

**NATURAL RESOURCES CONSERVATION SERVICE
MISSOURI AGRONOMY SPECIFICATION**

VEGETATION ESTABLISHMENT, HERBACEOUS SEEDING

CODE 723

GENERAL

This item of work shall consist of providing the species selection, site preparation, timing and manner of seeding, and facilitating practices for the establishment of permanent herbaceous vegetation. This specification is the criteria to be applied for the following conservation practice standards:

CONSERVATION COVER (327)
CRITICAL AREA PLANTING (342)
PASTURE AND HAYLAND PLANTING (512)
UPLAND WILDLIFE HABITAT MANAGEMENT (645)

The current version of Missouri SeedRate may be used to generate a seeding recommendation and to document the proper completion of the conservation practice. SeedRate creates a JS-AGRON-25 form that will be the record of planning and application for the conservation practice standards listed above. If SeedRate is not available, simple computations will be used to calculate the seeding rate for each species.

SPECIES SELECTION

Adapted Species - Species selected must be adapted to the site (soils, Pasture Suitability Group, wet soil conditions, drought tolerance, etc.) and expected growing conditions as well as the expected use and management of the vegetation. When erosion control is a primary purpose, the mixture must contain at least 60 percent perennial grasses.

Mixtures are usually desired over monoculture plantings. Where the primary use is for grazing management, legumes shall not exceed 50 percent of the mixture. If the primary planned use is hay production and the site is highly erodible, the mixture shall not exceed 75 percent legumes.

Where wildlife habitat is the resource objective, refer to the UPLAND WILDLIFE HABITAT MANAGEMENT (645) conservation practice standard for criteria.

Site Conditions – Plant species and cultivars shall be selected based on:

- 1) climatic conditions such as annual precipitation, seasonal precipitation distribution, length of growing season, humidity levels, temperature extremes, wind, and solar radiation;
- 2) soil condition and position attributes such as pH, available water holding capacity, aspect, drainage class, inherent fertility, salinity or alkalinity, flooding or ponding, and levels of toxic elements that may be present such as selenium or aluminum; and
- 3) resistance to disease and insects common to the site or location.

Use – Select species and cultivars that are desirable for the planned use and address the resource concerns.

Companion Crop – A companion crop may be established prior to or at the same time as a permanent seeding of grass, forbs, and/or legumes. The companion crop will be selected and managed to minimize competition with the permanent seeding. Approved companion crops are:

1) Redtop may be planted on erodible sites along with warm season grasses that are slow to establish. A seeding rate not to exceed 1.0 pound per acre pure live seed may be added to the full seeding rate of the planned warm season grasses, forbs, and legumes.

2) Spring Oats may be planted at a rate not to exceed 25 pounds per acre of high quality, relatively weed-free seed (feed-grade oats are suitable if they are clean). When the permanent seed is drilled in one operation along with the oats, the planting depth will be ½ -inch or less. Note: Oats seeded in the fall will winter-kill and not mature. Oats seeded earlier in the year must not be allowed to mature because of competition with the permanent seeding species. Clip, harvest, or flash-graze when the oats are in the milk stage; manage the stand as often as necessary to keep the canopy from becoming competitive.

3) Winter Wheat may be used ONLY where topsoil has been removed and the permanent vegetation is being established on subsoils. Wheat may be planted at a rate not to exceed 25 pounds per acre of high quality, relatively weed-free seed. Clip, harvest, or flash-graze when the wheat is in the milk stage; suppress the wheat cover as often as necessary to keep the canopy from becoming competitive with the permanent species.

SEEDING RATES

1) Based on Use – The seeding rates vary for each separate species as determined by the pure live seed needed for select uses. Refer to Table 1 for the specific base rates required for each of the seeding practices. The four conservation practices supported by this specification have four separate and distinct multipliers for the base rates in Missouri.

The CONSERVATION COVER (327) practice standard requires a seeding rate that represents 100 percent of the desired plant cover for erosion control. The base rate will be adequate for erosion control while providing quality habitat for wildlife. The base rate also applies to seedings under the UPLAND WILDLIFE HABITAT MANAGEMENT (645) practice standard unless there is an exception for specific mixes in the standard.

The CRITICAL AREA PLANTING (342) practice standard is usually applied on cut and fill construction sites. Herbaceous vegetation cannot be successfully established on these sites with the CONSERVATION COVER (327) or PASTURE AND HAYLAND PLANTING (512) practices. The CRITICAL AREA PLANTING rate is designed to supply additional seed to the site and allow natural selection to reduce the number of surviving seedlings. The seeding rate is 200 percent of the base rate in Table 1 (base rate times 2).

The PASTURE AND HAYLAND PLANTING (512) practice standard requires a seeding rate for the establishment of a production field either for grazing or hay harvesting. This 512 rate is the desired seeding rate for establishing adequate ground cover on relatively undisturbed sites and represents 125 percent of the base rate (base rate times 1.25).

Reduced seeding rates for the UPLAND WILDLIFE HABITAT MANAGEMENT (645) practice may be applied on non-highly erodible lands (NHEL) that do NOT have an erosion problem. Erosion rates from wind and water must remain within tolerable limits (T) after seeding, and concentrated flow erosion must be controlled. The seeding rate is 75 percent of the base rate (base rate times 0.75). This option for reduced seeding rates does not apply to wildlife field borders. Refer to Table 1 in the UPLAND WILDLIFE HABITAT MANAGEMENT (645) standard for the recommended species and seeding rates of wildlife field border.

These base rates and specific adjustments by conservation practice (practice multiplier) will be used whenever the soil, site conditions, equipment and management conditions are adequate for the establishment of the desired stand of grass, legumes, and forbs under each of the seeding practices.

TABLE 1: BASE SEEDING RATES - POUNDS PURE LIVE SEED PER ACRE

Species	Base Rate (100%)	Erosion Control Rating	Wildlife Habitat Rating	Wet Soil Tolerance Rating	Drought Tolerance Rating
Cool Season Legumes:					
Birdsfoot Trefoil	5.0	Fair	Fair	Low	Medium
Alsike Clover	3.2	Good	Good	High	Low
Ladino Clover	3.0	Good	Fair	Medium	Low
Red Clover	6.1	Fair	Fair	None	Low
Kura Clover	7.0	Fair	Fair	None	Low
Alfalfa	7.5	Fair	Excellent	None	High
Warm Season Legumes:					
Common Lespedeza ^{1/}	7.5	Poor	Excellent	Low	High
Illinois Bundleflower	14.5	Fair	Excellent	None	Medium
Partridge Pea ^{1/}	26.8	Fair	Excellent	None	Medium
Roundhead Bushclover	6.3	Poor	Good	None	High
Showy Ticktrefoil	10.0	Fair	Excellent	None	High
Cool Season Grasses:					
Canada Wildrye	15.3	Good	Excellent	Low	Medium
Virginia Wildrye ^{2/}	15.0	Good	Excellent	Medium	Medium
Kentucky Bluegrass	2.2	Good	Good	Low	Low
Orchardgrass	4.2	Fair	Excellent	None	Medium
Perennial Ryegrass	7.3	Poor	Good	None	Low
Redtop	1.7	Good	Good	Medium	Low
Reed Canarygrass	4.8	Excellent	Poor	High	Medium
Smooth Brome	8.0	Excellent	Fair	Low	Medium
Tall Fescue	8.0	Excellent	Poor	Low	High
Timothy	3.1	Good	Excellent	Low	Low
Warm Season Grasses:					
Bermudagrass	2.1	Excellent	Poor	Low Medium	High
Big Bluestem ^{2/}	8.0	Fair	Good	Medium	High
Oldworld Bluestem	2.5	Good	Poor	None	High
Composite Dropseed	2.3	Fair	Good	None	High
Eastern Gamagrass ^{2/}	8.0	Poor	Good	Medium	Medium
Indiangrass ^{2/}	7.8	Fair	Excellent	Low	Medium
Little Bluestem ^{2/}	6.4	Good	Excellent	None	High
Sideoats Grama ^{2/}	7.5	Good	Excellent	None	Medium
Southern Crabgrass ^{1/}	2.2	Poor	Poor	Low	Low
Switchgrass ^{2/}	4.7	Good	Good	Medium	Medium
Warm Season Forbs:					
Grayhead Coneflower	3.6	Poor	Good	None	Medium
Pale Purple Coneflower	16.4	Poor	Fair	None	Medium
Ox-eye Falsesunflower	11.3	Poor	Fair	None	High
Wild Bergamot	1.4	Poor	Fair	High	Low

^{1/} These species are annual species; plant early in the growing season to allow seedset to occur. Check to make sure that the use of these species meets the local environmental conditions and any program requirements prior to planning in the seed mixture.

^{2/} Locally adapted cultivars or ecotypes of these native species will be planted in Missouri. Refer to Table 2 of this specification for a listing of acceptable cultivars.

TABLE 2: NATIVE GRASS SPECIES CULTIVARS FOR USE IN MISSOURI

Grass Species	Cultivar	Area of Adaptation	Source of Collection
Native Cool Season Grasses			
Virginia Wildrye	Cuivre River	Statewide	Eastern Missouri
	O'Ma'Ha	North of I-70	East and Northeast Nebraska
Native Warm Season Grasses			
Big Bluestem	Rountree	Statewide	Western Iowa
	OZ-70	South of I-70	Southern Missouri, Southern Illinois, Northern Arkansas, and Eastern Oklahoma
	Kaw	Statewide	Eastern Kansas
	Pawnee	North of I-70	North Central Kansas and South Central Nebraska
	Champ	Statewide	North Central Nebraska
Little Bluestem	Aldous	Statewide	Eastern Kansas
	Cimarron	South of I-70, sandy sites only	Southwest Kansas and Oklahoma Panhandle
	Camper	North of I-70	North Central Kansas and South Central Nebraska
Eastern Gamagrass	Pete	Statewide	Kansas and Oklahoma
	PMK-24	Statewide	Kansas and Oklahoma
Sideoats Grama	El Reno	Statewide	Central Oklahoma
	Trailway	Statewide	North Central Nebraska
Indiangrass	Rumsey	Statewide	Southern Illinois
	Osage	Statewide	Eastern and Central Kansas and Oklahoma
	Cheyenne	Statewide	Western Oklahoma
	Nebraska 54	North of I-70	Nebraska
Switchgrass	Cave-In-Rock	Statewide	Southern Illinois
	Blackwell	Statewide	North Central Oklahoma
	Alamo	Lowland Sites – South of I-70	South Central Texas
	Kanlow	Lowland Sites - Statewide	East Central Oklahoma
	Pathfinder	North of I-70	North Central and South Central Nebraska
	Trailblazer	North of I-70	Selection from Pathfinder
	Nebraska 28	North of I-70	North Central Nebraska

2) Based on Method – When it is possible to properly place the seed and obtain good seed to soil contact, less seed is needed on the site to establish a full stand. This condition is represented by the base rate in Table 1 times the rate adjustment factor for each separate practice.

Certain broadcast seeding methods only offer a fair chance of adequate stand establishment. Broadcast planting methods that do not ensure uniform seed distribution and provide adequate seed to soil contact (firm soil and shallow placement of seed) meet the criteria. This site condition is represented by a method adjustment factor times the base rate in Table 1. The broadcast rates should be the base rate times 1.50 (50 percent increase in seed for the broadcast method) times practice adjustment factor of 0.75, 1.0, 1.25, or 2.0 for the specific conservation practice standard that applies.

3) Based on Mix – The amount of seed needed will vary based on the percentage of each species in the desired mix that is planned and applied to the site. Use SeedRate to calculate the amount of seed needed to apply the minimum seed to meet the practice criteria. Each conservation practice requires a different minimum amount of seed due to the different conservation purposes. Declare the desired percentage for each species in SeedRate.

An example of the seeding rate calculations for Use, Method, and Mixture follows the formula: Base Rate from Table 1 x Use (%) x Method(%) x Mix (%) = Seeding Rate. For seeding Birdsfoot Trefoil as a Critical Area Planting using broadcast methods and 20 percent of the mix, the formula would be:

$$5.0 \text{ PLS pounds/acre} \times 200\% \times 150\% \times 20\% = 3.0 \text{ pounds/acre seeding rate}$$

4) Based on Existing Stand – SeedRate allows a planner to calculate the seed needed to complete an interseeding practice. Interseeding is a process to plant a portion of the desired stand without removing or destroying all the established plants currently occupying the site. The interseeding rate will be based on 50 percent of the stand surviving site preparation and 50 percent of the stand being established from seed.

SITE PREPARATION

Weed Control – Competitive vegetation will be controlled on the site prior to seeding. Mechanical, chemical, or biological means will be employed to remove undesirable vegetation. Herbicides and/or tillage may be used to retard the growth of existing cover in an interseeding operation.

Surface Conditions – Prior to seedbed preparation, shape the site sufficiently to permit the use of tillage and seeding equipment. A firm, weedfree seedbed is required for all seedings. The seedbed will be made firm by rolling or culti-packing prior to seeding. The seedbed is firm if you can walk on it without sinking in more than one-half inch.

On highly erodible soils where soil erosion is likely to occur, particular attention to seedbed preparation and/or to the use of companion crops for protection during the erosive establishment period is encouraged. A no till establishment procedure should be used. Herbicides will be needed to control existing vegetation and suppress weedy competition. Always follow the herbicide label. The seedbed will be made firm by culti-packing or rolling prior to seeding when tillage is used for site preparation.

Where erosion is not a concern, a clean-tilled seedbed may be used. Firm the seedbed prior to planting grasses, legumes, or forbs.

For no till seeding into an existing pasture or hayland field, prescribed burning, herbicides, heavy grazing, close mowing, or some combination of these treatments will be used to weaken the existing stand, control weedy species, and/or prevent seed production during the growing season prior to seeding. Timing of herbicide applications shall be based on the growth stage of the targets species or specie being controlled. Adequate time for decomposition of root crowns should be provided so that good soil to seed contact may be obtained at planting time

When planning a no till seeding into heavy crop residue, remove some of the residue cover prior to planting. This may be accomplished by grazing, baling, shredding, or prescribed burning. Drills equipped with residue management attachments or aggressive coulters may be required to cut through or move heavy residue.

Surface Conditions for Construction or Critical Areas – Cover fine textured soils (greater than 40% clay) and coarse textured soils (sands, loamy sands) with a minimum of six (6) inches of topsoil after construction is complete. Topsoil shall be the highest quality surface soil available at

the site. Topsoil shall be free of brush, rocks, and other large materials to the extent that it is not detrimental to the establishment and maintenance of desired plants. Soil materials from drained ponds or surface material from an erosive area will not be used. If available topsoil material is no better than the material to be covered, do not apply topsoil.

Prepare a seedbed, incorporate lime and fertilizer, and plant or cover seed with mechanical operations on slopes where it is safe to operate equipment. Use appropriate methods to prepare a seedbed, control weeds, incorporate fertilizer, and achieve seed to soil contact of the permanent seeding or temporary cover where slopes are too steep for safe vehicle operation. All slopes must be smooth and free of rills or gullies.

Moisture in Soil Profile – Soil moisture shall be adequate for the germination and establishment of the desired vegetation. Plan seedings to be planted prior to the portion of the year when adequate precipitation is likely to occur. Follow required planting dates in Table 3 discussed below.

SOIL FERTILITY

Follow the criteria in the NUTRIENT MANAGEMENT (590) practice standard to apply fertilizer and soil amendments for stand maintenance.

The CRITICAL AREA PLANTING (342) practice standard allows an option to use all-inclusive fertilizer and limestone application rates for stand establishment. If seeding is being applied for wildlife habitat, see the UPLAND WILDLIFE HABITAT MANAGEMENT (645) practice standard.

The following criteria apply to any seeding standard where a soil test will be used to determine the fertility and effective neutralizing material needed for establishment of the vegetative stand:

- the application of fertilizer and soil amendments shall be based on a current soil test (less than 4 years old) taken since the last application of lime or fertilizer. Applied amounts shall be within the larger of ten (10) percent or ten (10) pounds per acre of the recommended amounts. Requirements for the application of nitrogen, phosphate, and potash may be waived when the soil test recommendation for each individual nutrient is less than 25 pounds per acre and the total amount of fertilizer material to be applied is less than 50 pounds per acre. Agricultural lime requirements of 600 pounds or less of effective neutralizing material (ENM) may be waived.
- on grass and legume plantings where no nitrogen is recommended and only where the vendor cannot provide a fertilizer blend without nitrogen, up to 30 pounds per acre of nitrogen may be applied.
- if lime or fertilizer is required for establishment, applications shall be appropriately placed and timed prior to seeding to be effective. Lime and fertilizer shall be applied prior to seeding and incorporated during tillage operations. To establish a legume crop, lime shall be applied at least three months prior to planting. On no till plantings containing legumes where incorporation with tillage cannot be accomplished, lime shall be applied at least 6 months prior to the seeding date. This advance time requirement (3 to 6 months prior to seeding) may be waived for mixes containing:
 - 1) alfalfa when the pH is equal to or more than 5.7 (salt) or 6.2 (water);
 - 2) warm season legumes when the pH is equal to or more than 5.2 (salt) or 5.7 (water); or
 - 3) all other legumes when the pH is equal to or more than 5.5 (salt) or 6.0 (water).
 Applications of liming materials in excess of 4 tons per acre can be applied in split applications with approximately half of the lime requirement being properly placed and timed prior to the seeding and the remainder applied within 2 years following the planting date.

PLANTING DATES

Specific planting dates are required for successful completion of vegetation establishment. Refer to Table 3 for acceptable and optimal planting dates.

TABLE 3: PLANTING DATES^{1/}

Plantings with a dominance of:	Spring Planting Period	Summer or Fall Planting Period	Dormant Season Planting Period
Cool Season Grasses and Legumes in Northern Missouri ^{1/} : Acceptable Dates Optimal Dates	Mar 16 – May 31 Mar 16 – Apr 30	Aug 01 – Oct 15 ^{2/} Aug 16 – Sep 15	Dec 01 – Mar 15
Cool Season Grasses and Legumes in Southern Missouri ^{1/} : Acceptable Dates Optimal Dates	Mar 01 – May 15 Mar 01 – Apr 15	Aug 16 – Oct 15 ^{2/} Sep 01 – Sep 30	Dec 16 – Feb 29
Warm Season Grasses, Legumes, and Forbs in Northern Missouri ^{1/} : Acceptable Dates Optimal Dates	Mar 16 – Jun 30 Apr 16 – Jun 15		Nov 16 – Mar 15
Warm Season Grasses, Legumes, and Forbs in Southern Missouri ^{1/} : Acceptable Dates Optimal Dates	Mar 01 – Jun 15 Apr 01 – May 31		Dec 01 – Feb 29

^{1/} Planting dates are based on plant suitability zones. Northern Missouri is all counties north of Bates, Henry, Benton, Morgan, Moniteau, Cole, Osage, Gasconade, Franklin, and St. Louis Counties. Southern Missouri is all counties including and south of those listed.

^{2/} Mixtures containing legume species will be planted by September 15 in Northern Missouri and the Ozark Highlands and September 30 in the rest of Southern Missouri.

Critical Area Planting Date Exemption - A special exemption on seeding dates may be used with CRITICAL AREA PLANTING (342) mixtures of cool-season grasses. These mixtures may be planted from June 1 through July 31 in Northern Missouri or from May 16 through August 15 in Southern Missouri only when the following conditions exist:

- 1) soil moisture on the site is at field capacity at time of seeding;
- 2) planting rates are increased by an additional 50 percent
- 3) an adequate, firm, and weed-free seedbed has been prepared;
- 4) seed is planted at a depth of ¼ inch or less with a grassland drill or similar quality seeding equipment; and
- 5) mulching material is applied following the planting operation according to the MULCHING (484) practice standard.

PLANTING METHOD

Drill or Planter Methods – Plant the seed mixture with a grassland drill, grain drill, or packer seeder at the proper depth. Drills shall be capable of properly metering and placing the size and kind of seed being planted. Desired seeding depth shall be between 1/8 and 1/4 inch for all species except eastern gamagrass which will be planted to a depth of 1 to 1½ inches. Set the drill or seeder at shallower depths (1/8 inch) for small seeds or planting on heavier soils. Plant large seeds at the deeper depth (1/4 inch) or when planting on sandy soil.

Broadcast Planting Methods – Spread the seed on the soil surface in any manner that applies adequate seed to the entire area. Rolling or packing after spreading the seed will be required for any broadcast seeding that occurs outside of the dormant seeding period. Seed may be broadcast on the soil surface without a mechanical operation to cover the seed where it is too steep for safe vehicle operation or where surface obstructions hinder mechanical operations.

SEED QUALITY

Only viable, high quality and adapted seed will be used. All seed shall have a current seed test within 10 months of the planting date that lists germination, purity, and hard seed as a percentage for determining pure live seed and lists the percent of weed seed present that meets State seed quality law standards. Seed must be clean and relatively free of weed seed and other contaminants. Seed that has become wet, moldy, or otherwise damaged in transit or storage is not acceptable. Certified seed is preferred but not required.

INOCULATION OF LEGUMES

Legume seed shall be inoculated with the proper, viable *Rhizobium* bacteria species prior to planting. Pre-inoculated seed shall be planted prior to the expiration date on the inoculum tag or be re-inoculated with the appropriate inoculum within 24 hours prior to seeding. Inoculated seed will not be exposed to direct sunlight.

Inoculation of legumes may be waived when a current pasture inventory (JS-AGRON-24 or similar inventory) shows that the legume species to be seeded occupies more than 5 percent of the vegetative cover on the site.

SPECIAL PLANTING METHODS

Sprigging – Planting sprigs, rhizomes, stolons, or cuttings of bermudagrass, prairie cordgrass, and reed canarygrass may provide quicker and easier cover than planting seed. The planting rate will be a minimum of 20 bushels of sprigs per acre. The following steps will be required:

- 1) Plant only in a moist, fertile, weed-free seedbed.
- 2) Plant reed canarygrass (only in the spring) and bermudagrass (spring or summer season by June 15) to take advantage of available precipitation and the growing season. Plant prairie cordgrass only with dormant rhizomes in early spring or as vegetative rooted plants by May 31.
- 3) Plant pure live sprigs as soon as possible after harvesting within the same day if possible or within 24 hours of digging the sprigs.
- 4) Plant sprigs at least 2 inches deep to ensure placement in soil moisture, but leave tips of green leaves above the ground.
- 5) Firm soil around the sprigs to obtain good soil to sprig contact.
- 6) Control weeds with selective herbicides applied immediately after planting.
- 7) Fertilize to hasten good ground coverage as soon as new stolons or rhizomes are evident.

Sodding for CRITICAL AREA PLANTING (342) – Apply fertilizer and lime according to a current soil test. Incorporate lime and fertilizer to a depth of 2 or 3 inches, and firm the site with a cultipacker, roller, or similar tool. The site must be relatively smooth to apply sod.

Wet the soil surface to a depth of 2 inches or more prior to laying the sod. Only moist, fresh sod shall be used. Lay sod as soon as possible after delivery to the site. Begin laying the sod from the lower end of any slope. On steep slopes the use of ladders will speed up the laying operation and limit damage to the sod.

Sod strips shall be laid at right angles to the flow of water. Stagger the joints between sod pieces. Fill any open joints with topsoil. Tamp and roll laid sod to ensure a solid contact of the sod rootmass with the moist soil surface.

On steep sites or when anticipating overland flow, sod shall be held in place by woven wire, wooden pegs, wire staples, or similar material designed for this use. Pegs or staples will be a minimum of 10 inches long.

Recently laid sod should be irrigated until moisture penetrates the soil layer beneath the sod.

Apply sod during the growing season and no later than October 1.

ESTABLISHMENT PERIOD

Weed Control – Weeds and companion crops will be controlled by herbicides, mowing, clipping, or controlled grazing prior to becoming competitive with the species planted. Competing species should be controlled depending upon their density, prior to becoming 12 inches tall, but always before viable seed set. Weed control procedures will be performed as often as necessary to ensure that stands are not reduced due to excessive competition.