

INTRODUCTION

This fact sheet provides instructions for planting and maintaining pasture, hay, and biomass grasses and/or legumes so they can serve their intended purpose. Using proper planting and management techniques, especially during the establishment years, will significantly improve plant health, reduce weed problems, and increase the likelihood of success.

SPECIES SELECTION

Start planning for new plantings at least six months before the planting season to allow sufficient time for soil tests, soil pH adjustment, and other site preparation that may be needed. Consider using cool-season species in some fields and warm-season species in others to take advantage of the entire growing season and to improve the availability of forage.

For pasture or hay production, the use of cool-season grass and legume mixes, instead of cool-season grass-only stands, is generally recommended. Mixes with legumes have multiple benefits including a reduced need for nitrogen fertilizer; improved forage quality, palatability and digestibility; winter frost heaving protection for legumes; and better stand longevity and productivity. Simple mixes of one grass plus one or two legumes are preferred because they are easier to manage than more complex mixes.

Use a single grass or legume species for sites with persistent weed problems that require the use of herbicides and for sites where biomass harvest is planned.

Warm-season grasses are generally easier to manage as single-species plantings. Indiangrass and big bluestem are the exception. They have similar maturity dates and can be planted as a mix. For warm-season grasses, it's especially important to base the seeding rate on the amount of Pure Live Seed (PLS). $PLS = (\text{purity} \times \text{germination})/100$. PLS is important because most warm-season grass seed tends to be significantly lower in purity and germination than the seed of cool-season grasses.

Use certified seed for all plantings. Before planting, inoculate legumes with the appropriate *Rhizobium* bacteria, as noted in Table 1. Use planter box treatment



or pre-inoculated seed and follow appropriate storage requirements.

Table 1. Inoculant groups and *Rhizobium* species for legumes.

Legume Group	Inoculant Group*	Rhizobium Species
Alfalfa and sweet clover	A	<i>R. meliloti</i>
True clovers	B	<i>R. trifolii</i>
Peas and true vetches	C	<i>R. leguminosarum</i>
Soybeans	S	<i>R. japonicum</i>
Birdsfoot trefoil	K	<i>R. loti</i>

*Letters indicate the manufacturer's reference to cross-inoculation groups.

Consider animal health issues associated with livestock consumption of some plant species. Concerns include fescue toxicosis due to endophyte infection of some varieties of tall fescue, bloat associated with alfalfa and clovers, and the "slobbers" (excessive salivation) due to a fungus that primarily infects red clover but may also infect other legumes.

Additional livestock health concerns are nitrate poisoning and prussic acid (hydrogen cyanide) poisoning associated primarily with sudangrass, sorghum, and sudan-sorghum hybrids, and also with

Land owners and managers please note: If you receive financial assistance for your planting, be sure to check with your funding agency/organization for specific maintenance or management requirements.

other plants, depending on environmental and management factors. Alsike clover poisoning is known to occur in horses (and occasionally in cattle), resulting in photodermatitis and long-term liver damage. For this reason, alsike clover should not be planted where pastures and hay will be used by horses.

If wildlife and/or pollinator habitat is desired, consider using plant species and management techniques that will provide food and cover for the desired species.

Contact your local NRCS Service Center or University of Delaware Extension office for recommendations concerning which species and varieties are best suited for your site and the planned use of the planting.

SITE PREPARATION AND PLANTING

Lime and Fertilizer

Use a current soil test for the planting site to determine the need for adjusting soil pH and nutrient levels, based on the requirements of the species to be seeded. Most cool-season grasses prefer a pH of 5.5 and above. If legumes are included in the planting, a pH of at least 6.0 is desirable. Warm-season grasses are much more tolerant of poor site conditions than most cool-season grasses or legumes. It is usually not necessary to add lime to warm-season grass plantings, provided the soil pH is 5.0 or above.

If soil pH adjustment is necessary, apply lime well before planting to allow sufficient time for soil reaction. Soil-incorporated lime requires application three to six months before planting. Surface-applied lime may need more than six months' reaction time.

If soil nutrient levels need adjustment, apply soil amendments such as animal manure or commercial fertilizer, and allow sufficient time before planting for soil reaction. Organic nutrient sources such as manure may require six months to a year to adjust soil fertility adequately.

The use of commercial fertilizer and other forms of plant nutrients must be in compliance with Delaware nutrient management regulations, as applicable. For additional information, consult with your local NRCS Service Center or certified nutrient management consultant.

Do not apply nitrogen to warm-season grasses at the time of planting. Apply phosphorus (P) and/or potassium (K) only if soil test results indicate that P and/or K levels are in the low range.

Controlling Competing Vegetation

Before planting, it is essential to reduce competition from other vegetation that may be present on the planting site, such as undesirable grasses or weeds. The

type and density of the existing vegetation will determine how much pre-planting control is needed.

It's important to allow adequate time to complete this process. If significant quantities of noxious, aggressive, or invasive plants are present, be aware that you may need a year or two to control them before you can plant, especially if you will be planting a large area. Noxious weeds — johnsongrass, Canada thistle, burcucumber, giant ragweed, Texas panicum, and Palmer amaranth — must be controlled as required by Delaware state law.

Seeding New Pastures and Hay Fields

Establishment of pasture and hay in former cropland fields or other lands can be accomplished using conventional tillage, reduced tillage, or no-till methods. The critical aspect of each method is to prepare an environment that is conducive to seedling establishment and growth. The seedbed must be firm, not fluffy and loose. If tillage is performed, it must be followed by packing with a rolling packer or similar type implement before seeding. Competition from weeds must be controlled through the use of tillage and/or herbicides. Herbicide carryover from previous crops, which could impair establishment of new seedlings, should also be considered.

A cultipacker-seeded or a no-till drill may be appropriate for planting. The implement used must be designed for seeding the types of grasses or legumes that will be planted. Seeding depth and placement must be accurate to ensure seedling survival. On a conventionally prepared seedbed, using a cultipacker-seeder that distributes seed evenly (versus in rows) and incorporates seed at a uniform depth generally will produce a more uniform and dense stand that is preferred for grazing. Where erosion control and weed management are concerns, using a no-till drill without cultivation is preferred because soil disturbance is minimized. It is essential that no-till seeding be done in two perpendicular directions to provide a denser stand similar to a broadcast seeding, but with good depth control.

A nurse crop of small grain (preferably oats) may be used on sites where erosion during the establishment period is a concern. The nurse crop should be planted at a rate no greater than $\frac{3}{4}$ of a bushel per acre, and should be harvested mechanically or by pasturing during the vegetative growth stage to limit competition with seedlings.

For more information about planting grasses and grass-legume mixes, refer to the Delaware NRCS fact sheets *Warm-Season Grasses* and *Cool-Season Grasses*, as appropriate.

Renovation of Existing Pastures and Hay Fields

Introduction of desirable species into an existing pasture or hay field can be accomplished in several ways. The type of seeding equipment and the site preparation required are dependent on the species presently in the stand and the species to be introduced. As described for new plantings, site preparation and seeding for renovations can be carried out by using conventional tillage, reduced tillage, or no-till methods.

Legumes. Legume introduction into cool-season grasses can be accomplished by using no-till drilling or frost seeding. Prior to any seeding, the existing vegetation must be suppressed by heavy grazing, mowing, or herbicide treatment. For successful frost seeding, the seed must reach the soil to germinate. Approximately 30 to 40% bare soil must be exposed for successful frost seeding. After legume germination, the stand should be managed to reduce competition from existing grasses and allow legumes to become well-established. Rotational grazing can be used to remove top growth from grasses and open the canopy to provide sunlight for the legume seedlings.

Seeding of alfalfa into a stand containing alfalfa is not recommended, due primarily to the presence of autotoxic compounds produced by older alfalfa plants that inhibit the growth of young seedlings.

Cool-season grasses. Only a low percentage of cool-season grass seedlings will survive if grass seed is planted into an existing stand. In most cases, mechanically and/or chemically killing the existing vegetation will need to be done. Interseeding may be considered only if there is almost no competition with existing grasses or weeds. Frost seeding grasses is generally not a successful method for improving existing grass stands.

On fields where endophyte-infected stands of tall fescue currently exist, the fescue will need to be completely removed. One herbicide treatment or tillage operation usually will not eradicate established fescue. It is generally recommended that tall fescue fields be treated with herbicide or tillage, planted to an annual forage or grain crop, treated again with herbicide or tillage to kill any remaining fescue, and then planted to the desired species.

For more information about establishing cool-season grasses on sites with existing vegetation, refer to the Delaware NRCS fact sheet *Cool-Season Grasses*.

Warm-season grasses. Conversion of a cool-season grass stand to a warm-season stand also requires a total eradication program. Warm-season grasses cannot compete with established cool-season grasses. For more information about establishing warm-season grasses on sites with existing vegetation, refer to the Delaware NRCS fact sheet *Warm-Season Grasses*.

ESTABLISHING AND MAINTAINING THE PLANTING

Proper management of forage seedings is essential to the establishment and longevity of a pasture or hay planting. Management practices, including mowing, grazing, and herbicide treatment, may be necessary to reduce competition from established forage species and/or undesirable competitive species. Cool-season species are usually fully established by the summer of the second growing season. Warm-season grasses generally take two to three full seasons to become fully established.

The first harvest from a new pasture or hay planting should be completed at the correct height or growth stage, which is species-specific and seasonally variable. For more information about managing grasses and grass-legume mixes, refer to the Delaware NRCS fact sheets *Warm-Season Grasses* and *Cool-Season Grasses*.

Your local NRCS Service Center or Delaware Cooperative Extension office can also provide you with specific recommendations concerning management of your planting.

ADDITIONAL REFERENCES

Johnson, Quintin, Mark VanGessel, Richard W. Taylor. 2014. *Pasture and Hay Weed Management Guide*. Delaware Cooperative Extension, University of Delaware.

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Penn State Extension, College of Agricultural Sciences. *Forage Crops*.

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