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MINIMIZING EROSION ON HARVEST SITES BY REVEGETATING LOGGING ROADS, SKID TRAILS AND LANDINGS

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The purpose of revegetating disturbed areas after harvesting operations is to reduce soil erosion. Cutting trees does not cause soil loss, but skidding or dragging the trees or logs from the stump to the paved road increases the probability of soil erosion. Thus, soil disturbance on skid trails, log landings or loading areas and on truck roads are causes of erosion from two sources. One source is the exposure of mineral soil that is subject to raindrop erosion. The velocity or force of rain droplets separates soil particles upon impact, allowing these minute particles to be suspended in water and transported through overland flow. The second source is soil compression from the weight of heavy equipment, trucks and logs. Soil is composed of about 50 percent solids such as minerals and organic matter and 50 percent air and water known as pore space. Water cannot infiltrate compacted soil. Instead of absorbing water during rainfall events, the water will stay on the soil surface and flow downhill overland with increasing energy and velocity, picking up and suspending soil particles. Once the energy or velocity of the water slows when approaching more level areas, these suspended soil particles are deposited before they reach a stream or other water body.

Revegetation of bare mineral soil as quickly as possible after a harvest will alleviate potential erosion. Most areas will revegetate on their own within 12 to 18 months after a harvest from the natural seed bank stabilizing the soil on the site. Some areas where seed banks are depleted or the topsoil has been removed will require longer to naturally regenerate. The greatest probability for soil erosion is the time immediately after the harvest and before the site is naturally revegetated when the soil is exposed and not stabilized. Seeding with grasses, grains or other herbaceous vegetation is necessary to address both raindrop erosion and compaction of surface soils. Aboveground vegetation will absorb the energy of rain droplets, so soil particles stay in place while the rooting zone of established plants allows more infiltration of water into soil reducing overland flow.

In combination with water control structures such as water bars, turnouts and broad-based dips, revegetation can limit soil loss. This article provides guidelines for quickly establishing vegetation through seeding to control erosion after logging operations until natural vegetation becomes established. The primary focus is to stabilize soils. Often, a secondary goal is to seed vegetation beneficial to wildlife which may or may not provide quick soil stabilization and usually involves more time, effort and cost to establish, requiring equipment and experience not normally available on logging operations. If revegetation can simultaneously address both soil erosion and wildlife considerations, then wildlife beneficial vegetation should be implemented, especially on more level sites such as log landings. However, on grades and steeper slopes, soil stabilization is the primary concern. For more information on wildlife food plots and the benefits and concerns with different seed mixtures, refer to UT Extension publication PB 1874 Landowners' Guide to Wildlife Food Plots (tiny.utk.edu/PB1874).

INITIAL CONSIDERATIONS

Roads, skid trails and landings are necessary to facilitate logging operations. These features can provide long-term assets to properties such as improved access for management or recreation, use as firebreaks or development of natural regeneration or introduced plantings; however, left untreated, disturbed areas may quickly erode and lead to gullies, water pollution, loss of property access and degraded aesthetics. Revegetating disturbed areas should always be a primary consideration when planning timber harvests — not an afterthought. The following questions should be reviewed when planning revegetation efforts:

1. Are Best Management Practices (BMPs) and grading that control water runoff installed?
2. Where and what methods of seedbed preparation are necessary to successfully revegetate the site?
3. How much area requires seeding?
4. What is the best seed mixture for the site and time of year?

Addressing these questions enables informed decision-making and influences revegetation success.

SITE PREPARATION FOR SEEDING

Before seeding, all BMPs for the retirement of the logging operation should be completed, such as installing water control structures (broad-based dips, turnouts, water bars) and grading (out-sloping, re-contouring, re-surfacing) for proper drainage. For more information about BMPs, refer to Tennessee Department of Agriculture, Division of Forestry publication Guide to Forestry Best Management Practices in Tennessee (https://www.tn.gov/agriculture/forests/protection/water-quality.html). If roads and landings are freshly graded, seeds can be sown without further preparation. Seeds can be broadcast by hand, cyclone seeder or hydroseeder. A surface that is hard packed from hauling or loading timber should be broken up to a depth of three inches by a disk or the ripper teeth of a dozer blade. These practices will loosen the soil for better receptivity of seed, especially when the soil surfaces are compacted, hard and dry. Other measures that can be taken but may not be as effective on compacted soil surfaces include back-dragging skidder or dozer blades or using farm tractors with a harrow or rake. Steeply sloped areas or trails require more careful preparation to prevent the potential for erosion. Deep or excessive tillage should be discouraged. The goal of site preparation is to provide good seed to soil contact which can be achieved by shallow scarification. Properly prepared seedbeds will increase seed germination, revegetation success and save time and money from repeated attempts to establish cover.

DETERMINING THE SIZE OF THE TREATMENT AREA FOR SEEDING

The amount of seed required to revegetate roads, skid trails and landings should be determined and planned. Seeding rates are typically expressed in pounds per acre; therefore, an approximate total acreage should be estimated. Total acreage can be computed by taking a few measurements with the following step by step recommendations.

1. Measure the width across the area to be seeded in several locations and determine the average width.
2. Measure the length across the area to be seeded in several locations and determine the average length.
3. Multiply the average length by the average width to obtain square feet of the treated area.
4. Divide the square feet of the treated area by 43,560 square feet per acre to obtain the acreage of the area.
5. Multiply the acreage of the area by the amount of seed per acre to determine the amount of seed required. Refer to Table 1.

Example: 2,500 feet of road that is 14 feet wide. 2,500 x 14 = 35,000 sq. ft. ---- 35,000 / 43,560 = 0.80 acres

Table 1. Road surface area determination for application

Road	Road Width (ft)				
Length	8	10	12	14	16
(ft.)	----------acres----------				
100	.02	.02	.03	.03	.04
500	.09	.12	.14	.16	.18
1,000	.18	.24	.28	.32	.37
2,500	.46	.57	.69	.80	.92
5,000	.92	1.15	1.38	1.60	1.84
Some frequently used estimations for acreage: 100 feet by 100 feet square = 1/4 acre 150 feet by 150 feet square = 1/2 acre 200 feet by 200 feet square = 1 acre					

Understanding the following definitions is necessary when selecting a seed or seed mixture.

- **Annual vs. perennial vegetation**
  Annual plants grow (germinate, flower, produce seed) and die within one growing season. Perennial plants produce seed each year, become dormant, then grow back from root systems the next growing season.
- **Cool-season vs. warm-season vegetation**
  Cool-season plants grow most vigorously during the cooler parts of the year during the spring and fall. Warm-season plants grow during the warmer months (summer) of the year.
- **Native vs. non-native vegetation**
  Native plants are those that have historically existed within an area. Non-native plants have not existed historically but have been introduced within an area due to human activities. Non-native plants do not necessarily pose a threat to native plants, as many non-native plants have become naturalized, but non-native plants may not support ecosystem health as well as native plants.
- **Invasive, non-native species**
  Many non-native species are invasive causing harm to the environment; economy; or human, animal or plant community health. A few examples include kudzu, non-native lespedezas, Chinese silver grass and Japanese stiltgrass. Avoid planting these invasive species, and, if these species are present, control measures should be implemented.
- **Herbaceous cover**
  Mixture of annual and perennial herbaceous species, primarily grasses and legumes. Herbaceous cover can be both temporary species and permanent mixes to revegetate disturbed areas.
- **Temporary cover**
  Species that grow quickly and vigorously to provide a rooting mass until permanent mixtures are established.
- **Permanent mixes**
  Combinations of grass and legume species that are compatible and grow for several years on a site until natural seeding occurs.
- **Disturbed areas**
  Access roads, skid trails and landings are areas where the duff layer has been removed leaving bare mineral soil.

Considerations when revegetating areas with seed.

- The purpose of re-seeding directly after the harvest is to minimize soil erosion of exposed soils from raindrop erosion. The seed bank and the resident vegetation of the harvest site usually stabilize soils within 12 to 18 months after the harvest. Seeding annual vegetation is the primary recommendation to provide temporary cover until natural vegetation occurs. Perennial and biennial plantings should be considered where seed banks have been depleted or removed, on steep slopes where immediate establishment of persistent vegetation is needed and on roads or trails with ongoing traffic.
- Logging roads and skid trails are usually planted after the harvest is completed. Depending on weather conditions, seed planted in November through mid-February (cold temperatures and shorter day length) and in July (hot temperatures and low moisture or drought) often do not germinate and grow. Planting during these times is discouraged and a waste of time and resources. Instead, plant seeds within their specified seeding dates as designated in the next section and reference publications such as UT Extension publication PB 378 Forage and Field Crop Seeding Guide for Tennessee (tiny.utk.edu/PB378).
- Seeds can be broadcast by hand, cyclone seeder or hydroseeder. Calibrate equipment to deliver prescribed seeding rates.
- Typically, at least four hours of sunlight per day is necessary to re-vegetate a road, skid trail or log landing. Shade adjacent to these areas can constrain growth and survival of vegetation from planted seed.
- When wheat is used for both revegetation and a wildlife food objective, use an awnless variety that does not have long, stiff bristles on the seed head that deters wildlife accessibility. Also avoid using ryegrass and instead use a cereal grain such as cereal rye, wheat or oats which are more attractive to wildlife with greater nutritional value. Diverse mixes including both grasses and legumes are generally more beneficial to wildlife species than monoculture plantings.
- Soil amendments including lime and fertilizer can benefit the health and longevity of plantings. Apply amendments at time of establishment. Obtain a soil test and follow recommendations from your local county Extension office.

- Straw mulch and erosion control blankets (ECB) should be considered when seeding. This practice may increase germination and survival particularly on exposed soil sites with little organic residues and during periods of hot, dry weather. When applying straw mulch, target 70 percent ground coverage which is approximately two tons (or one 74-pound bale per 800 square feet) of dry straw per acre, Erosion control blankets are best suited to steep slopes where topsoil has been removed or banks of stream crossing approaches.
- All seeding recommendations are presented as Pure Live Seed (PLS), defined near the end of this article.

General Fertilizer and Lime Recommendation

Usually a minimum rate of 70 to 80 lbs. of nitrogen (N), 120 lbs. of phosphorus (P_2O_5) and 120 lbs. of potassium (K_2O) per acre is adequate. For native grasses, a maximum of 40 to 50 pounds of nitrogen should be applied at planting to avoid excessive competition. Where the need is indicated by a soil test, 2 or 3 tons of agricultural ground limestone per acre are sufficient.

RECOMMENDED SEEDS AND MIXTURES

Seeds can be mixed in a wide variety of combinations to meet the planting objectives. Individual species in a mix are often selected and substituted based on seed availability and price. This is acceptable providing species in a mix are seeded at the prescribed time, correct rate, and are suited to meet the objectives. Table 2 (page 7) provides common seeding recommendations. No one mixture is perfect for every situation. Five example mixes are presented to address a variety of applications.

1. Cool-season grain and legume, annual mixtures

Seed material: Cereal grain (oats, wheat, cereal rye) and annual clovers

Time of application: Mid-August – Mid-October and Mid-February – March (spring oats only)

Application rate: 100-120 lbs./acre cereal grain mixed with an annual clover adapted to site conditions. Add clover at 25 percent of the full rate, full rates are shown in Table 2.

Examples: Well-drained site – 120 lbs./acre wheat and 6 lbs./acre crimson clover
Poorly drained site – 120 lbs./acre cereal rye and 2 lbs./acre ball clover

Comments: Excellent temporary cover. Although these three grains have similar maturation dates, oats tend to grow faster in the early growing season and produce seeds that deteriorate quickly during the summer. Winter wheat has slower growth rates initially, increasing growth rates when nearing maturity and seeds that persist longer after maturity. Cereal rye is more cold-tolerant. Make sure to use cereal rye rather than ryegrass. Often various clovers are added to these grains to extend vegetative cover, provide additional wildlife benefit and allow some persistence until the natural vegetation on the site becomes established. Table 3 (page 9) offers some vegetative features of various clover species. Shade tolerance, re-seeding capabilities, whether perennial or annual, and trafficability (roads) are common factors in selecting a clover to add to the cool-season grain. White clovers are often chosen for its longevity (perennial), trafficability and shade tolerance, where red and crimson clovers are shorter-lived with less trafficability.

2. Warm-season mixture, annual

Seed material: Buckwheat and millets (usually browntop or foxtail or in combination)

Time of application: Mid-April – June

Application rate: 20 lbs./acre buckwheat; 15 lbs./acre millet

Comments: Best option when seeding during the summer months. Seed can be easily top-sown. Both buckwheat and millets germinate and grow quickly with favorable weather and soil moisture.

Variations: Buckwheat, though an annual with a wide range of planting dates during the summer, reseeds vigorously. With earlier planting dates, buckwheat can reseed at least two times. Buckwheat plantings in April or early May will produce seed within 60 days in July and August; seed planted in mid- to late June will mature in August and September. Maturation of millets varies from 60 to 80 days.

3. Native warm-season mixtures, perennials

Seed material: Switchgrass, Indiangrass, big bluestem, little bluestem.

Time of application: April – Mid-June

Application Rate: 8-10 lbs./acre PLS (individual species or mixtures)

Example: 3 lbs./acre big bluestem, 3 lbs./acre little bluestem, 3 lbs./acre Indiangrass (calculation of Pure Live Seed (PLS) is imperative for native, warm-season grass plantings)

Comments: These native species are long-lived, deep-rooted, tolerant of drought and low fertility. If native grass species are desired, use only on log landings or other areas with level ground that have full sunlight. These grasses require a good seedbed, care in seeding (usually drilled and should not exceed a depth of ¼ inch), and take a year or more to establish. Do not use in highly erosive areas since these grasses take at least a year and probably more to establish, thus revegetating log landings is the prime application. These grasses will not thrive in shady areas. Native forbs from the seed bank are encouraged in warm-season grass plantings. Sideoats grama and partridge pea could be added to the seed mixture, if desired. Native warm-season grasses are not a substitute for wildlife food plots. These bunch grasses provide nesting and escape cover structure with little nutritive value for wildlife. The seeds are sometimes difficult to find and more expensive than other options. To be successful in establishing native warm-season grasses, seedbed preparation is essential to loosen compacted soils on log landings. Prescribed burning of planted areas is commonly conducted after establishment to maintain stand health and enhance wildlife habitat quality.

4. Cool-season mixtures, perennials

Seed material: Kentucky 31 tall fescue, perennial clover(s) and cereal grain (nurse crop)

Time of application: February – April; Mid-August – Mid-October

Application rate: 20 lbs./acre tall fescue, 2 lbs./acre white clover, 30 lbs./acre wheat or oats

Comments: With adequate moisture, fescue seed germinates quickly and provides cover to abate raindrop erosion within two or three weeks. Exposed soils are stabilized until the resident vegetation and seedbank become established within 12 to 18 months, eventually shading the fescue, and causing it to dissipate. Even though non-native and not beneficial to wildlife, fescue is recommended to quickly stabilize exposed, erosive slopes because of its ease of establishment, minimal site preparation, availability, lower cost and hardiness during droughts. Fescue requires full sunlight for survival and growth. Once the resident, natural vegetation is established, fescue is easily shaded, diminishes and eventually dies. On level areas, where erosion does not occur, the cool-season mixture with native vegetation should be employed which has greater benefit to wildlife. However, on highly erodible slopes, fescue is a tested and low-cost alternative cover to control erosion until the colonization of the natural vegetation.

5. Seed mixtures for wet or poorly drained areas (wetlands and bottomlands), perennial and annual

Seed material: Berseem clover (annual), alsike clover (perennial), ladino white clover (perennial) and cereal grain (nurse crop)

Time of application: Mid-August – Mid-October

Application rate: 7 lbs./acre berseem, 3 lbs./acre alsike, 2 lbs./acre ladino white, 30 lbs./acre wheat or oats

Comments: Wet soils in wetland/bottomland systems are difficult to plant until the late summer and early fall due to less rainfall (and flooding) and drier soils, thus the narrow range of planting dates. These clovers tolerate poor drainage. Berseem clover is an annual that germinates and grows quickly, is not shade-tolerant, does not tolerate cooler temperatures and reseeds poorly. Alsike and ladino white clovers are perennials and become more prominent the next year once the berseem clover succumbs. These perennial clovers do tolerate some shade. Most bottomland systems are highly productive and prolific, revegetating from the residual seedbank and flora quickly after a disturbance or harvest. Bottomlands are disturbed often at intermittent intervals by water and flooding. Usually, revegetation is not necessary unless erosion potential is apparent from the harvest, for example, at approaches to stream crossings or rutting of wet soils causing a water conveyance to a stream. Birdsfoot trefoil (perennial, 4-6 lbs./acre) can also be added to this mixture, if desired.

DETERMINING PURE LIVE SEED (PLS) TO APPLY (reference tag on seed bag):

1. Multiply percent germination by percent purity.

2. Divide the result into pounds of seed per acre to obtain the amount of bulk seed needed.

Example: Winter wheat has 92 percent purity and 85 percent germination. To seed 35 lbs./acre ---- 0.92 purity x 0.85 germination = 0.78. Then divide 35 lbs./acre by 0.78 = 44.9 pounds of seed required per acre.

SUMMARY

The primary consideration with revegetating areas disturbed by logging is to establish cover quickly and efficiently. The critical phase of potential erosion occurs during the year following the disturbance. Re-vegetation may serve other purposes than preventing erosion such as providing wildlife habitat. These uses are secondary to erosion prevention and protecting water quality and should be done only when there is no impact on erosion control.

Seeding roads, skid trails and log landings reduce erosion and water pollution. Landowner surveys suggest greater satisfaction with the harvesting operations when roads, trails and landings are revegetated. The “green” appearance of these areas displays that the operator has taken care to control erosion and to ensure that the harvested site is left in a sound environmental condition.

Revegetation minimizes raindrop erosion and the green vegetation results in a gratifying view during the winter season. *Photo credit Wayne Clatterbuck.*

Lack of BMPs and vegetation establishment can quickly lead to excessive soil erosion following logging operations. *Photo credit Wayne Clatterbuck.*

Table 2. Planting information for various herbaceous species.

Species	Seeding rate (lbs./ac.)	Planting date	Optimum seeding depth (in.)	Comments
Cool-season grasses				
Oats (annual)	100-150	Aug 15-Oct 15; Feb 15-Mar 15	1-2	Sandy loam to clay; well-drained
Cereal Rye (annual)	100-150	Aug 15-Oct 15	1-2	Sandy loam to clay; well-drained
Wheat (annual)	100-150	Aug 15-Oct 15	1-2	Light-textured soils; not in poorly drained or heavy clay
Ryegrass (annual)	20-30	Aug 15-Oct 15; Feb 20-Apr 1	1/4-1/2	Sandy loam to clay; well-drained
Ryegrass (perennial)	20-30	Aug 15-Oct 15	1/4-1/2	Sandy loam to clay; well-drained
Tall Fescue (perennial)	15-20	Aug 15-Oct 1; Feb 1-May 1	1/4-1/2	Widely adapted; moderate trafficability
Warm-season grasses				
Grain sorghum (annual)	8	Apr 15-June 15	1	Widely adapted, well-drained soils; moderate fertility requirements
Browntop millet (annual)	25	Apr 15-July 15	1/4-1/2	Well-drained soils; moderate fertility requirements
Foxtail millet (annual)	25	Apr 15-June 15	1/4-1/2	Well-drained soils; moderate fertility requirements
Proso millet (annual)	30	Apr 15-June 15	1/4-1/2	Well-drained soils; tolerates dry sites; moderate fertility requirements
Bermudagrass (perennial)	5-8	Apr 15-July 1	1/4	Well-drained soils; moderate fertility requirements; high trafficability
Little Bluestem (perennial)	8-10 PLS*	Apr 15-June 1	1/4	Native species; slow to establish; good wildlife cover; well-drained soils; drought tolerant
Big Bluestem (perennial)	8-10 PLS*	Apr 15-June 1	1/4	Native species; slow to establish; good wildlife cover; well-drained soils; drought tolerant
Indiangrass (perennial)	8-10 PLS*	Apr 15-June 1	1/4	Native species; slow to establish; good wildlife cover; well-drained soils; drought tolerant
Switchgrass (perennial)	5-8 PLS*	Apr 15-June 1	1/4	Native species; slow to establish; good wildlife cover; widely adapted
Cool-season legumes and other forbs				
Alsike clover (perennial)	6-10	Aug 15-Oct 15; Feb 15-May 1	1/4	Adapted to cool climate; tolerates wet bottomland soils
Arrowleaf clover (annual)	6-10	Aug 15-Oct 15	1/4	Fertile, well-drained sandy loams and light clay; good re-seeder
Balansa clover (annual)	8	Aug 15-Oct 15	1/4	Grows on wide range of soils, including wet bottoms
Ball clover (annual)	6	Aug 15-Oct 15	1/4	Sandy loams and clay loams; tolerates poor drainage and relatively low fertility; good re-seeder
Berseem clover (annual)	20	Aug 15-Oct 15	1/4	Tolerates poor drainage; high fertility requirements; not cold tolerant, but winter hardy variety available; poor re-seeder; not shade tolerant
Crimson clover (annual)	20-25	Aug 15-Oct 15	1/4	Well-drained sandy loams to heavy clays; moderately shade tolerant, but winter hardy variety available; good re-seeder

Species	Seeding rate (lbs./ac.)	Planting date	Optimum seeding depth (in.)	Comments
Cool-season legumes and other forbs, continued				
Red clover (biennial)	10	Aug 15-Oct 15; Feb 15-May 1	1/4	Sandy loam to clay; wide range of moisture regimes; fairly drought tolerant
Rose clover (annual)	20	Aug 15-Oct 15	1/4	Well drained sandy loam to clay; tolerant to low soil fertility and drought; good re-seeder
Subterranean clover (annual)	25	Aug 15-Oct 15	1/4	Sandy loam to clay; moderately shade tolerant; tolerates both dry and moist sites as well as low fertility; fair re-seeder
White clover (including ladino and intermediate) clover (perennial)	6	Aug 15-Oct 15; Feb 15-May 1	1/4	Sandy loam to clay; moderate fertility requirements; mildly shade tolerant; tolerant to poor drainage
Austrian winter pea (annual)	50	Aug 15-Oct 15	1-2	Loam to heavy clay; moderate fertility requirements
Birdsfoot trefoil (perennial)	10	Aug 15-Oct 15; Feb 15-May 1	1/4	Widely adapted; moderately tolerant to drought and poor soil drainage
Radish (cool-season biennial)	10-12	Aug 1-Oct 15	1/2-1	Widely adapted; does not tolerate wet soils
Rape and kale (cool-season annual)	6-8	Aug 1-Oct 15	1/2-1	Widely adapted; high fertility requirements
Turnip (cool-season biennial)	3-6	Aug 1-Oct 15	1/4	Widely adapted; high fertility requirements
Warm-season legumes and other forbs				
Alyceclover (annual)	20	Apr 1-June 15	1/4	Sandy loam to clay
American jointvetch (annual)	20	Apr 1-June 15	1/4-1	Sandy loam to clay
Korean lespedeza (annual)	15	Feb 15-June 15	1/2-1	Widely adapted; tolerates relatively low fertility; not wet soils
Partridge pea (annual)	1-4	Feb 15-June 15	1/2-1	Sandy loam to clay
Buckwheat (warm-season annual)	40	Apr 15-Aug 15	1/2-1	Widely adapted; tolerates relatively low fertility
Chicory (cool-season perennial)	10	Aug 15-Oct 15; Mar 1-May 1	1/4	Widely adapted; drought tolerant

*PLS = % pure live seed = % GERMINATION x % PURITY. This information is found on seed tags. All seeding rates are based on PLS.

*When planting legume seed use pre-inoculated seed or inoculate raw seed prior to planting.

*Seeding rates in this chart are for a single-species broadcast planting. When planting mixtures, the seeding rate for each species included should be reduced according to the number of species in the mixture and the percent of each species desired in the mixture.

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Table 3. Characteristics of common clovers (legumes) for planting in Tennessee[1]

Clover species	Lifespan	Planting date	Shade tolerance	Re-seeding	Comments
Alsike	Perennial	Aug 15-Oct. 15	Poor	Fair	Intolerant to cold and drought, tolerates wet soils and spring flooding
Arrowleaf	Annual	Feb 15-May 1 Aug 15-Oct. 15	Poor	Good	Drought-hardy, tall, traffic tolerance is poor
Berseem/ Egyptian	Annual	Aug 15-Oct. 15	Mild	Poor	Intolerant to cold, tolerates wet soils and heat
Crimson	Annual	Aug 15-Oct. 15	Good	Good	Traffic, cold/heat, drought, dry/wet tolerances all moderate
Red	Biennial	Aug 15-Oct. 15 Feb 15-May 1	Good	Good	Fairly drought tolerant, wide range of moisture and temperature regimes, fair traffic tolerance, persistent for 2-3 years
White/Ladino	Perennial	Aug 15-Oct. 15 Feb 15-May 1	Mild	Fair	Persists on roads, tolerant of poor drainage, intolerant to drought

[1]References:

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