conditions while other populations were more likely to enter dormancy when exposed to alternating light and darkness(10). Target population response to germination under different light regimes should be tested prior to plant production to find optimal light conditions. If this is not possible seeds should be germinated without exposure to light to avoid potentially triggering dormancy.
Length of Establishment Phase	1-3 days is the typical time to germinate(6), although different populations may have different dormancy periods and germination requirements that effect this time(10). Germination should occur within 10 days at the maximum(11)
Active Growth Phase	Growth occurs with mean temperatures ranging from 60°F and 105°F with optimal growth occurring at 82°F(11). Soluble 20-20-20 fertilizar (1tbsp/gal) should be applied to the seedlings two weeks after germination based on propagation procedures for domestic *Amaranthus* species(7). Domestic *Amaranthus* seedlings generally require 6 or more hours of direct sunlight(7) and *Amaranthus powellii* likely requires similar conditions. *Amaranthus powellii* is photosensitive(1) and may require over 12 hours of light per day for optimal growth. If grown without sunlight or when days are shorter then nights grow lights should be used to extend daily light exposure to over 12 hours. For optimal energy consumption and reduced risk of damaging plants from light exposure 6 hours of direct sunlight or a grow light equivalent and at least 6 hours of indirect sunlight or a grow light equivalent are recommended per day
Hardening Phase	Domestic *Amaranthus* species should be hardened off in a cold frame 3 weeks after germination to prepare for transplanting(7) and *Amaranthus powellii* is likely similar
Length of Hardening Phase	1 week based on procedures for domestic *Amaranthus* species(7)
Guidelines for Outplanting / Performance on Typical Sites	Outplanting should occur once mean temperatures have reached at least 55°F. Lower temperatures to 46°F could also work but should be trialed on a small scale before any largescale production efforts.

Other Comments	These guidelines are based on *Amaranthus powellii* populations outside their native range growing in agricultural fields. It's possible that certain growing qualities differ between these populations and populations within their native range
INFORMATION SOURCES	
References	(1) M. Costea, S. E. Weaver, and F. J. Tardif. 2004. The biology of Canadian weeds. 130. *Amaranthus retroflexus* L., *A. powellii* S. Watson and *A. hybridus* L.. *Canadian Journal of Plant Science*. **84**(2): 631-668. https://doi.org/10.4141/P02-183 (2)Sergei L. Mosyakin, Kenneth R. Robertson. *Amaranthus powellii*. Flora of North America. http://floranorthamerica.org/Amaranthus_powellii accessed 4/30/2024 (3)*Amaranthus powellii*. Plants for a Future. https://pfaf.org/User/Plant.aspx?LatinName=Amaranthus+powellii accessed 4/30/2024 (4) *Amaranthus powellii* — Powell's amaranth. Native Plant Trust. https://gobotany.nativeplanttrust.org/species/amaranthus/powellii/#:~:text=Native%20to%20southwestern%20North%20America,Hopi%20People%20of%20the%20Southwes Accessed 5/1/2024 (5) Albert Adjesiwor, Timothy Prather, Joel Felix, Don Morishita. 2021. Pigweeds: Current and Emerging Weed Threats in the Pacific Northwest, University of Idaho PNW 758. https://www.uidaho.edu/extension/publications/pnw/pnw758 accessed 4/30/2024 (6) Mark Schonbeck. 2022. Powell Amaranth (*Amaranthus powellii*). Eorganic. https://eorganic.org/node/5123 accessed 4/30/2024 (7)Abigail A. Maynard, David E. Hill. How to grow vegetable amaranth in Connecticut. The Connecticut Agricultural Experiment Station. https://portal.ct.gov//media/caes/documents/publications/fact_sheets/forestry_and_horticulture/howtogrowvegetableamaranthinconnecticutpdf.pdf Accessed 5/1/2024 (8) PimaLab Seed Library. 2019. Now Sowing: Amaranth (March 15–May 15, July–August). Pima County Public Linrary. https://www.library.pima.gov/blogs/post/now-sowing-amaranth-mar15-may15-july-aug/ accessed 5/1/2024

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Other Sources Consulted	SUSAN E. WEAVER. 1984. DIFFERENTIAL GROWTH AND COMPETITIVE ABILITY OF *Amaranthus retroflexus*, *A. powellii* AND *A. hybridus*. *Canadian Journal of Plant Science*. **64**(3): 715-724. https://doi.org/10.4141/cjps84-098
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