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Interseeding Clover and Legumes in Grass Sod

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Adding legumes to grass pastures and hay fields offers many benefits to forage system sustainability. Legumes in grass pastures improve animal performance, increase nutritional quality of hay and pasture, extend grazing seasons and reduce the need for nitrogen fertilizer. In a recent survey (2011), over 40 percent of Arkansas producers reported having added clover to pastures within the past five years and over 25 percent planted clover in fescue pastures to reduce fescue toxicity in their livestock.

Commonly planted legumes adapted to Arkansas include annual and perennial clovers (e.g., red, white, crimson and arrowleaf), alfalfa, annual lespedeza, hairy vetch, winter peas and others. Recommended seeding rates are shown in Table 1. Legumes are not as tolerant of poor growing conditions or overgrazing as fescue and bermudagrass, so good management must be used to establish and maintain legume stands. More information on characteristics of specific legume species can be found in FSA2117, *Forage Clovers for Arkansas*.

Basic Steps for Planting Legumes

Site selection is important for maintaining good legume stands. Avoid shallow, droughty soils and sites with very low soil fertility or heavy weed infestation. Several methods can be used to successfully establish legumes into a grass sod. The basic steps for success of any method include:

1. Establishing adequate soil pH and fertility
2. Controlling weeds prior to and after planting
3. Removing the grass canopy and excess residue before planting
4. Calibrating planting equipment for correct seeding rate
5. Providing good seed-to-soil contact during planting
6. Planting at the correct depth
7. Controlling the grass canopy after planting to reduce competition

Table 1. Recommended seeding rates for legumes commonly planted into pastures and hayfields.

Annual Legumes	**Seeding Rate (lbs per acre)**
Annual lespedeza (*Kummerowia stipulacea* and *K. striata*)	15-20
Arrowleaf clover (*Trifolium vesiculosum* Savi)	8-10
Crimson clover (*Trifolium incarnatum* L.)	15-20
Hairy vetch (*Vicia villosa* Roth)	15-20
Subterranean clover (*Trifolium subterraneum* L.)	12-15
Winter peas (*Pisum sativum* L.)	20-30
Perennial Legumes	**Seeding Rate (lbs per acre)**
Alfalfa (*Medicago sativa* L.)	20-25
Red clover (*Trifolium pretense* L.)	10-12
White clover (*Trifolium repens* L.)	2-3

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8. Using proper grazing or hay harvest to allow legume persistence

Conversely, the most common reasons for unsuccessful legume establishment include excessive grass residue at planting time, poor weed control, low soil fertility, planting too deep, poor seed-to-soil contact, planting too late in fall or spring, causing excess grass competition by applying nitrogen fertilizer or litter and overgrazing.

Field Preparation

Fields should be clipped or grazed as closely as possible to remove the grass canopy and excess thatch before planting. In heavy grass residue, no-till drills perform poorly and broadcast seed will not reach the soil surface. A closely grazed grass stubble of two inches or less is ideal.

Good clover stands can be established with a no-till drill (Figure 1) or by broadcast seeding (Figure 2). Research at the Livestock and Forestry Research Station near Batesville showed no difference in stand counts between no-till or broadcast methods for establishing white clover.

No-till drills should be calibrated and set to plant the seed an average depth of ¼ inch but no more than ½ inch deep. Note that the depth of cut into the sod by the drill's disk openers sets the depth of seed placement. Shallow planting is far more successful for legume establishment than deep planting. Good success is often achieved by adjusting the disk openers to barely cut the sod and adjusting more down-pressure on the following press wheels. This allows the seed to drop to the soil surface and be firmed into the soil surface by the press wheels.

Figure 1. Planting clover with a no-till drill into closely grazed fescue sod in late February.

Figure 2. Planting clover with a broadcast seeder and ATV followed by a tire drag on a closely grazed fescue sod in late February.

When planting with a broadcast planter, roughing up the short sod by pulling a harrow, tire drag or even a cedar tree across the field exposes soil and improves legume establishment (Figure 2). Seeds that drop onto a slightly loosened soil surface will become anchored in place by action of frost or rain. Well-anchored seeds have a higher chance of forming established seedlings than seeds lying in thatch or on a hard soil surface. During germination, the seed must be well-anchored for the emerging root to penetrate the soil. If the seed is not well-anchored, the growing root pushes the seed away from the soil surface, leaving both the seed and root exposed. This reduces seedling survival and causes poor stand establishment.

Planting Legumes in Fescue and Other Cool-Season Grasses

Legumes can be planted into fescue and cool-season grass sods during fall or in late winter. Planting in late winter (February to early March) is sometimes called "frost-seeding" because freezing and thawing of soil helps work the legume seed into the soil surface. The fescue is usually grazed very short during winter so the small legume seed can reach the soil surface.

An effective method also is to overseed legumes after stockpiled fescue has been completely grazed in late winter. Fall planting, late September to mid-October, can be successful if the fescue is grazed short (2- to 3-inch stubble). Fescue can produce heavy growth in fall, making it competitive for soil moisture during dry fall seasons.

Planting Legumes in Bermudagrass or Bahiagrass

Fall (late September to mid-October) is the preferred season for planting legumes into bermudagrass or bahiagrass sod. The reason is that warm-season grasses start to go dormant in fall when night temperatures drop below 60°F and they are not competitive with the legume seedlings. Planting during this period allows enough time for adequate seedling development before onset of cold weather. Fall establishment also allows the legume to have a developed root system for rapid growth in spring before warm-season grasses become competitive. Clipping or grazing the sod to a 2-inch stubble height before planting improves establishment success.

Winter annual legumes are commonly grown in bermudagrass and bahiagrass pastures to provide forage in spring before the warm-season grasses become productive. Typical winter annual species include crimson clover, arrowleaf clover and hairy vetch. Winter annual legumes should be planted in fall for best results. Dry matter yield of winter annual legumes planted in February is lower and the production is typically delayed compared to fall plantings.

Planting Strategies

Legumes are usually solid-seeded, meaning that the entire field is planted. Success is variable, with establishment ranging from 0 to near 100 percent of field coverage, depending on factors already discussed. For perennial legumes, such as red and white clover, establishment rate is often 25 to 30 percent of the pasture.

Two alternative planting strategies for white clover called "strip-seeding" and "stripe-seeding" have been developed. These methods may improve establishment success and reduce planting costs.

For strip-seeding, white clover is planted in strips over an area equivalent to 25 percent of the field (see FSA2159, *Strip-Seeding Strategy for Establishing Clover in Pastures*). The seeding rate is increased over the recommended rate. For example, the typical recommended seeding rate for white clover is 2 pounds per acre. If the same total amount of seed is planted in wide strips (50 to 60 feet wide) over 5 percent of the field, the effective seeding rate is 8 pounds per acre in those strips. This helps ensure good establishment of clover, and then natural vegetative growth and seed dispersal by grazing livestock help spread clover into the unplanted areas of the field. This method reduces machine and fuel costs by 75 percent over solid-seeding.

A newer approach called "stripe-seeding" is to plant white clover in even narrower strips. The clover stripe is 10 feet wide and is alternated across the field with a 30-foot-wide unplanted space. As with strip-seeding, a high seeding rate is used within the stripes because only 25 percent of the field is planted. The closer spacing of the clover stripes enhances grazing uniformity and distribution of clover in the field because there is less distance between clover stripes than for the strip-seeding method. Both alternative methods reduce machine and fuel costs and may be useful under certain conditions.

Weed Control for Establishing Legumes

Weed control in mixed grass/legume pastures is a common concern. Reducing the reservoir of weed seeds in the soil before planting legumes should be of primary focus since few options are available for controlling weeds once legumes are established in pastures.

Several good herbicides and management practices can be used to reduce weed populations in grass pastures prior to planting legumes. Heavy grazing pressure may reduce growth of certain weeds, but some may survive to produce even more seed.

Long-term prevention of weed seed production will help reduce the weed seed bank in the soil. A combination of good soil fertility, well-timed herbicide application and good grazing management is the most effective weed control program.

Legumes can be planted after adequate weed control is achieved. For herbicide options for controlling weeds in pastures, refer to MP44, *Recommended Chemicals for Weed and Brush Control*.

Soil Fertility

Adequate soil fertility is necessary for good root growth and stand persistence. Nitrogen fertilizer is not needed for establishing legumes in grass sods. Nitrogen fertilizer or animal manure will stimulate growth of the grass sod which will out-compete developing legume seedlings.

Soil test phosphorus levels should be 75 to 100 pounds per acre and soil test potassium levels should be 260 to 350 pounds per acre. Recommended soil pH for legumes is 6.2 or higher. Lime may take up to a year to increase soil pH. Soil tests should be made 6 to 12 months in advance of planting to allow time for correction of serious fertility deficiencies. To get fertilizer and lime recommendations for overseeding legumes, ask for **soil test code #116, "Legumes Over-seeded into Grass Sod,"** when submitting soil samples to the county Extension office.

Legume seed should be inoculated with the correct strain of rhizobia bacteria for nitrogen fixation to occur. Many newer legume varieties are sold pre-inoculated with a seed coating containing rhizobia bacteria, fungicide to control seedling disease and germination-enhancing amendments. Seed of older legume varieties are often sold without preinoculation or seed coating so inoculation with fresh rhizobia bacteria is required.

Different legume species require different rhizobia inoculants. For example, the same inoculant for white clover will not work for arrowleaf clover. Most seed vendors can obtain the correct rhizobia strain for each legume species. For detailed information about legume seed inoculation, refer to FSA2035, *Forage Legume Inoculation*.

The rhizobia bacteria that are responsible for nitrogen fixation require a higher soil pH than the legume plant. It is not uncommon for clover stands to establish initially in low fertility pastures but then fade away quickly because the soil pH was too low for both the clover and rhizobia bacteria to survive.

Management After Planting

After legumes have been planted, pastures should be grazed early in spring to reduce grass competition while the clover seedlings are emerging. It is recommended to continue grazing the grass canopy until the legume plants begin to emerge to control competition from the grass and allow more sunlight to reach the new seedlings.

As new seedlings emerge, remove livestock until the legumes reach sufficient size for grazing or hay harvest. Sufficient size of the legume will vary with species and intended use of the legume. If the legume is being used for grazing, turn-in livestock when the legume is about 6 to 10 inches in height and remove the livestock when it has been grazed down to 3 inches. Rotational grazing will allow for more total yield produced over the growing season and will aid in maintaining the stand. However, if using arrowleaf, crimson or red clover for hay, the legume should be harvested at early bloom to achieve optimum quality. White clover should be harvested at the correct stage of production for the companion grass.

Summary

Basic steps for successful interseeding of legumes into grass sod and a suggested timeline for each are shown in Table 2.

Table 2. Suggested timeline of practices for successful legume establishment in grass sod.

Suggested Timeline	Management Practice
6 to 12 months prior to planting	Assess weed pressure and weed species. Start controlling any weed problems in the field where legumes will be planted. Preventing weeds from producing seed to reduce the seed bank in the soil is important. Few good herbicide options are available for controlling weeds in seedling legume stands, so control prior to planting is recommended.
6 to 12 months prior to planting	Soil-test the field and apply lime and begin major fertility adjustments as needed. Request **crop code #116, "Legumes Over-seeded into Grass Sod,"** for the proper fertilizer and lime recommendation. Most legumes require higher soil pH and fertility than grasses. Low fertility is a common cause of poor legume stands.
6 to 12 months prior to planting	Select a legume species compatible with the forage and livestock operation and plan the time frame for planting. For fescue sod, plant in fall or late winter. For bermudagrass sod, late September through late October is preferred. Plant winter annual legumes in fall.
2 to 3 months prior to planting	Work with the local agricultural supplier to ensure seed of the desired legume species and variety, as well as the correct strain of rhizobia inoculant, is on hand at planting time.
1 month to 1 week prior to planting	Graze or clip grass to leave a sod stubble height of 2 inches on the day of planting. Planting into excessive grass residue and thatch results in poor legume establishment.
1 month to 1 week prior to planting	Select the planter to be used, make repairs and calibrate for the proper seeding rate. **If using rented planting equipment, plan time to clean it from prior users and to get it in working order.** Seed can be broadcast planted after dragging or harrowing fields or can be no-till drilled.
Day of planting	Finish planter calibration and set it to plant at the proper depth. For small-seeded clovers, plant at an average depth of ¼". **The most common cause of stand failure is planting too deep.**
After planting	Graze the grass canopy until the legumes begin emerging to control competition from the sod and allow more sunlight to reach the new seedlings. Then remove livestock until the legumes reach sufficient size for grazing or hay harvest.
For stand maintenance	Rotationally graze and fertilize as recommended for the legume.

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