

PLANT MATERIALS TECHNICAL NOTE

SUNFLOWER *Helianthus* L.

Native Sunflowers for Conservation Use in Montana and Wyoming

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Common sunflower

General Description

There are many members of the Aster Family (Asteraceae) casually referred to as sunflowers because of their showy, yellow flowers. True sunflowers belong to the genus *Helianthus* and are divided in two groups, those growing under cultivation or in the wild. Cultivated varieties are hybrids of the native annual, common sunflower, and are used as food or ornamental crops. In the wild, annual and perennial sunflowers grow in a wide variety of shapes and sizes in diverse environments across the United States and Canada. There are 52 *Helianthus* sunflower species native to North America—14 annuals and 38 perennials.

Wild sunflowers are warm-season plants with active growth periods from mid-summer to early fall. They produce several small-headed yellow inflorescences per stalk with each head composed (the Aster Family was formerly called the Composite Family) of two different types of florets—an outer ring of yellow ray flowers (sterile bracts) surrounding numerous very small brown disk flowers (fertile florets that produce seed). A distinguishing characteristic in *Helianthus* is two awn-like appendages (pappi) borne at the end of the disk flowers that easily detach or fall off at maturity. The achene-like fruit of a sunflower is called a cypsela and contained within is a single seed.

Sunflowers are difficult to identify due to ecologic adaptability (plasticity) and multiple sets of chromosomes (polyploidy) with $2n = 34, 51, 68, \text{ or } 102$, resulting in inter-specific hybridization. Of the six species in Montana and seven species in Wyoming, one annual and three perennials have utility in restoration and conservation seeding projects.

Common sunflower *Helianthus annuus*, also called annual sunflower, is a showy annual found in open disturbed areas, and along roadsides, ditches, and field edges in dry to moderately moist soils. It grows 1 to 6 feet tall with stout, coarse, and branching stems. The rough leaves are arranged alternately along the stem, broadly heart-shaped at the base, and 2 to 10 inches long. The flowers are borne at the end of a branched stem. The orange-yellow ray flowers are 1 to 2 inches long and the reddish brown disk is up to 2 inches across. The number of chromosomes is $2n = 34$ (diploid). Common sunflower readily hybridizes with other annual and perennial sunflowers, including prairie sunflower *Helianthus petiolaris* and Jerusalem artichoke *Helianthus tuberosus*.

Maximilian sunflower *Helianthus maximiliani* is a tall and robust perennial, with short rhizomes and fibrous roots adapted to deep clay loam to sandy loam soils. It grows 3 to 8 feet tall with single or loosely clustered, stout, white-hairy stems. The leaves are arranged alternately along the stem, 3 to 6 inches long, 0.4 to 1 inch wide, lance-shaped with somewhat wavy margins to a sharp tip, and often rigidly folded downward in a trough shape. The deep yellow ray flowers are 1 to 1½ inches long and the yellowish-brown disk is up to 1 inch across. The number of chromosomes is $2n = 34$ (diploid). Hybrids of Maximilian sunflower and common sunflower are sterile. Maximilian sunflower will hybridize with stiff sunflower and Jerusalem artichoke (also native to Montana and Wyoming) as shown in plant breeding trials conducted by Cox et al. (2010).



Common sunflower (left) and Maximilian sunflower (right)

Stiff sunflower *Helianthus pauciflorus*, also called rigid sunflower, is an erect, single stemmed, strongly rhizomatous perennial adapted to upland range sites with silty, shallow, or thin soil. It grows 1 to 4 feet tall in dense colonies and is often found on sandy sites. The single stems are commonly reddish and branched above in the inflorescence. The stiff, dark green leaves are mostly arranged opposite along the stem, lance to oval in shape, 2 to 8 inches long with three prominent ribs, leathery textured, and rough on both sides with serrated to entire margins. The yellow ray flowers are up to 1.5 inches long and the dark brown disk is up to 1 inch across. The number of chromosomes is $2n = 102$ (hexaploid). Stiff sunflower readily hybridizes with many sunflowers, including Jerusalem artichoke. The hybrid, cheerful sunflower *Helianthus x laetiflorus*, is commonly cultivated.

Littleflower sunflower *Helianthus pumilus*, also called dwarf sunflower, is a perennial found growing naturally on dry, rocky sites in the plains and mountains of central and southeastern Wyoming and central Colorado, and is adapted to many sites including those found in Montana. It grows 1 to 3 feet tall and plants are rough and hairy throughout. There are 5 to 7 pairs of ashy-green leaves arranged opposite along the stem, each leaf 1.5 to 6 inches long by 0.4 to 2 inches wide. The rounded yellow ray flowers are generally less than 1 inch long with glandular dots on the lower

surface and the yellow or light brownish disk is approximately 0.5 inch across. The number of chromosomes is $2n = 34$ (diploid).



Stiff sunflower (*left*) and Littleflower sunflower (*right*)

Adaptation or Range

Sunflowers are common in the United States and Canada, ranging south from Saskatchewan to Texas and east from the Great Basin to the Great Plains. Littleflower sunflower is considered an endemic species in Wyoming and Colorado. Sunflowers are very adaptable and grow on a wide variety of soils and habitat types. They require full sun, are moderately resistant to drought, and all but common sunflower are tolerant, when dormant, of wildfire. The foliage is a palatable source of food for livestock and wildlife. In general, the perennial sunflowers may be found growing in association with big bluestem *Andropogon gerardii*, little bluestem *Schizachryium scoparium*, switchgrass *Panicum virgatum*, yellow Indiangrass *Sorghastrum nutans*, purple prairieclover *Dalea purpurea*, scurfpea *Pediomelum* and *Psoraleidium*, and dotted blazing star *Liatris punctata*.

In Montana, common sunflower is adapted to a wide range of soil types and precipitation zones at elevations of 2,300 feet to 5,000 feet. It is present as an ephemeral annual component on many ecological sites and is likely found in all of the Major Land Resource Areas (MLRAs). Common sunflower is known to inhabit at least 37 of the 56 counties in Montana.

In Wyoming, common sunflower is found growing on a wide range of soil types and precipitation zones at elevations of 3,200 feet to 6,600 feet. It is present as an ephemeral annual component on many ecological sites and is likely found in all of the MLRAs, with the possible exception of 47. Common sunflower is known to inhabit at least 19 of the 23 counties in Wyoming.

In Montana, Maximilian sunflower grows well on deep upland soils and heavier lowland soils in areas receiving a minimum 10 inches of average annual precipitation at elevations of 2,200 feet to 4,000 feet. It is present as a long-lived perennial on ecological sites in MLRAs 52, 53A, 58A, and 60B. Maximilian sunflower is known to inhabit at least 15 of the 56 counties in Montana.

In a field planting near Jordan, Montana (MLRA 58A, 10 to 12 inches average annual precipitation, (Floweree and Lonna silt loam soils), when Maximilian sunflower was harvested in a fall-dormant state, it contained adequate levels of crude protein, energy, and minerals to maintain a moderate level of performance in most ruminant animals. When harvested in the active growing stage, it provided higher levels of energy and crude protein than dormant plants, but lower levels of minerals for moderate animal performance. Forage quality values are reported in Table 1.

In a 2014 field planting near Bozeman, Montana (MLRA 43A, 15 to 19 inches average annual precipitation on Sourdough loam soil), Medicine Creek Germplasm Maximilian sunflower had “good” establishment and excellent vigor. It grew to a flowering height of 2 to 3 feet the first year of the planting.

In Wyoming, Maximilian sunflower is adapted to deep upland soils and heavier lowland soils in areas receiving a minimum 14 inches of average annual precipitation at elevations of 3,500 feet to 6,000 feet. It is present as a long-lived perennial on ecological sites in MLRAs 58B, 60A, 60B, 61, 64, and 67A. Maximilian sunflower is known to inhabit at least 6 of the 23 counties in Wyoming.

In Montana, stiff sunflower grows well on medium- to coarse-textured soils on dry hillsides and ridge tops in areas receiving a minimum of 13 inches of average annual precipitation at elevations of 3,000 feet to 5,000 feet. It is present as a long-lived perennial on ecological sites in MLRAs 43B, 44, 52, 53A, 58A, and 60B. Stiff sunflower is known to inhabit at least 13 of the 56 counties in Montana.

In the field planting mentioned above near Jordan, Montana, when stiff sunflower was harvested in a fall-dormant state, it did not provide enough crude protein to maintain rumen function in livestock. Energy and mineral content of both active and dormant plants was adequate for low levels of animal performance but was lower than Maximilian sunflower. Forage quality values are reported in Table 1.

Table 1. Forage quality values for Maximilian and stiff sunflower harvested during active and dormant growth stages. Jordan, Montana, 2000-2001.

	Maximilian sunflower		Stiff sunflower	
	Active	Dormant	Active	Dormant
Dry matter %	19.6	79.0	28.0	67.8
Crude protein %	16.4	9.6	12.1	5.3
Acid detergent fiber %	29.9	33.7	29.6	34.5
Total digestive nutrients %	51.8	64.2	60.1	62.8
Net energy lactation MCal [†]	0.71	0.66	0.72	0.63
Net energy maintenance MCal	0.66	0.64	0.59	0.61
Net energy gain MCal	0.54	0.37	0.35	0.33
Sulfur %	0.54	0.21	0.18	0.12
Phosphorus %	0.39	0.24	0.21	0.17
Potassium %	3.94	1.68	2.77	2.45
Magnesium %	0.42	0.42	0.61	0.39
Sodium %	0.01	0.02	0.01	0.01
Calcium %	2.59	3.01	2.08	2.16
Iron PPM [‡]	992	227	933	105
Manganese PPM [‡]	106	87	99	68
Copper PPM	25	8	18	4
Zinc PPM	93	95	42	85

[†] Mega-calories per pound; [‡] Parts per million.

In Wyoming, stiff sunflower is adapted to medium- to coarse-textured soils on dry hillsides, ridge tops, and ravines in areas receiving a minimum of 13 inches of average annual precipitation at elevations of 3,700 feet to 5,000 feet. It is present as a long-lived perennial on ecological sites in MLRAs 58B, 60A, 60B, 62, and 67A. Stiff sunflower is known to inhabit at least 6 of the 23 counties in Wyoming.

In Montana, littleflower sunflower is not a component of native plant communities. It has been grown successfully on sites in Carbon and Custer Counties (MLRA 32 and 58A, respectively).

In Wyoming, littleflower sunflower is adapted to medium- to coarse-textured soils on gravelly and siltstone hills, sandy ridges, and stony knolls in areas receiving a minimum of 11 inches of average annual precipitation at elevations of 3,400 feet to 7,660 feet. It is present as a long-lived perennial on ecological sites in MLRAs 43B, 49, 58B, and 67A. Littleflower sunflower is known to inhabit at least 9 of the 23 counties in Wyoming.

Conservation Uses

Sunflowers are used as a forb component in the reclamation of drastically disturbed lands, range renovation projects, and numerous conservation practices, such as pollinator habitat, conservation cover, range and critical area plantings, and restoration and management of rare and declining habitats. The seeds are a very good food source for many species of birds and animals. Sunflowers can be included in many seeding mixtures for creating and enhancing habitat for upland game birds. Sunflower stalks are used for silage and feed for livestock and poultry. Maximilian and stiff sunflower are readily eaten and rarely found in pastures that are continually over-grazed. They are used in landscapes as border and screen plantings and in containers as showy ornamentals. Sunflowers are drought tolerant and suitable for use in water-efficient (Xeriscape™) gardens.

Cultural Uses

Common sunflower is an important crop grown globally for production of cut flowers, vegetable oil, fuel, commercial fiber, and seeds for snacks and bird food. Sunflowers have historically been used by humans as a nutritious food source, a medicinal treatment for many ailments, and as a dye for body paint and coloring basketry. Native Americans boiled and ate flower buds and raw seeds. Drinking an infusion of the plant alleviated rheumatism, soothed chest pain, and stimulated appetite. Purple, black, and yellow dyes were made by boiling different parts of the plant.



Honey bee foraging for nectar and pollen on littleflower sunflower

Ease of Establishment

Sunflowers are easy to establish by direct seeding. Seedling vigor is good in annual and perennial sunflowers with many plants flowering the year of establishment.



Medicine Creek Germplasm Maximilian sunflower seedling

Planting Rates (all recommended amounts based on pure live seed [PLS]).

As a guideline, full stand drill seeding rates are based on 12-inch wide row spacing as shown for four sunflowers in Table 2. Forbs are seldom seeded in a pure stand, and in native seed mixtures rates are adjusted as a percentage of the mix and in general are ¼ to ½ pound PLS per acre. Seeding rates vary by planting method (drill versus broadcast) and site condition (non-critical versus critical area), refer to Plant Materials Technical Note, MT-46 for more information (Majerus et al., 2013). Critical areas are highly disturbed, highly erodible, and/or have physical, chemical, or biological conditions that prevent establishment with normal practices. Seeding rates for four sunflowers as determined by planting method and site condition are shown in Table 3. Wildland collected and field-produced seed is commercially available and cost is dependent on supply and demand.

Table 2. Seeding rates for conservation plantings of four species of sunflower *Helianthus*.

Common Name	Seeds/lb [†]	Seeding Date	Seeds/ft [‡]	Full Stand Rate [§]	
			1 lb PLS/ac	PLS/ft ²	lb PLS/ac
Common sunflower	53,000	spring/summer	1.2	10.0	8.2
Maximilian sunflower [¶]	250,000	spring/fall dormant	5.7	5.7	1.0
Stiff sunflower [¶]	85,000	spring/fall dormant	0.5	5.0	2.5
Littleflower sunflower	200,000	fall dormant	5.0	25	5.4

[†] Number of pure live seeds (PLS) per pound; [‡] number of PLS per linear or square foot at 1 pound PLS/acre seeding rate; [§] full stand drill seeding rate in PLS pounds per acre at 12-inch between rows; and [¶] USDA-NRCS North Dakota Field Office Technical Guide.

Table 3. Seeding rates for four species of sunflower *Helianthus* as determined by planting method and site condition.

Common Name	Non-Critical	Non-Critical	Critical Area	Critical Area
	Drilled	Broadcast [¶]	Drilled [¶]	Broadcast [‡]
	lb PLS/ac	lb PLS/ac	lb PLS/ac	lb PLS/ac
Common sunflower	8.2	16.4	16.4	32.8
Maximilian sunflower	1.0	2.0	2.0	4.0
Stiff sunflower	2.5	5.0	5.0	10.0
Littleflower sunflower	5.4	10.8	10.8	21.6

[¶] Multiply the non-critical drill rate times 2; [‡] multiply the non-critical drill rate times 4.

Stand Establishment

For best results, seed should be planted into a firm, weed-free seedbed in early spring after the soil has warmed up to at least 45° Fahrenheit or as a dormant seeding in late fall (see Table 2). It is recommended seeding be done with a drill that will ensure a uniform seeding depth. The seeding depth of common sunflower is ¼- to 1-inch, whereas the seeding depth of perennial sunflowers is ¼- to ½-inch. Seeding a forb component in alternate rows, or cross-planting (forb in one direction and grass in the other) may ensure better forb establishment. Common sunflower sets seed and will volunteer profusely the second year. It is considered competitive at high levels of establishment. Medicine Creek Germplasm and 'Prairie Gold' attained flowering heights of greater than 8 feet under irrigated conditions at the USDA-NRCS Plant Materials Center in Bridger, Montana. Medicine Creek began prolific flowering as early as mid-July, with seeds maturing in early September. Prairie Gold began prolific flowering in mid-August, but seeds did not ripen before the onset of freezing temperatures in late summer to early fall.



Prairie Gold (*left*) and Medicine Creek Germplasm (*right*), August 6, 2014, Bridger, Montana

Seed Production

Seed production specifications for four species of sunflower are shown in Table 4. Between-row spacing is dependent on the species and the type of planting and cultivation equipment used, and ranges from 24 to 42 inches. Sunflowers are sensitive to fertilizer salts. Direct combine when the back portion of the head turns brown. Maximilian sunflower can be mowed early in the season to keep plants shorter for ease of harvest.

Table 4. Seed production specifications for four species of sunflower *Helianthus*.

Common Name	Row Spacing <i>inches or feet</i>	Seeding Rate		Irrigated Seed Yield <i>lb PLS/ac</i>
		<i>PLS/ft²</i>	<i>lb PLS/ac</i>	
Common sunflower	24 to 36 inches	25	10.3 to 6.8	100 to 200 (estimated)
Maximilian sunflower [†]	42 inches	10/linear feet	0.50	75 to 150
Stiff sunflower [†]	24 to 36 inches	15	3.8 to 2.6	75 to 150
Littleflower sunflower	24 to 36 inches	25	2.7 to 1.8	40 to 50 (bulk)

[†]Duckwitz, W., personal communication.

Limitations

Sunflowers are affected by many diseases, including but not limited to: bacterial infections from leaf spot *Pseudomonas*, head and stem rot *Erwinia*, and crown gall *Agrobacterium*; and fungal infections from rusts *Puccinia helianthi*, gray mold *Botrytis*, leaf spots *Alternaria*, and downy mildew *Plasmopara*. Seed crops are subject to shatter and are preyed upon by birds and insects such as the banded sunflower moth *Cochylis hospes*, seed maggot *Neotephritis finalis*, and headclipping weevil *Haplorhynchites aeneus*. Common sunflower is considered weedy and invasive.

Releases

There are hundreds of hybrid varieties of common sunflower for various uses.

There are two releases of Maximilian sunflower suitable for use in Montana and Wyoming. Prairie Gold (Kansas origin) was released in 1978 from the USDA-NRCS Plant Materials Center in Manhattan, Kansas, in cooperation with the Nebraska Agricultural Experiment Station. Prairie Gold is used in critical area reseeding and wildlife food plantings. Medicine Creek Germplasm (South Dakota origin) was released in 2000 from the USDA-NRCS Plant Materials Center in Bismarck, North Dakota, in cooperation with Agricultural Experiment Stations in North and South Dakota and Minnesota. Medicine Creek Germplasm is used in range and pasture seedings, wildlife habitat enhancement, prairie restoration and landscaping, hedge or screen plantings, and has potential for use in filter strips.

Bismarck Germplasm stiff sunflower was released in 2000 from the USDA-NRCS Plant Materials Center in Bismarck, North Dakota (North Dakota origin) in cooperation with Agricultural Experiment Stations in North and South Dakota and Minnesota. Bismarck Germplasm stiff sunflower is used in prairie restoration, native landscaping, and range improvement projects.



Medicine Creek Germplasm Maximilian sunflower first-year establishment

Additional Information

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