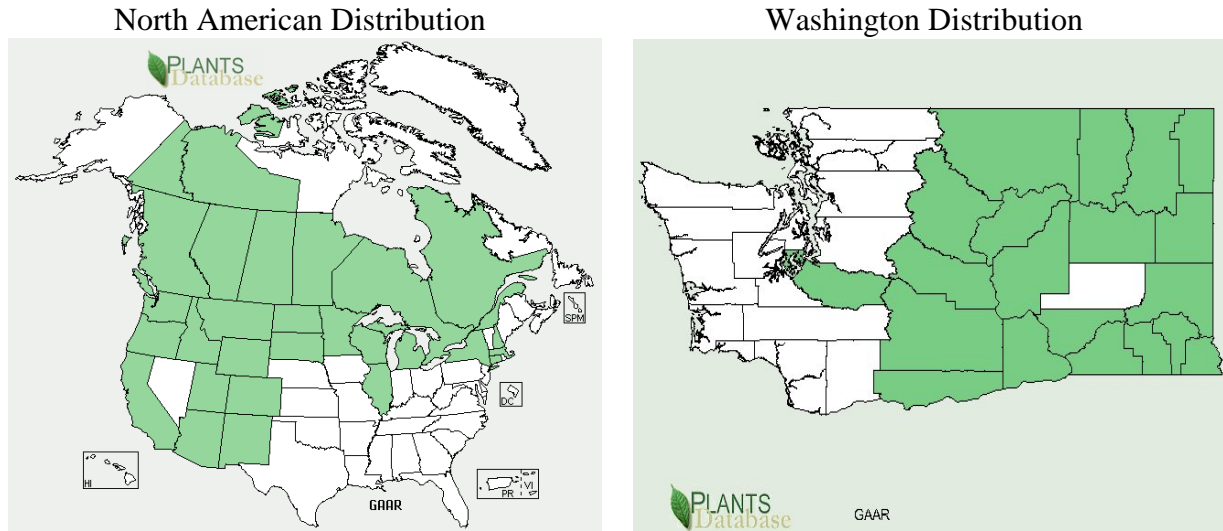


Plant Propagation Protocol for *Gaillardia aristata*
 ESRM 412 – Native Plant Production



Source: USDA Plants Database

TAXONOMY	
Family Names	
Family Scientific Name:	Asteraceae
Family Common Name:	Sunflower Family
Scientific Names	
Genus:	<i>Gaillardia</i>
Species:	<i>aristata</i>
Species Authority:	Pursh
Common Name(s):	Blanket Flower, Indian Blanket Flower, Common Gaillardia, Great Flowered Gaillardia, Brown-eyed Susan
Species Code:	GAAR
GENERAL INFORMATION	
Geographical range:	Northern areas of North American and Southwest United States. See maps for detailed distribution in North America and Washington
Ecological distribution:	Dry sites in grasslands, meadows and open, coniferous forests. Occurs in lowland meadows to foothills and mountain regions. ^{6,10} Occasionally occurs on well-drained rocky areas near treeline. ¹⁰
Climate and elevation range	Arid to temperate climates. ⁶ Elevations of 1,300 – 9,000 ft. ¹¹
Local habitat and abundance:	<i>G. aristata</i> grows in well-drained soil in full sun. ¹
Plant characteristics:	Perennial herb, 20-70 cm tall with alternate, lance-shaped, hairy leaves. Flowers are yellow and 3-lobed with yellow ray florets around a domed, orange-brown

	to purple cluster or disc florets. ⁶
PROPAGATION DETAILS	
Wick, Luna, Evans and Hokasawa: Protocol¹⁰	
Propagation Goal:	Plants
Propagation Method:	Seed
Product Type:	Plug (conetainer)
Stock Type:	160 ml containers
Time to Grow:	5 months
Target Specifications:	7 cm tall plant, with 6-10 true leaves and a root system that is a firm plug in conetainer.
Propagule Collection:	Seeds are collected by hand when the seeds are grey to dark brown and the achenes easily separate from receptacle. They are stored in brown paper bag and dried before cleaning.
Propagule Processing/Propagule Characteristics:	NRCS uses a hammermill and then an office clipper to clean the seeds. # of seeds: 90,290/lb Purity: 100% Germination: 92% Seed Longevity: Up to 5 years at 3-5 °C in sealed containers. Dormancy: Physiological dormancy that may be overcome stored dry and if they mature in the autumn.
Pre-Planting Propagule Treatments:	A 30-day cold, moist stratification is recommended. However, a dry storage of 3 or more months will also break dormancy and a brief stratification will increase germination rates.
Growing Area Preparation / Annual Practices for Perennial Crops:	Seeds are directly sowed in a growing medium and lightly covered with the medium or grit. The medium contains milled sphagnum peat, perlite and vermiculite at a 6:1:1 ratio. A control released fertilizer, Osmocote, is used at the rate of 1 gram per 172 ml conetainer with Micromax at 0.20 gram per 172 ml conetainer.
Establishment Phase:	At 22 °C germination of seeds occurs 10-15 days after sowing and true leaves are formed 7-15 days later. Soil must dry out a little between irrigating once the seeds are established.
Length of Establishment Phase:	4 weeks
Active Growth Phase:	Roots and shoots grow rapidly and flowers will develop in some plants by week 16. 20-20-20 liquid NPK fertilizer is added at 100 ppm every week until fall.
Length of Active Growth Phase:	8-12 weeks
Hardening Phase:	Fertilizer switches to 10-20-20 liquid NPK at 200 ppm in fall and the pots are leached with water. During September and October irrigation gradually reduces.

Length of Hardening Phase:	2-4 weeks
Harvesting, Storage and Shipping:	Harvest takes 5 months and the harvest date is in July. The plants over winter outdoors under insulating foam and snow.
Length of Storage:	5 months
Guidelines for Outplanting / Performance on Typical Sites:	On sites with coarse soils, in grasslands, open slopes and talus slides at higher elevations, this plant can be a pioneer species.
Other Comments:	This plant is susceptible to root rot, because it has a slender taproot, so the nursery conditions must not be too moist.
Skinner: Protocol ⁸	
Propagation Goal:	Plants
Propagation Method:	Seed
Product Type:	Plug (Container)
Stock Type:	10 cu. in.
Time to Grow:	4 months
Target Specifications:	A compact root in the plug.
Propagule Collection:	The achene, the fruit, is grey in color and ripens in August. There are 3 methods of collection. <ol style="list-style-type: none"> 1. Cutting the stem below the flower when seeds are beginning to fall on their own. 2. Collect by hand, but the seeds can be prickly. 3. By using a vacuum seeds that are ripe release and the others are left to germinate. Seeds are stored at room temperature until cleaning.
Propagule Processing/Propagule Characteristics:	If the bristly pappus is left on the seed, it makes it harder to clean and does not run in mechanical seeding equipment well. A belt thresher works well for large amounts at folding the bristles and then cleaned with air screen equipment. For small amounts rubbing the seeds between rubber sheets folds down the bristles and an air column is used to clean. Seeds are stored at 4.4 °C and 40% humidity. # of Seeds: 186,436 seeds/ lb
Pre-Planting Propagule Treatments:	Using alternating light/ dark cycles and alternating temperatures of 20 and 30 °C germination was 84%.
Growing Area Preparation / Annual Practices for Perennial Crops:	Seeds are sown in January in 10 cu. in. Ray Leach Super cell containers using Sunshine # 4 soil medium. The seeds are lightly covered with the medium and with grit to prevent floating. A space of ¼ - ½ inch is left for watering.
Establishment Phase:	Medium is kept moist until germination of plants. Germination occurs after 5-7 days and competes in 14-16 days.
Length of Establishment Phase:	2 weeks

Active Growth Phase:	Plants are fertilized with a water-soluble fertilizer containing micronutrients 1/week and watered deeply every other day.
Length of Active Growth Phase:	3 months
Hardening Phase:	In late March or early April plants are moved to a cold frame where they are watered every other day during cool temperatures and every day during hot.
Length of Hardening Phase:	2-4 weeks
Guidelines for Outplanting / Performance on Typical Sites:	Transplanting is done in May, by drilling a 1.5 inch diameter hole first. Survival is at least 95% if there is not competition from other plants and the plants may flower that year.
Other Comments:	Plants perpetuate themselves mostly from self-seeding, but direct seeding by the grower is more successful if done in the springtime rather than the fall. Sometimes rodents eat the crown of the plant in the winter, but the plants usually survive.
Summary of Multiple Sources for Growing from Seed	
Propagation Goal:	Plants
Propagation Method:	Seed
Product Type:	Outdoor flats, pots, ^{5,7} conetainer, ¹¹ or direct seeded in the ground. ²
Stock Type:	10 cu. in. ¹¹
Time to Grow:	4 months. ¹¹
Target Specifications:	
Propagule Collection:	Collect seeds in October when they are mature. ^{5,7}
Propagule Processing/Propagule Characteristics:	# of Seeds: 220,700 seeds/lb. ¹¹ Longevity: Several years. ¹¹
Pre-Planting Propagule Treatments:	Seeds stored for 3 months at 5 °C and then planted at 20 °C. ³ Seeds may need to be cold, moist stratified if sourced from a higher elevation. ⁹ Or store them in a dry refrigerator for the winter. ⁷ Light breaks dormancy. ⁹
Growing Area Preparation / Annual Practices for Perennial Crops:	Sow seeds is ¼ inch in soil medium. ^{2,5} Seed is germinated at 21 – 24 °C in light, ^{3,4,9} Can germinate between 13-30 °C, but germination is 10% below 10 °C. ³
Establishment Phase:	40% of seeds germinate between 1-3 days, ³ 5-10 days, ⁷ or 7-14 days. ² Mist 3 times a day to keep moist. ⁹
Harvesting, Storage and Shipping:	Transplant seedlings in June.
Length of Storage:	
Guidelines for Outplanting / Performance on Typical Sites:	Prefers well-drained soils, ² so mix sand in soil that is clayey. ⁵ Do not add compost or fertilizer, and in more humid regions of the northeast United States mulch heavily for winter. ² <i>G. aristata</i> will not flower the first year. ¹

Other Comments:	Remove old flower heads for prolonged blooming. ⁵ Direct seeded plants are recommend to be planted at a density of 10 lbs/acre, ⁷ or ½ to 1 lb/acre. ¹¹
Summary of Multiple Sources for Vegetative Propagation	
Propagation Goal:	Plants
Propagation Method:	Vegetative
Product:	Outdoor flats or pots. ⁵
Time to Grow:	3 weeks
Propagule Collection:	Cuttings can be taken from a full grown plant in June. ^{5,7} Roots can be divided in spring, ² summer or early fall. ^{4,7} Dividing of the taproot can be done vertically, but be sure to include a bud on each section with as many lateral roots as possible. ²
Growing Area Preparation / Annual Practices for Perennial Crops:	Plant cuttings in moist sand and vermiculite mix. ⁵
Establishment Phase:	Mist regularly. ⁵
Harvesting, Storage and Shipping:	Transplant 3 weeks after cuttings were planted. ⁵
Other Comments:	Division of plants in a garden may want to be done every 2-3 years to ensure prolonging the plant's survival. ²
INFORMATION SOURCES	
References:	See below
Other Sources Consulted:	See below
Protocol Author:	Lindsey S. Hamilton
Date Protocol Created or Updated:	04/17/12

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³ Deno, N. C., and N. C. Deno. 1998. *Second supplement to Seed germination theory and practice*. State College, PA: N.C. Deno.

⁴ Hartmann, Hudson Thomas, and Dale E. Kester. 1975. *Plant propagation: principles and practices*. New Delhi: Prentice-Hall.

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⁷ Martin, Laura C. 1990. *The wildflower meadow book: a gardener's guide*. Chester, Conn: Globe Pequot Press.

⁸ Skinner, David M. 2006. Propagation protocol for production of container *Gaillardia aristata* Pursh ' ' plants (10 cu. in.); Pullman Plant Materials Center, Pullman, Washington. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 15 March 2006). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

⁹ Smith, Laura. April 16, 2012. "Project Question." Westscape Nursery, Belgrade, MT. Email to Lindsey Hamilton.

¹⁰ Wick, Dale; Luna, Tara.; Evans, Jeff.; Hosokawa, Joy. 2008. Propagation protocol for production of container *Gaillardia aristata* Pursh. plants (160 ml containers); USDI NPS - Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 16 April 2012). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

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