

RELEASE NOTICE
OF
GARNET GERMPLOSM MOUNTAIN BROME, BROMUS
MARGINATUS

AS

A tested class mountain brome with emphasis on head smut resistance, longevity and seed production

by the

UPPER COLORADO ENVIRONMENTAL PLANT CENTER (UCEPC)

and the

USDA - NATURAL RESOURCES CONSERVATION SERVICE

and the

COLORADO STATE AGRICULTURAL EXPERIMENT STATION

and the

MONTANA STATE AGRICULTURAL EXPERIMENT STATION

and the

WOMING STATE AGRICULTURAL EXPERIMENT STATION

This announces the release of Garnet mountain brome (Bromus marginatus Nees ex Stued, PLANTS Data base, USDA - Natural Resources Conservation Service, also Hitchcock, A.S. 1950. Manual of the Grasses of the United States. 2nd Edition revised by A.Chase.) The identification was confirmed by Colorado State University, Department of Bioagricultural Sciences and Pest Management, Identification and Diagnostic Service. Garnet was selected for its head smut resistance, longevity, ease of establishment and good production of both forage and seed.

Application for Approval of a Cultivar

1. **Crop:** Mountain Brome, Bromus marginatus. See attached release information.
2. **Experimental numbers:** M-1236 (Bridger, Montana) - 9005308.
3. **Pedigree and history:** Collected in Powell County Montana near ghost town of Garnet. Tested at Meeker, Colorado and Bridger, Montana plant material centers and Bozeman, Kalispell, Moccasin and Missoula, Montana, Idaho Falls, Idaho, Pinedale, Wyoming and Scottsbluff, Nebraska. Tested class seed is produced in Meeker, Colorado from 1994 to present. No genetic manipulation - natural selection.
4. **Description:** Mountain Brome is considered a short lived perennial cool season bunchgrass of the C3 type (Wasser, 1982). It is native to the mountains and foothills of the Rocky Mountains and Pacific Coast regions (Stefferd, 1948). It does well on 18 inches or more of annual precipitation and grows at elevations from 5,000 to 10,000 feet (1,525-3,050 meters) [(Wasser, 1982 and Herzman, et al., 1975)]. It has been noted to interbreed with California brome (B. carinatus) and foothills brome (B. polyanthus) when found in close proximity (Wasser, 1982). Sheaths and leaves are normally pubescent and panicles are open. Mountain brome does well on moderately deep fertile medium textured soils (Wasser, 1982). It has a deep well branched root system that is important for protecting erodible slopes (Hanson, 1972). Mountain brome starts growth in early spring and is an important palatable forage for wildlife and all livestock. It has large seeds with good seedling vigor, but seeds do deteriorate rapidly in storage. Mountain brome has approximately 71,000 seeds per pound. In comparison, 'Garnet' mountain brome has 77,879 seeds per pound (seed count by Colorado Seed Laboratory on the 1998 seed lot).
5. **Location where developed:** Meeker, Colorado and Bridger, Montana plant material centers.
6. **Participating scientists:** Dr. Gary L. Noller, John Scheetz, Mark Majerus, Dan Ogle and Larry Hoizworth.
7. **Superior/inferior traits:** Superior to other mountain bromes for head smut resistance and longevity, also is equal or superior to other mountain bromes for ease of establishment forage and seed production. No inferior traits noted.
8. **Method of propagation:** By seed through tested class seed from Meeker plant materials center.
9. **Amount of stocks available:** See number 10.
10. **Seed Stocks available:** Approximately 1300 pounds of tested class seed is available from Meeker plant materials center, plus 1999 harvest (not processed).

11. **Bud material:** Not applicable.

12. **No difficulty is expected in the production of any class of seed:** The **only** seed production problems noted at Meeker were, in the 1989 planting (08S191) and the 1993 planting (08S217) Diuraphis (Holcaphis) tritici (Gillette) western wheat aphid and Diuraphis nodulus (Richards) were noted, and in some cases did cause damage (Hammon, 1998). In addition, downy mildew [Sclerophthora macrospora (Sacc) T.S. & N.] has been noted in a few years in both of these plantings (08S191 and 088217) and when present with Diuraphis spp. they did substantial damage.

13. **Suggested name:** Garnet for ghost town near collection site.

14. **Names approved by the cultivar release committee.** Garnet

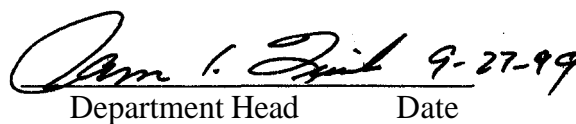
15. **Form of release and intellectual property protection:** Tested Class release. Joint release as described in the Upper Colorado Environmental Plant Center release notice.

16. **Other considerations relative to mode of reproduction and isolation of seed fields:** From a telephone conversation with Mary Barkworth - Utah State University, Herbarium, she indicates that mountain brome seems to have both self fertilized and cross fertilized plants within the species. She indicated that rarely are species 100% self or cross fertilized. With this as a guide, we recommend 900 feet isolation for seed fields from other bromes (Bromus spp.).

Plant Variety Protection will be obtained. Yes No

RECOMMENDED BY:

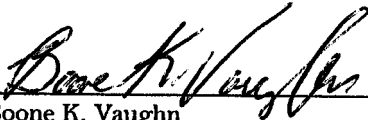

Originating Scientist Date


Department Head Date



Chairperson, CRC Date


Director, CAES Date

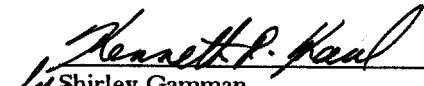
**SIGNATURES FOR RELEASE OF
Garnet germplasm mountain brome grass (Bromus marginatus)**


Boone K. Vaughn
President Administrative Board
UCEPC
Meeker, Colorado

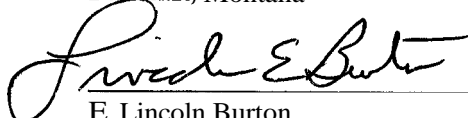
10/21/99
Date


@Steve Black
State Conservationist
NRCS
Lakewood, Colorado

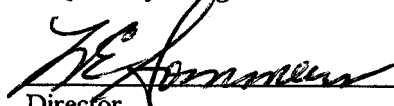
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Date


for Shirley Gamman
State Conservatinist
NRCS
Bozeman, Montana

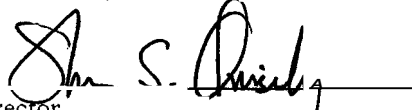
Date


E. Lincoln Burton
State Conservationist
NRCS
Casper, Wyoming

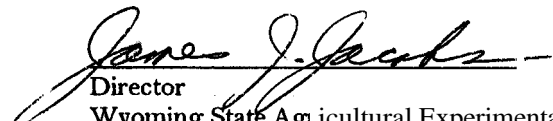
3-14-2000
Date


Director
Colorado State Agricultural Experimental Station
Fort Collins, Colorado

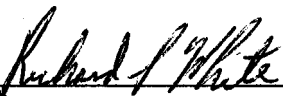
10/1/99
Date


Director
Montana State Agricultural Experimental Station
Bozeman, Montana

2/25/00
Date


Director
Wyoming State Agricultural Experimental Station
Laramie, Wyoming

3/27/00
Date


for Director
Ecological Sciences Division
NRCS
Washington, DC

4/28/00
Date

ORIGIN:

Garnet mountain brome (**9005308, M-1236**) was collected in Powell County, Montana, near the ghost town of Garnet, at an elevation of **5,800 feet (1,770 m)**. This elevation is near the lower limit of the range for the species. In an Initial Evaluation Planting (IEP) in Montana, it exhibited better overall vigor and longevity than 'Bromaf, which is relatively short lived and has a head smut problem. Head smut when present in the seed head produces smut instead of seed. Threshing spreads the spores to healthy seed increasing the presence of smut in the next generation. Head smut can be controlled by seed treatment but resistance through selection is the only practical means of controlling the disease (Stefferd, **1948**).

DESCRIPTION:

Mountain brome is considered a short lived perennial cool season bunchgrass of the C₃ type (Wasser, **1982**). It is native to the mountains and foothills of the Rocky Mountains and Pacific Coast regions (Stefferd, **1948**). It does well on **18 inches** or more of annual precipitation and grows at elevations from **5,000 to 10,000 feet (1,525-3,050 meters)** [(Wasser, **1982** and Herzman, et al., **1975**)]. It has been noted to interbreed with California brome (*B. carinatus*) and foothills brome (*B. polyanthus*) when found in close proximity (Wasser, **1982**). Sheaths and leaves are normally pubescent and panicles are open. Mountain brome does well on moderately deep fertile medium textured soils (Wasser, **1982**). It has a deep well branched root system that is important for protecting erodible slopes (Hanson, **1972**). Mountain brome starts growth in early spring and is an important palatable forage for wildlife and all livestock. It has large seeds with good seedling vigor, but seeds do deteriorate rapidly in storage. Mountain brome has approximately **71,000** seeds per pound. In comparison, Garnet mountain brome has **77,879** seeds per pound (seed count by Colorado Seed Laboratory on the **1998** seed lot).

DEVELOPMENT:

Garnet mountain brome was initially tested at the Bridger Plant Materials Center in Montana. In a planting (planted April **11, 1977**) at Bridger, Montana, the stand of Garnet ranged from **90% to 100%** and was better than the other mountain brome in the study. In **1979** (the last year of the study) moderate vigor, and production of both forage and seed was recorded for Garnet, which again was generally better than the other mountain brome in the project (see **APPENDIX I**).

In a planting (seeded October **26, 1983**) at Missoula, Montana, the stand of Garnet ranged from **90% to 100%** and in **1988** exhibited good vigor and good production of both forage and seed. The performance of 'Bromar' in the project was not as good as Garnet (see **APPENDIX 11**). In a second planting (seeded April **14, 1987**) at Missoula, Montana, the stand of Garnet mountain brome ranged from **25% to 50%** and had moderate vigor in **1990**, the last year of the study. In this test 'Bromar' in **1990** had a better stand than Garnet (see **APPENDIX 11**).

Garnet mountain brome was included in forage production plantings (**1993, 1994, & 1995**) at four locations (Bridger, Bozeman, Kalispell and Moccasin) in Montana. The average

forage production for Garnet ranged from **1.36** to **4.86** tons per acre. In each location Garnet produced less forage than 'Regar' meadow brome (see APPENDIX III).

In an initial evaluation project (08I046D, **1980 - 1983**) at the Meeker Plant Materials Center, **55** accessions of mountain brome were examined. Garnet was selected as one of the top four accessions based on disease resistance, longevity, ease of establishment and production of both forage and seed.

In **1984** the top five accessions from project 08I046D were evaluated for head smut resistance and seed production. Garnet was the top performer in the project. However, it should be noted that although Garnet was the top seed producer, it was also the only accession receiving supplemental water (from sprinkler drift). Two of the top five accessions were combined because of limited seed and proximity of collection. The remaining two accessions displayed poor emergence and weak stands and were destroyed in **1985**. 'Bromar' mountain brome was not one of the top five accessions but was included in the four year project and was dead after the second winter.

In **1989** Garnet mountain brome was planted in a space planting (**08S191**) at the Meeker Plant Materials Center. Off types were removed and seed was produced for a seed increase planting. In **1993** a one acre seed production field (**08S217**) was established. **This** field continues to produce seed (July, **1999**). Five years of seed production from this field probably indicates that Garnet has improved longevity over other mountain bromes. Based on the five years of seed production (**1994** through **1998**) yields have averaged **812.6** pounds of clean seed per acre (see APPENDIX IV).

Certain seed production problems have been noted for Garnet through the years at the Meeker Plant Materials Center. In the **1989** planting (**08S191**) and the **1993** planting (**08S217**) *Diuraphis (Holcaphis) tritici* (Gillette) western wheat aphid and *Diuraphis nodulus* (Richards) were noted, and in some cases did cause damage (Hammon, **1998**). In addition, downy mildew [*Sclerophthora macrospora* (Sacc) T.S. & N.J.] has been noted in a few years in both of these plantings (**08S191** and **08S217**) and when present with *Diuraphis* spp. they did substantial damage.

In **1996** in project **08S217**, head smut was noted (at only **1%** or less) in Garnet mountain brome. In **1997** and in **1998** in the same seed field head smut was present with only a few plants in the one acre field. The identification of head smut (*Ustilago bullata*) was confirmed by Colorado State University, Department of Bioagricultural Sciences and Pest Management, Identification and Diagnostic Service.

In a dryland field test in Idaho Falls, Idaho (**1996-1998**), Garnet maintained an excellent stand and vigor rating. Seed production averaged **325** pounds per acre for **1997** and **1998** (see APPENDIX V). Some head smut was noted during years with very abundant spring moisture.

Garnet mountain brome was included in a cool season forage production test with other bromes and orchard grasses in Scottsbluff, Nebraska in **1997** and **1998**. Seed production in

1998 was 600 pounds per acre for Garnet while 'Regar' meadow brome produced 520 pounds of seed.

In a 1991 demonstration planting at Pinedale, Wyoming (elevation 7,450 feet), nine mountain brome accessions were planted, including 'Bromar' and Garnet. In 1995 all mountain brome grass stands decreased from the previous year. However, Garnet declined the least and was still maintaining a 75% rating, while 'Bromar' rated only 1%. In 1996, stands of mountain bromes had continued to decline, 'Bromar' was dead, Garnet had only a 10% stand and three of the nine mountain bromes had a better stand rating, ranging from 23% to 55% (see APPENDIX VI).

Results from a replicated fall planting that included Garnet and 'Bromar' mountain bromes at Coyote draw in Utah, showed that Garnet had a 40% stand while 'Bromar' had only a 20% stand.

In 1998, seed lots of Garnet grown at the Meeker Plant Materials Center that were 10 to 13 years old were tested for germination. These small lots had not been tested in the years grown, but in 1998 the germination percentages were all poor, ranging from 0% for the 13 year old material, to only 5% for the 10 year old lot (see APPENDIX VII). Other seed lots of Garnet mountain brome that were tested when produced, had germination percentages that deteriorated rapidly. A 1994 lot had a germination of 77% at time of production, but in two years (1997) germination had declined to 64%. Another lot produced in 1990 had a germination of 83% at the time of production, but in six years (1997) was only 25% (see APPENDIX VII). This information demonstrates that Garnet seed can not be stored for long periods due to loss of germination.

USES:

Garnet should provide good performance where traditional mountain brome has been historically present. This includes planting for quick cover and erosion control in mountains and foothills (Plant Materials Handbook, 1988). It is also used in seeding mixtures with alfalfa and sweet clover to revegetate livestock and big game ranges, to protect road cuts and fills, mined lands and burned over forestlands (Wasser, 1982 and Stefferud 1948). It is a quick establishing species which provides initial soil stabilization when planted with other slower establishing natives. As slower developing species become established, the stands of the short-lived mountain brome will slowly decline. Mountain brome grass is considered a pioneer species on disturbed sites and a decreaser species in the range sites it occupies. It is commonly found in Major Land Resource Areas (MRLA) Northern Rocky Mountains and Valleys (44 & 43), Northern Rocky Mountain Foothills (46), Wasatch and Uinta Mountains (47), Southern Rocky Mountains Parks (48B), and Southern Rocky Mountain Foothills (49) [(Long Range Plans for field Plantings and Planting Guides, Section 540.25 (B) and (C) January 1997)].

AREA OF ADAPTATION:

Garnet mountain brome is adapted to areas with 15 inches or more of annual precipitation in the foothills and mountain zones of the Rocky Mountains. Garnet was collected at an elevation of 5,800 feet (1,770 meters) and has not been tested at elevations higher than Pinedale, where the species does occur (10,000 feet). Mountain brome grass prefers

deep fertile, and mesic soils of medium to fine texture. It can survive on thin, dry, or coarse soils, but at a reduced level of production. Mountain brome grass grows throughout the mountain areas of the Pacific Northwest, thriving in climates with cool, dry summers and good winter precipitation. This grass does not tolerate a high water table or flooding, but has good tolerance of shade, fair tolerance of fire, and is very winter hardy. This species has excellent seedling vigor and establishes quickly, often producing seed the year of establishment. Stands of mountain brome depend on natural reseeding for its self perpetuation (Long Range Plans for Field Plantings and Planting Guides, Section 540.25 (B) and (C) January 1997).

MAINTENANCE AND CERTIFIED SEED PRODUCTION:

It is expected that official state seed certification agencies will certify seed production fields. Tested class seed of Garnet mountain brome can be obtained from the Upper Colorado Environmental Plant Center, Meeker Colorado. Seed production fields of Garnet mountain brome will be limited to having less than 5% head smut. This will eliminate the possibility of seedlings with no smut resistance from becoming a substantial part of the seed production stand. UCEPC will maintain G1 (generation 1) seed and seed will only be certified and distributed as a G1. So, Garnet will be limited to one generation of tested class seed beyond G1. G2 seed will be sold for only commercial seed stock for conservation use.

ENVIRONMENTAL CONCERNS:

In the development for release of Garnet mountain brome no invasive tendencies were noted or reported. The test results we have to date indicate that Garnet germplasm has not been invasive in its areas of adaptation or for its intended use.

SEED PRODUCTION:

An irrigated seed production field at the Meeker Plant Materials Center was established with a three foot row spacing and planting about 30 seeds per foot of row at a depth of about one half inch. A fall application of fertilizer at a rate of 90 pounds of available nitrogen per acre is applied at Meeker. However, a soil test is recommended to determine fertilizer needs for most seed production fields. Good seed production can be expected the year following a spring, late summer or fall planting. Seed production fields of Garnet mountain brome will be limited to having less than 5% head smut. This will eliminate the possibility of seedlings with no smut resistance from becoming a substantial part of the seed production stand. Seed fields should be monitored for insects, mildew and head smut. Seed at Meeker has been harvested with a combine from a standing crop and dried before cleaning and storage. The large seeds are easily cleaned with traditional seed cleaning equipment.

COMMERCIAL SOURCES:

Contact the Upper Colorado Environmental Plant Center, Meeker, Colorado for tested class seed for seed production fields. Contact can also be made through the Colorado Seed Growers Association, Fort Collins, Colorado.

LITERATURE CITED:

- Hammon, R.W. and F.B. Peairs. 1998. Natural history of *Diuraphis* (Homoptera: Aphididae) species occurring in western Colorado. In: S.S. Quisenberry & F.B. Peairs ed. Response Model for an Introduced Pest - The Russian Wheat Aphid. Thomas Say Publications. Entomol. Soc. Am. Lanham, MD. pp 412-428.
- Hanson, A.A. 1972. Grass varieties in the United States. USDA, ARS - Agriculture Handbook NO. 170.
- Herzman, C.W. R.M. Hyde and C. S. Fonte. 1975. Native grasses - handbook of Colorado. Colorado State University - Bulletin 450-A.
- Hitchcock, A.S. 1950. Manual of the Grasses of the United States. Second edition, Revised by A. Chase. U.S. Printing Office.
- Long Range Plans for Field Plantings and Planting Guides, Section **540.25** (B) and (C). 1997. National Plant Materials Manual (NPMM) Issue NO MT-11.
- Plant Materials Handbook. 1988. Office of surface mining, reclamation and enforcement. Submitted by Soil Conservation Service Plant Materials Center.
- Stefferd, Alfred. 1948. Grass - The yearbook of agriculture 1948. USDA.
- Wasser, C.L. 1982. Ecology and culture of selected species useful in revegetating disturbed lands in the West. Fish and Wildlife Service (FWS/OBS-82/56).

UPPER COLORADO ENVIRONMENTAL PLANT CENTER
P O Box 448
Meeker, Colorado 81641

DOCUMENTATION OF A PLANT SELECTED FOR ADVANCED TESTING

Species: Bromus marginatus Nees ex Steud.
Common Name: mountain brome
Plant Symbol: BRMA4
Tested Class: Garnet mountain brome
Accession Number: 9005308 (Alternate Number = M-1286)

Method of

Selection: The genetic material was collected in Powell County, Montana near the ghost town of Garnet. The elevation at the collection site is **5,800** feet (1,700 m).

Performance:

Garnet mountain brome has been tested at Plant Material Centers in Colorado and Montana. It also has been evaluated in field plantings in Montana, Wyoming, Idaho, Utah and Nebraska. Garnet was selected for its head smut resistance, longevity, ease of establishment and production of both forage and seed. It does well on moderately deep fertile medium textured soils (Wasser, 1982).

Description:

Garnet mountain brome is considered a short lived perennial cool season bunchgrass. It is native to the mountains and foothills of the Rocky Mountains. Mountain brome does well with 18 inches or more of annual precipitation and grows at elevations from 5,000 to 10,000 feet (1,525 3,050 meters) [(Wasser, 1982 and Herzman, et al., 1975. Sheaths and leaves are normally pubescent and panicles are open. It has a deep well branched root system that is important for protecting erodible slopes (Hanson, 1972). Mountain brome starts growth in early spring and is an important palatable forage for wildlife and all livestock. It has large seeds with good seedling vigor, but seeds do deteriorate rapidly in storage. Mountain brome has approximately **71,000** seeds per pound, while Garnet has 77,879 (seed count by Colorado Seed Laboratory on the 1998 seed lot).

Anticipated

Conservation Use: Garnet should provide good performance where traditional mountain brome has been historically present. This includes planting for quick cover and erosion control in mountains and foothills (Plant Materials Handbook, 1988). It is also used in seeding mixtures with alfalfa and sweet clover to revegetate livestock and big game ranges, to protect road cuts and fills, mined lands and burned over forestlands (Wasser, 1982 and Stefferud 1948). It is a quick establishing species which

provides initial soil stabilization when planted with other slower establishing natives. As slower developing species become established, the stands of the short-lived mountain brome will slowly decline. Mountain brome grass is considered a decreaser species in the range sites it occupies. It is commonly found in Major Land Resource Areas (MRLA) Northern Rocky Mountains and Valleys (**44& 43**), Northern Rocky Mountain Foothills (**46**), Wasatch and Uinta Mountains (**47**), Southern Rocky Mountains Parks (**48B**), and Southern Rocky Mountain Foothills (**49**) [(Long Range Plans for field Plantings and Planting Guides, Section **540.25**(B) and (C) January **1997**)].

Potential Area
of Adaptation

Garnet mountain brome is adapted to areas with **15** inches or more of annual precipitation in the foothills and mountain zones of the Rocky Mountain. Garnet was collected at an elevation of **5,800** feet (**1,770m**) and has not been tested at higher elevations where the species does occur (**10,000** feet). Garnet should grow throughout the mountain areas of the Pacific Northwest, in climates with cool, dry summers and good winter precipitation. This grass does not tolerate a high water table or flooding, but has good tolerance of shade, fair tolerance of fire, and is very winter hardy. This species has excellent seedling vigor and establishes quickly, often producing seed the year of establishment. Stands of mountain brome depend on natural reseeding for its self perpetuation (Long Range Plans for field Plantings and Planting Guides, Section **540.25**(B) and (C) January **1997**).

Potential Soil
Adaptation

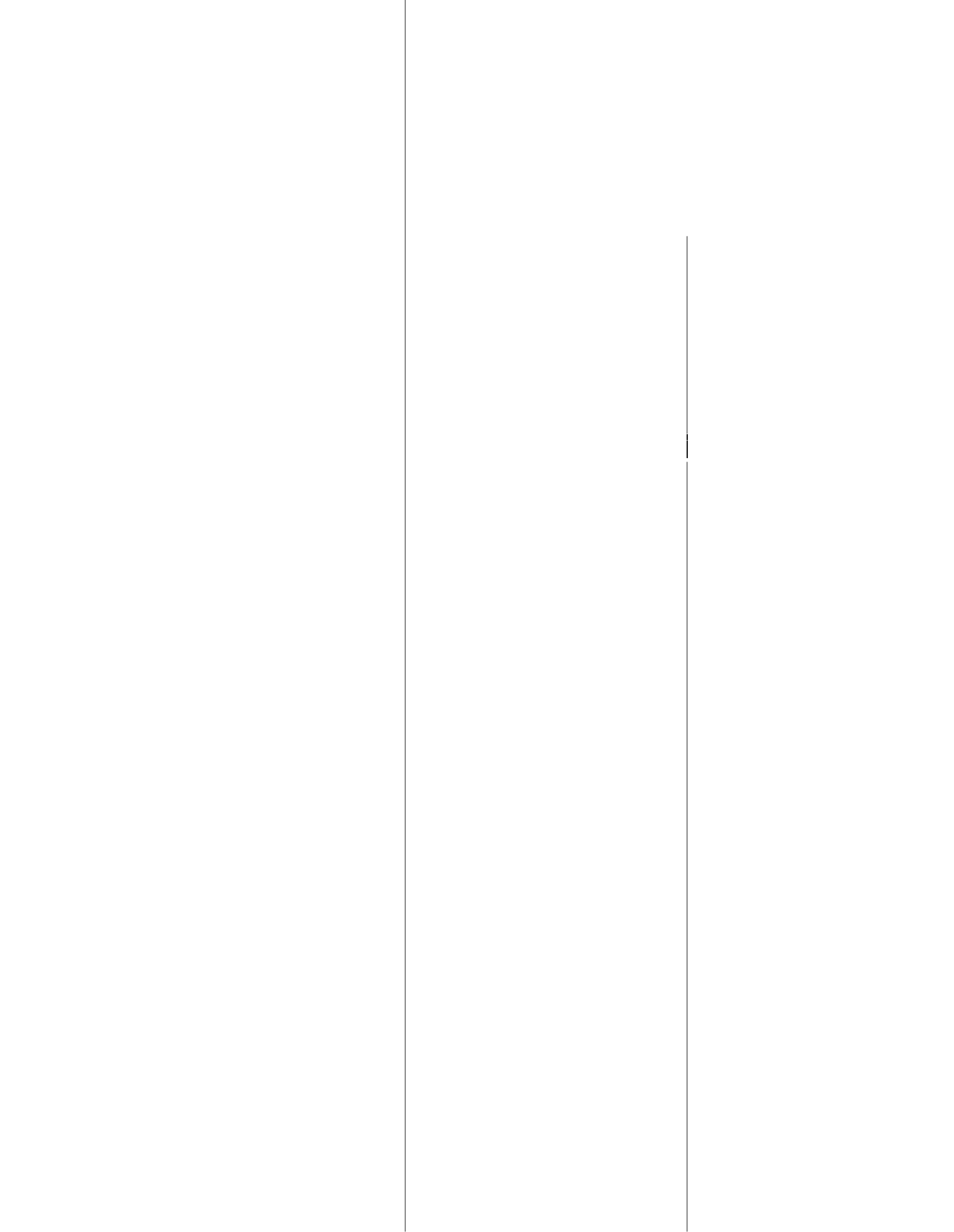
Garnet prefers deep, fertile, and mesic soils of medium to fine texture. It can survive on thin, dry or coarse soils, but at a reduced level of production (Long Range Plans for field Plantings and Planting Guides, Section **540.25**(B) and (C) January **1997**).

Where Seed
Maintained:

Tested class seed of Garnet mountain brome can be purchased from the Upper Colorado Environmental Plant Center, Meeker, Colorado. The Colorado Seed Growers Association, Fort Collins, Colorado can also be contacted for seed.

Prepared by:

Dr. Gary L. Noller, Upper Colorado Environmental Plant Center, Meeker, Colorado.



UPPER COLORADO ENVIRONMENTAL PLANT CENTER MEEKER, COLORADO

AND THE

USDA - NATURAL RESOURCES CONSERVATION SERVICE

Planting Guide

SPECIES: Garnet Mountain Brome
Bromus marginatus Nees **ex Steud.**
9005308 (Alternate Number = M-1236)

USES: Garnet mountain brome should provide good performance where traditional mountain brome has been historically present. This includes planting for quick cover and erosion control in mountains and foothills (Plant Materials Handbook, 1988). It is also used in seeding mixtures with alfalfa and sweet clover to revegetate livestock and big game ranges, to protect road cuts and fills, mined lands and burned over forestlands (Wasser, 1982 and Stefferud 1948). It is a quick establishing species which provides initial soil stabilization when planted with other slower establishing natives. As slower developing species become established, the stands of the short-lived mountain brome will slowly decline. Mountain brome is considered a pioneer species on disturbed sites and a decreaser species in the range sites it occupies. It is commonly found in Major Land Resource Areas (MRLA) Northern Rocky Mountains and Valleys (44 & 43), Northern Rocky Mountain Foothills (46), Wasatch and Uinta Mountains (47), Southern Rocky Mountains Parks (48B), and Southern Rocky Mountain Foothills (49) [(Long Range Plans for field Plantings and Planting Guides, Section 540.25 (B) and (C) January 1997)].

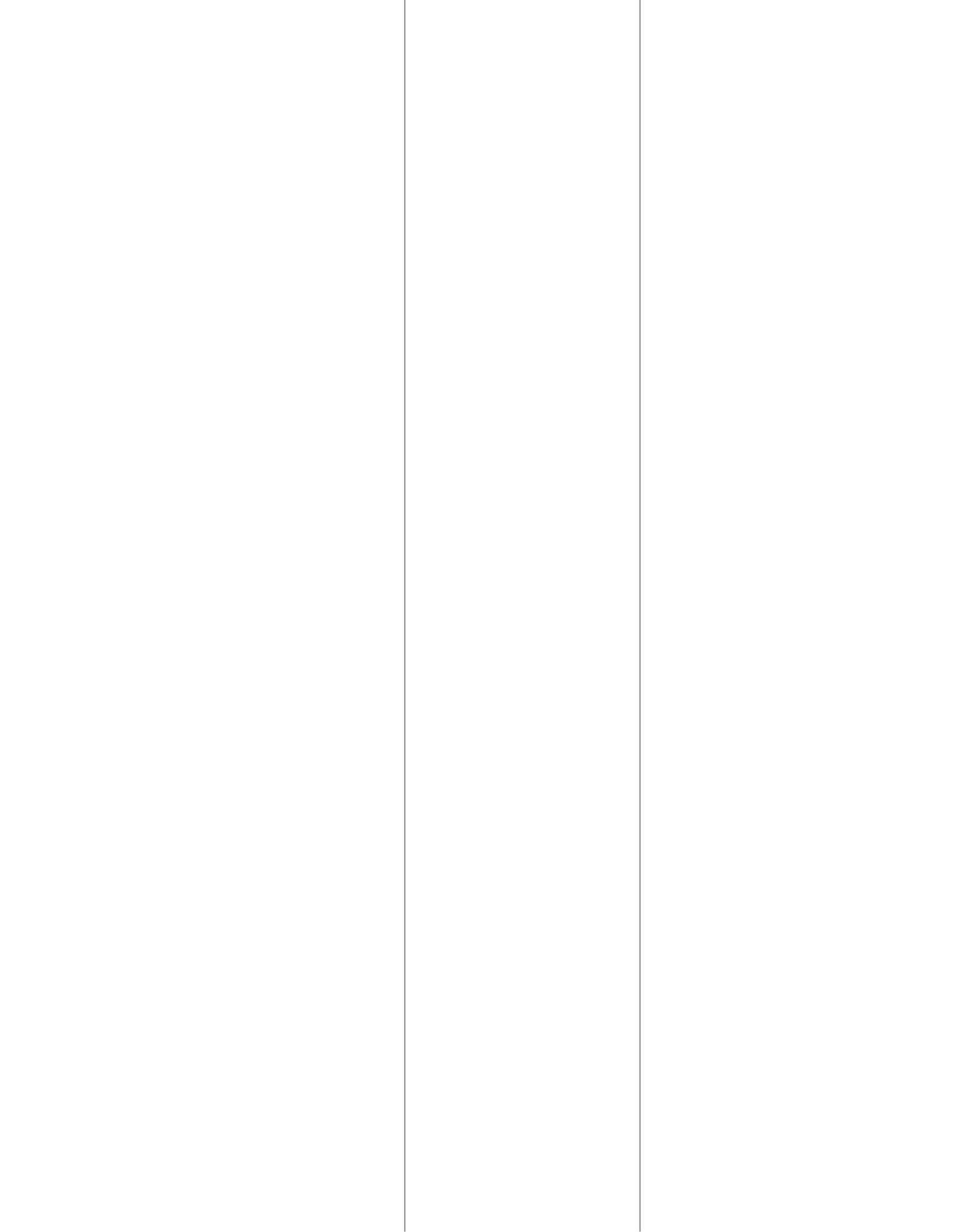
DESCRIPTION: Garnet mountain brome is considered a short lived perennial cool season bunchgrass. It is native to the mountains and foothills of the Rocky Mountains. Mountain brome does well with 18 inches or more of annual precipitation and grows at elevations from 5,000 to 10,000 feet (1,525-3,050 meters) [(Wasser, 1982 and Herzman, et al., 1975)]. Sheaths and leaves are normally pubescent and panicles are open. Mountain brome does well on moderately deep fertile medium textured soils (Wasser, 1982). It has a deep well branched root system that is important for protecting erodible slopes (Hanson, 1972). Mountain brome starts growth in early spring and is an important palatable forage for wildlife and all livestock. It has large seeds with good seedling vigor, but seeds do deteriorate rapidly in storage. Mountain brome has approximately 71,000 seeds per pound. In comparison, Garnet has 77,879 seeds per pound (seed count by Colorado Seed Laboratory on the 1998 seed lot).

ADAPTATION: Garnet mountain brome is adapted to areas with 15 inches or more of annual precipitation in the foothills and mountain zones of the Rocky Mountains. Garnet was collected at an elevation of 5,800 feet (1,770 meters) and has not been tested at higher elevations where the species does occur (10,000 feet). Mountain brome grass prefers deep

fertile, and mesic soils of medium to fine texture. It can survive on thin, dry, or coarse soils, but at a reduced level of production. Mountain brome grass grows throughout the mountain areas of the Pacific Northwest, thriving in climates with cool, dry summers and good winter precipitation. This grass does not tolerate a high water table or flooding, but has good tolerance of shade, fair tolerance of fire, and is very winter hardy. This species has excellent seedling vigor and established quickly, often producing seed the year of establishment. Stands of mountain brome depend on natural reseeding for its self perpetuation (Long Range Plans for Field Plantings and Planting Guides, Section 540.25(B) and (C) January 1997).

ESTABLISHMENT: Garnet mountain brome needs 15 inches or more of annual precipitation. Seeds should be planted about one half inch deep in a firm weed free seedbed with about 30 seeds per foot of row. In most plantings mountain brome will be included in a mixture with other grasses, forbs, and shrubs (Long Range Plans for Field Plantings and Planting Guides Section 540.25 (B) and (C), January, 1997). Plantings can be done in late summer, fall or early spring.

MANAGEMENT: Like most cool season grasses, mountain brome initiates growth in early spring with seed maturity by late July or early August. With good soil moisture conditions, this grass will develop late summer or fall regrowth. Only a moderate response to fertilization can be expected. Weed control (mowing and/or chemical control) may be necessary the establishment year. Mountain brome has good palatability for all classes of livestock and wildlife in the early spring. At maturity the stems and leaves become rough and coarse, resulting in lower palatability; however, at this stage the nutritious seed heads are relished by all grazing animals (Long Range Plans for Field Plantings and Planting Guides, Section 540.25(B) and (C), January, 1997). Garnet seedlings have good vigor but should be protected from grazing until roots have an opportunity to become sufficiently developed so plants are not pulled up with grazing. Seed production fields should be monitored for insects, and disease. Seed production fields should have soil tests to determine the fertilizer need.



APPENDIX I.

1977 seeding at Bridger Plant Materials Center, Initial Evaluations

In a project to evaluate potential species for reclamation of mined lands, range revegetation and soil stabilization, the stand of Garnet mountain brome ranged from 90% to 100% (1977-79) and was better than the other mountain brome (M-1196) in the study. In 1979 Garnet had moderate vigor and production of both forage and seed which again was generally better than the other mountain brome in the project.

64 Accessions seeded April 11, 1977

YEAR	ACCESSION	STAND*	VIGOR*	PRODUCTION FORAGE*	SEED*
1977	Garnet mtn brome	90%	2	-	-
	M-1196 mtn brome	65%	3	-	-
1978	Garnet mtn brome	2%	2	3	2
	M-1196 mtn brome	2%	2	4	3
1979	Garnet mtn brome	100%	3	3	3
	M-1196 mtn brome	85%	6	5	5

* rating of 1-9 where 1 is best

APPENDIX 11.

Field evaluation plantings in 1983 and 1987 at Missoula, Montana

The stand of Garnet mountain brome in a 1983 planting ranged from 90% to 100% (1984-88) and in 1988 had good vigor and production of both forage and seed. The performance of 'Bromar' in 1988 was not as good as Garnet. In a second planting (1987) in Missoula the stand of Garnet ranged from 25% to 50% (1987-90) and vigor in 1990 was moderately good. In this test 'Bromar' in 1990 had a better stand than Garnet.

1983 Seeding - Fall evaluation

YEAR	ACCESSION	STAND	VIGOR*	PRODUCTION FORAGE*	SEED*
1984	Garnet	90%	3	3	-
	'Bromar'	100%	1	1	-
1985	Garnet	100%	2	2	2
	'Bromar'	100%	2	2	2
1986	Garnet	100%	2	2	3
	'Bromar'	100%	3	3	3
1987	Garnet	95%	2	3	3
	'Bromar'	100%	2	3	3
1988	Garnet	95%	2	2	2
	'Bromar'	90%	3	5	4

* rating of 1-9 where 1 is best

1987 Seeding

YEAR	ACCESSION	STAND	VIGOR*
1987	Garnet	25%	3
	'Bromar'	25%	4
1988	Garnet	50%	2
	'Bromar'	25%	3
1989	Garnet	50%	3
	'Bromar'	30%	4
1990	Garnet	50%	3
	'Bromar'	60%	3

* rating 1-9 where 1 is best

APPENDIXIII.

Forage Production Evaluation Planting

Garnet mountain brome was included in a forage production planting (1993, 1994, & 1995) at four locations (Bridger, Bozeman, Kalispell and Moccasin) in Montana. The average forage production of Garnet ranged from **1.36** to **4.86** tons per acre. In each location Garnet mountain brome produced less forage than 'Regar' meadow brome.

Average Forage Production of Garnet mountain brome at four locations in Montana

LOCATION	SPECIES	YEARS	TONS/ACRE
Bridger	Garnet mountain brome	1993 & 1994	1.36
	'Regar' meadow brome	1993 & 1994	1.90
Bozeman	Garnet mountain brome	1993, 1994 & 1995	1.74
	'Regar' meadow brome	1993, 1994 & 1995	2.33
Kalispell (Irrigated)	Garnet mountain brome	1993, 1994 & 1995	4.86
	'Regar' meadow brome	1993, 1994 & 1995	5.55
Moccasin	Garnet mountain brome	1993 & 1994	1.38
	'Regar' meadow brome	1993 & 1994	1.48

APPENDIX IV.

**Projects 08S191 and 08S217
Seed Production for Garnet mountain brome**

Seed was produced from a spaced planting project (08S191) and off types were removed. A one acre seed production field (08S217) was planted in 1993 and has maintained 5 years of seed production.

SEED PRODUCTION FROM PROJECTS 08S191 AND 08S217

Project No.	YEAR	ACRES	POUNDS CLEAN SEED
08S191	1989	0.20	0.00
	1990	0.20	76.00
	1991	0.20	92.00
	1992	0.20	104.00
	199s	0.20	6.20
<hr/>			
08S217	1994	1.00	Planted in 1993 1235.00
	1995	1.00	1266.00
	1996	1.00	610.00
	1997	1.00	473.00
	1998	1.00	479.00

APPENDIX V.

Idaho Falls, Idaho, Dryland Field Test of Garnet mountain brome

In a field test of Garnet in Idaho Falls, Idaho, an excellent stand and excellent vigor were maintained from 1996 through 1998. Seed production for 1997 and 1998 averaged 325 pounds per acre.

Field Planting of Garnet mountain brome at Idaho Falls, Idaho

YEAR	STAND	VIGOR	POUNDS/ACRE CLEAN SEED
1996	Excellent	Excellent	---
1997	Excellent	Excellent	350
1998	Excellent	Excellent	300

APPENDIX VI.

**1991 Demonstration Planting
Pinedale, Wyoming**

In a demonstration planting at Pinedale, Wyoming, nine accessions of mountain brome were planted including 'Bromar' and Garnet. In 1995 all mountain brome stands decreased from the previous year. However Garnet declined the least and was still maintaining a **75%** rating, while 'Bromar' rated only **1%**. In 1996, stands of mountain brome continued to decline. 'Bromar' was dead and **Garnet had only a 10% stand rating**. Three of the other nine mountain brome accessions had **better stand ratings, but ranged from only 23% to 55%**.

1991 Demonstration Planting
of
Garnet mountain brome at Pinedale, Wyoming

YEAR	ACCESSION	% STAND	VIGOR*
1995	'Bromar'	1%	9
	Garnet	75%	5
	9054369	50%	6
	9054372	50%	6
	9054373	40%	7
	9054374	20%	8
	9054375	5%	9
	9054376	5%	9
	9054510	1%	9
1996	'Bromar'	0%	0
	Garnet	10%	8
	9054369	10%	8
	9054372	55%	7
	9054373	45%	7
	9054374	23%	8
	9054375	0%	0
	9054376	3%	8
	9054510	0%	0

* rating of 1-9 where 1 is best

APPENDIX VII.

Germination information from tests at the Meeker Plant Materials Center

In **1998** small seed lots of Garnet mountain brome grown at the Meeker Plant Materials Center that were **10** to **13** years old were tested for germination. These lots were not tested when grown, but in **1998** all lots had poor germination, ranging from **0** for the **13** year old material to only **5%** for the **10** year old lot.

Other seed lots of Garnet that were tested when produced, had germination that deteriorated rather quickly. A **1994** lot had a germination of **77%** when produced, but in two years (**1997**) had declined to **64%**. Another lot produced in **1990** had a germination of **83%** at the time of production, but in 6 years (**1997**) was only **25%**. This information demonstrates that Garnet seed can not be stored for long periods due to loss of germination.

Germination Information on Garnet mountain brome

Year Grown	1998 Test % Germ
1985	0%
1986	1%
1987	1%
1988	5%

Year Grown	% Germ Year of Test	Updated % of Germ Year of Test
1994	77%(1995)	64%(1997)
199s	93%(1994)	
1992	77%(1993)	
1991	94%(1992)	
1990	83% (1991)	25%(1997)