

## RECOMMENDATION FOR THE RELEASE OF 9081988 UPRIGHT PRAIRIE CONEFLOWER SELECTED CLASS

### Introduction

**Scientific Name:** *Ratibida columnifera* (Nutt.) Woot. & Standl.

**Synonym:** *Ratibida columnaris*, (Sims) D. Don, *Lepachys columnifera* (Nutt.) Rybd.

**Common Name:** Upright prairie coneflower, prairie coneflower, yellow coneflower, Mexican hat, columnar prairie coneflower, long headed coneflower

**Germplasm Name:** 9081988

**Other Identification Used:** 9081988 (bulk of 9058112, 9058113, 9058116, 9058117, 9058120)

**Origin:** The seed of 9058112 was originally collected in Stillwater County, Montana (Section 24, T3S R19E). The site description is a Hilger soil, on a 5% south slope, at an elevation of 1,402 m (4,600 ft), and annual precipitation at 254 to 356 mm (10 to 14 in). It was collected on August 16, 1989, by Philip Sandoval, Soil Conservationist with the USDA, Natural Resources Conservation Service at Columbus, Montana.

The seed of 9058113 was originally collected in Stillwater County, Montana (Section 2, T3S R20E). The site description is a Lambeth-Yawdim soil, with a silty clay texture, on a 2% west slope, at an elevation of 1,097 m (3,600 ft), and annual precipitation of 305 to 356 mm (12-14 in). It was collected on October 8, 1989, by Geri Sullivan, Soil Conservationist with the USDA, Natural Resources Conservation Service at Columbus, Montana.

The seed of 9058116 was originally collected on the West Donohoe Ranch in Stillwater County, Montana (Section 30, T6S R19E). The site description is a Charlos soil, with a loam texture, on a 1% slope, at an elevation of 1,609 m (5,280 ft), and annual precipitation of 483 mm (19 in). It was collected on August 29, 1989, by Doris Donohoe, Soil Conservationist, with the USDA Natural Resources Conservation Service at Joliet, Montana.

The seed of 9058117 was originally collected in Carbon County, Montana (Section 25, T6S R18E). The site description is a Thiel soil, with a cobbly clay loam texture, on a 15% west slope, at an elevation of 1,640 m (5,380 ft), and annual precipitation of 483 mm (19 in). It was collected on September 4, 1989, by Doris Donohoe, Soil Conservationist, with the USDA Natural Resources Conservation Service at Joliet, Montana.

The seed of 9058120 was originally collected in Carbon County, Montana (Section 18, T3S R23E). The site description is a sandstone outcrop, on a 4% northwest slope, at an elevation of 1,118 m (3,667 ft), and annual precipitation of 381 mm (15 in). It was collected on August 11, 1989, by Connie Fischer, Soil Conservationist, with the USDA Natural Resources Conservation Service at Joliet, Montana.

**Description:** *Ratibida columnifera* (Nutt.) Woot. & Standl. upright prairie coneflower, is a native, late-season, short- to moderately-lived, herbaceous perennial in the Aster family. It is commonly found in the Great Plains region and in foothills and valleys of the Intermountain West. The range of distribution is north from the western prairie provinces of Canada, south to Arizona, Texas, and northeastern Mexico, and west from Manitoba and Minnesota to southeastern Idaho (20). It prefers to grow in the dry, open spaces of prairie grasslands and mountain foothills, and is found along roadsides, in waste and disturbed areas, and along railroad rights-of-way (17). Upright prairie coneflower is an early successional species that may colonize on disturbed sites, and performs well on loam, sandy loam, and clayey loam soils (31). It begins growth in mid- to late-spring, initiates flowering in early- to mid-summer, and seed ripens in mid- to late-summer.

Upright prairie coneflower is prominently taprooted, erect, and mostly single stemmed with multiple branches off a short caudex (24). The plants grow to a height of 0.3 to 1.2 m (12 to 48 in) and have rough-feeling, strongly ribbed stalks with appressed, upwards pointing hairs (13). The cauline leaves are alternately arranged on the stem, pinnately divided into 5 to 9 linear segments, and up to 15 cm (6 in) in length (9). The inflorescence is a showy, multi-flowered, radiate head, typically composed of six, sterile, drooping, mostly yellow (occasionally reddish-brown), elliptical ray flowers that are 7 to 35 mm (0.3 to 1.4 in) long (7). The fertile, central disk flowers have grayish corollas, and the columnar-shaped receptacle is generally 1.5 mm (0.06 in) in diameter and 2 to 5 cm (2 in) long (15). The receptacle has a pleasant anisate odor when bruised (19). The fruit is a 1-seeded, compressed, gray-black achene, 1.5 to 3 mm (0.06 to 0.12 in) long with winged margins, and the pappus is a crown with one or two low teeth (11).

**Method of Development:** 9081988 is a bulk of five superior performing accessions that were selected from among 21 entries over a testing period of 10 years. The composite was made up of five collections from Carbon and Stillwater Counties (Montana) because of their uniformity in seed maturity dates (table 1), consistent taller stature (table 4), and superior seed production (table 2). Direct increase of  $G_0$  seed (equivalent to Breeders) constitutes the germplasm.

**Uses:** 9081988 was selected primarily for adding species diversity to native plant seed mixes in the rehabilitation of disturbed sites, such as rangelands, minelands, roadsides, park and recreation areas, prairie restoration projects, and conservation plantings in accordance with government farm bill program requirements. Upright prairie coneflower is commonly used as an ornamental wildflower in low maintenance or natural landscapes such as personal residences, apartment complexes, and private businesses. American Indians traditionally used the cones and leaves to make a medicinal tea, and produce a dye from the flowers.

**Area of Adaptation:** Upright prairie coneflower is a native wildflower of the Great Plains and is commonly found from southcentral Canada to northern Mexico on dry to mesic, well-drained sites in areas receiving 254 to 762 mm (10 to 30 in) of annual precipitation (31). It does well on a variety of soil types, including loams to rocky, gravelly-sandy textures; it tolerates a pH range from slightly acidic to moderately alkaline and weakly saline conditions (3). Upright prairie coneflower attains optimum growth in full sun and low to moderate levels of competition from native plant communities (21). It occurs at elevations ranging from 975 to 2,565 m (3,200 to 8,400 ft) in Colorado, Montana, Utah, and Wyoming (35).

**Insect or Disease Problems:** Powdery mildew may become temporarily present at times of elevated humidity, but usually does not have a long-term negative impact on the plants.

**Increase and Distribution:** One generation ( $G_2$  equivalent to Certified) beyond  $G_1$  (equivalent to Foundation) are recognized.  $G_1$  seed is available through the Foundation Seed Program at Montana State University-Bozeman or the University of Wyoming, and the USDA-Natural Resources Conservation Service (NRCS) Plant Materials Center (PMC) in Bridger, Montana.  $G_1$  stock will be available in 2004.

### **Performance of 9081988 Upright Prairie Coneflower**

**Testing:** 9081988 was tested as 9058112, 9058113, 9058116, 9058117, and 9058120.

**Initial Evaluation Plantings (IEP).** The initial testing of any new collection usually begins with Initial Evaluation Plantings (IEP). This involves the establishment of single direct-seeded, or spaced-planted, rows in comparison with other collections of the same or similar species.

IEP--Bridger PMC 1991. A total of nine accessions of *Ratibida columnifera* upright prairie coneflower were included in an IEP established at the Bridger PMC on May 17, 1991 (25). Performance of the five accessions bulked into 9081988 ranged from fair to excellent (bolded in table 1).

Table 1. Initial Evaluation Planting. The 1992 performance of *Ratibida columnifera* at the Bridger PMC.

Accession	Stand %	Vigor <sup>†</sup>	Forage Production <sup>†</sup>	Forage Uniformity <sup>†</sup>	Ground Cover <sup>†</sup>	Seed Production <sup>†</sup>	Seed Uniformity <sup>†</sup>
<b>9058112</b>	<b>80</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2</b>
<b>9058113</b>	<b>85</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
9058114	75	2	1	3	1	2	3
9058115	35	3	2	3	2	3	3
<b>9058116</b>	<b>95</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>
<b>9058117</b>	<b>80</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
9058118	25	3	3	5	3	3	4
9058119	80	2	2	2	2	2	2
<b>9058120</b>	<b>65</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>

† Rated 1-9 with 1 best.

The plots were part of a larger native wildflower IEP that suffered from very poor establishment and was mostly removed in 1992 (26). The nine plots of upright prairie coneflower were maintained and seed was collected on August 4 and August 19, 1993 (bolded in table 2).

Table 2. Initial Seed Increase. The 1993 seed harvest of *Ratibida columnifera* from an Initial Evaluation Planting in Field 6 at the Bridger PMC.

Accession	Montana County Origin	Date	Clean Seed	
			kg	lb
<b>9058112</b>	<b>Stillwater</b>	<b>8/19</b>	<b>0.450</b>	<b>0.99</b>
<b>9058113</b>	<b>Stillwater</b>	<b>8/19</b>	<b>0.495</b>	<b>1.09</b>
9058114	Stillwater	8/04	0.284	0.63
9058115	Phillips	8/19	0.153	0.38
<b>9058116</b>	<b>Carbon</b>	<b>8/19</b>	<b>0.633</b>	<b>1.40</b>
<b>9058117</b>	<b>Carbon</b>	<b>8/19</b>	<b>0.487</b>	<b>1.07</b>
9058118	Glacier	8/19	0.096	0.21
9058119	Carbon	8/04	0.585	1.29
<b>9058120</b>	<b>Carbon</b>	<b>8/19</b>	<b>0.212</b>	<b>0.47</b>

IEP--Bridger PMC 1994-1997. In the spring of 1994, seed of 16 upright prairie coneflower accessions was assembled and planted in Cone-tainers™ in the greenhouse. On June 1, the seedlings were transplanted in the field as part of a larger native forb IEP that was evaluated for 4 years (26, 27, and 28). Their performance is reported (in bold) in table 3 and table 4, and the five accessions that comprise 9081988 continued to perform very well.

Table 3. Initial Evaluation Planting. The 1994-1997 mean performance of stand and vigor for 16 accessions of *Ratibida columnifera* at the Bridger PMC.

Accession	Montana Origin	Percentage Stand				Vigor <sup>†</sup>		
	County	1994	1995	1996	1997	1994	1995	1996
<b>9058112</b>	<b>Stillwater</b>	<b>100</b>	<b>100</b>	<b>50</b>	<b>17</b>	<b>6</b>	<b>5</b>	<b>4</b>
<b>9058113</b>	<b>Stillwater</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>8</b>	<b>6</b>	<b>4</b>	<b>3</b>
9058114	Stillwater	100	100	100	0	5	3	4
9058115	Phillips	100	100	50	8	4	6	7
<b>9058116</b>	<b>Carbon</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>17</b>	<b>5</b>	<b>4</b>	<b>1</b>
<b>9058117</b>	<b>Carbon</b>	<b>100</b>	<b>100</b>	<b>83</b>	<b>8</b>	<b>6</b>	<b>2</b>	<b>4</b>
9058118	Glacier	100	100	25	0	5	6	4
9058119	Carbon	100	100	100	8	5	4	3
<b>9058120</b>	<b>Carbon</b>	<b>100</b>	<b>100</b>	<b>83</b>	<b>8</b>	<b>5</b>	<b>4</b>	<b>5</b>
9076020	Custer	100	100	69	0	4	4	5
9076021	Daniels	100	100	50	0	4	6	7
9076022	Fallon	100	100	50	25	4	6	3
9076023	Garfield	100	100	50	17	5	6	5
9076024	Custer	100	100	75	25	5	5	5
9076025	McCone	100	100	100	25	5	5	3
9076076	Sheridan	100	100	75	25	3	5	3

<sup>†</sup> Rated 1-9, with 1 best.

Table 4. Initial Evaluation Planting. The 1994-1997 performance of vegetative height and seedhead abundance for 16 accessions of *Ratibida columnifera* at the Bridger PMC.

Accession	Montana Origin	Vegetative Height cm			Seedhead Abundance <sup>†</sup>	
	County	1994	1995	1996	1995	1996
<b>9058112</b>	<b>Stillwater</b>	<b>26</b>	<b>54</b>	<b>24</b>	<b>3</b>	<b>2</b>
<b>9058113</b>	<b>Stillwater</b>	<b>25</b>	<b>53</b>	<b>28</b>	<b>3</b>	<b>2</b>
9058114	Stillwater	17	55	26	3	2
9058115	Phillips	20	48	20	2	3
<b>9058116</b>	<b>Carbon</b>	<b>21</b>	<b>53</b>	<b>27</b>	<b>3</b>	<b>1</b>
<b>9058117</b>	<b>Carbon</b>	<b>27</b>	<b>59</b>	<b>26</b>	<b>3</b>	<b>2</b>
9058118	Glacier	26	46	16	2	3
9058119	Carbon	21	53	22	3	2
<b>9058120</b>	<b>Carbon</b>	<b>23</b>	<b>54</b>	<b>22</b>	<b>2</b>	<b>3</b>
9076020	Custer	24	51	24	2	2
9076021	Daniels	23	48	24	2	3
9076022	Fallon	19	39	16	2	3
9076023	Garfield	24	46	24	2	3
9076024	Custer	25	50	25	2	3
9076025	McCone	24	51	23	2	2
9076076	Sheridan	18	46	26	2	2

<sup>†</sup> Rated 1-4, with 1 best.

IEP--Bridger PMC 1998-2001. In early November 1997, seed of 22 collections of upright prairie coneflower was assembled and planted as part of a miscellaneous forb IEP (28 and 30). The five accessions bulked (9058112, 9058113, 9058116, 9058117, and 9058120) to form 9081988 upright prairie coneflower performed very well in this IEP (bolded in table 5 and table 6) as well as in the two previous studies.

Table 5. Initial Evaluation Planting. The 1998-2001 mean performance of stand and vigor for 22 accessions of *Ratibida columnifera* at the Bridger PMC.

Accession	Origin County	Percentage Stand				Vigor <sup>†</sup>			
		1998	1999	2000	2001	1998	1999	2000	2001
9057982	Carbon, MT	20	80	80	30	6	3	3	3
<b>9058112</b>	<b>Stillwater, MT</b>	<b>6</b>	<b>30</b>	<b>30</b>	<b>20</b>	<b>6</b>	<b>5</b>	<b>3</b>	<b>4</b>
<b>9058113</b>	<b>Stillwater, MT</b>	<b>2</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>7</b>	<b>6</b>	<b>4</b>	<b>4</b>
9058114	Stillwater, MT	13	75	70	15	5	4	2	5
9058115	Phillips, MT	1	15	15	15	6	7	3	3
<b>9058116</b>	<b>Carbon, MT</b>	<b>42</b>	<b>60</b>	<b>55</b>	<b>50</b>	<b>4</b>	<b>4</b>	<b>3</b>	<b>3</b>
<b>9058117</b>	<b>Carbon, MT</b>	<b>25</b>	<b>70</b>	<b>70</b>	<b>25</b>	<b>5</b>	<b>3</b>	<b>2</b>	<b>4</b>
9058118	Glacier, MT	1	60	50	35	8	5	3	3
9058119	Carbon, MT	-	0	0	0	-	-	0	-
<b>9058120</b>	<b>Carbon, MT</b>	<b>-</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>-</b>	<b>6</b>	<b>4</b>	<b>5</b>
9076021	Daniels, MT	15	85	70	1	6	3	4	6
9076022	Fallon, MT	-	10	10	1	-	8	4	5
9076023	Garfield, MT	15	20	15	10	3	5	3	5
9076024	Custer, MT	25	70	65	5	3	3	2	5
9076025	McCone, MT	19	80	70	5	5	5	3	6
9076076	Sheridan, MT	19	75	60	2	5	4	3	7
9076253	Park, MT	39	55	50	40	4	3	2	2
9076254	Custer, MT	1	20	10	10	6	5	4	4
9078440	Roosevelt, MT	46	70	60	10	6	3	1	3
9078462	Campbell, WY	76	90	80	5	2	1	1	4
9078642	Weston, WY	10	50	30	1	6	4	4	5
9078665	Powder River, MT	11	65	45	5	2	6	3	4

<sup>†</sup> Rated 1-9, with 1 best.

Table 6. Initial Evaluation Planting. The 1998-2001 mean performance of stand and vigor for 22 accessions of *Ratibida columnifera* at the Bridger PMC.

Accession	Origin County	Height cm				Seedhead Abundance <sup>†</sup>			
		1998	1999	2000	2001	1998	1999	2000	2001
9057982	Carbon, MT	11	63	60	26	6	3	3	4
<b>9058112</b>	<b>Stillwater, MT</b>	<b>15</b>	<b>48</b>	<b>62</b>	<b>32</b>	<b>6</b>	<b>6</b>	<b>3</b>	<b>4</b>
<b>9058113</b>	<b>Stillwater, MT</b>	<b>11</b>	<b>45</b>	<b>56</b>	<b>30</b>	<b>6</b>	<b>6</b>	<b>3</b>	<b>4</b>
9058114	Stillwater, MT	14	50	63	25	5	4	2	3
9058115	Phillips, MT	20	25	55	22	7	7	3	4
<b>9058116</b>	<b>Carbon, MT</b>	<b>21</b>	<b>70</b>	<b>52</b>	<b>27</b>	<b>3</b>	<b>4</b>	<b>3</b>	<b>3</b>
<b>9058117</b>	<b>Carbon, MT</b>	<b>23</b>	<b>58</b>	<b>50</b>	<b>30</b>	<b>6</b>	<b>2</b>	<b>1</b>	<b>4</b>
9058118	Glacier, MT	5	40	45	32	4	5	3	3
9058119	Carbon, MT	-	-	0	-	8	-	0	-
<b>9058120</b>	<b>Carbon, MT</b>	<b>-</b>	<b>40</b>	<b>51</b>	<b>27</b>	<b>-</b>	<b>6</b>	<b>4</b>	<b>5</b>
9076021	Daniels, MT	13	48	44	26	5	4	3	6
9076022	Fallon, MT	-	15	46	25	-	8	5	5
9076023	Garfield, MT	20	60	49	23	4	5	4	5
9076024	Custer, MT	25	58	58	22	3	3	2	5
9076025	McCone, MT	17	40	55	23	5	5	3	6
9076076	Sheridan, MT	19	42	50	19	5	3	3	7
9076253	Park, MT	18	55	60	32	4	3	2	3
9076254	Custer, MT	13	42	49	24	7	5	4	5
9078440	Roosevelt, MT	15	44	45	22	6	3	1	4
9078462	Campbell, WY	14	65	66	29	4	1	2	4
9078642	Weston, WY	12	43	52	24	6	3	3	5
9078665	Powder River, MT	30	53	42	27	3	6	3	5

<sup>†</sup> Rated 1-9, with 1 best.

**Environmental Considerations:** Upright prairie coneflower is an important native forb adapted to many ecological sites in the Great Plains of Canada and the United States. It is a palatable species that provides fair to good forage for domestic livestock when grazed in stages of early plant development (8). It is considered a desirable spring browse plant for big game animals and the seed of upright prairie coneflower is preferred by several species of birds and small mammals (34). Upright prairie coneflower is a medium- to tall-statured forb that may fill a structural cover niche for multiple species of upland game birds in a variety of plant communities.

There is an ever-increasing demand for appropriately sourced, high quality, native forb seed to compete against undesirable weeds and invasive plants, and to facilitate ecological structure and function in restored sites across Canada and the United States (6). The successful establishment of a diverse plant community relies, in part, on the use of adapted plant material that can survive the typically harsh environmental conditions on the site of a reclamation project (22). The extensive distribution, relative abundance, and quick establishment of upright prairie coneflower make it a primary candidate for providing much-needed species diversity in seed mixes for the revegetation of disturbed lands (16). Upright prairie coneflower has good seed germination and seedling emergence, vigorous growth that quickly reaches a reproductive stage, has a moderate to high percentage cover, and produces a considerable amount of seed and annual plant biomass (5). It is a perennial species that lends itself to agronomic seeding methods with acceptable results when planted at the right time and appropriately mixed at the proper seeding rate (4).

As the global demand increases for drinking and irrigation water, there is a concern over the excessive amounts used by introduced plant materials in highly consumptive residential and commercial landscapes (18). Upright prairie coneflower is an attractive, showy, native wildflower that is very drought tolerant (29). It is recommended for use as an ornamental specimen plant or a mass display in low watering zones of Xeriscape™ and waterwise gardens (12). This species is also used in specialty themes to attract butterflies, moths, songbirds, and a variety of pollinating insects (1).

The Indian tribes of North America long recognized the medicinal qualities of upright prairie coneflower and used it to treat many ailments (33). The Cheyennes boiled stems and leaves to make tea and applied the solution externally to draw out poison from rattlesnake bites (23). The Lakotas used a decoction to relieve pain and to treat the rash caused by poison ivy (10). It was used internally as an infusion to lessen headache pain and stomachaches and to bring down a fever. A rust-colored dye was produced from boiled leaves and stems (14).

**Seed Increase.** In 2001, seed from five accessions of upright prairie coneflower was assembled and submitted for tetrazolium (Tz) tests to Montana State Seed Testing Laboratory. The seed was originally collected in 1993 from increase plots at the Bridger PMC. Test results averaged 92%, and percentage of viable seed ranged from 85 to 95. On May 9, 2002, equal amounts of pure live seed from each lot were bulked (accession 9081988) and seeded into an increase field (32). On August 8 and August 11, 2003, the crop was harvested and produced 73 kilograms (161 pounds) of seed. Seed production was 451 kg/ha (403 lb/acre). The seed of upright prairie coneflower is classified as having physiologically dormancy (2), the percentage seed fill is good, and germination is achieved in a fairly short period of time (5).

No other release of native upright prairie coneflower is available to the seed industry. There is a commercial shortage of native forb seed for use in revegetating disturbed areas and re-establishing native plant communities in conservation enhancement and wildlife habitat improvement programs. The majority of available seed of this species comes only from harvest of native sources.

**Submitted by:** This recommendation for the release of 9081988 upright prairie coneflower was prepared and submitted by Susan R. Winslow and Mark E. Majerus, USDA-NRCS, for joint release by the USDA-NRCS and the Montana and Wyoming Agricultural Experiment Stations, December 2003.

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