

INTRODUCTION

This job sheet provides instructions for planting and maintaining pasture and hay 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

Grass-legume mixes, consisting of cool-season grasses mixed with one or two legumes, are usually recommended as compared to cool-season grass-only stands. 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 easier to manage and are generally preferred.

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

Use certified seed for all pasture and hay plantings. Legumes need to be inoculated with the appropriate *Rhizobium* bacteria before planting. Legume seeds can be purchased pre-inoculated, or the inoculant can be purchased separately and applied to the seed just before planting.

Warm-season grasses should be planted alone when the purpose is pasture or hay production. Indiangrass and big bluestem are the exception. They have similar maturity dates and can be planted as a mix for forage production. 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.

Contact your local NRCS Field Service Center or University of Maryland Extension office for recommendations concerning which species and



varieties are best suited for your site and the planned use of the forage.

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.

Land owners and managers please note: *If you will receive cost-sharing for your pasture or hay planting, be sure to check with your funding agency/organization for specific maintenance or management requirements.*

Remember that the use of commercial fertilizer and other forms of plant nutrients must be in compliance with Maryland nutrient management regulations, as applicable. For additional information, consult with your local University of Maryland Extension agent or certified nutrient management consultant.

Do not apply nitrogen to warm-season grasses at the time of planting. Apply phosphorus and/or potassium 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 or aggressive weeds 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. By state law, noxious weeds in Maryland are Johnsongrass, shattercane, Canada thistle, bull thistle, plumeless thistle, and musk thistle.

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, must also be considered.

Seed may be planted by using several types of implements. 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. Using an implement such as a cultipacker-seeder that distributes seed evenly (versus in rows) on a prepared seedbed and incorporates seed at a uniform depth generally will produce a more uniform and dense stand that is preferred for grazing. In most cases, because of concerns about erosion and weed management, a no-till drill is the best way to do a grass planting. It is essential that 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 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 Maryland NRCS jobsheets entitled "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 favor establishment of the legume. Height to begin grazing, to stop grazing, and the duration of grazing should be based on the growth of the legume.

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.

Seeding of cool-season grasses where an endophyte-infected stand of tall fescue currently exists requires total eradication of the existing fescue. 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.

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 Maryland NRCS jobsheet entitled "Warm-Season Grasses."

ESTABLISHING AND MAINTAINING THE PLANTING

Proper management of forage seedings is essential to the establishment and longevity of the 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 the new pasture or hay planting should be completed at the correct height or growth stage, which is species-specific and seasonally variable. The Maryland NRCS GLCI Pasture Stick provides details on proper grazing heights and is a convenient tool to use in the field.

For more information about managing grasses and grass-legume mixes, refer to the Maryland NRCS jobsheets entitled "Warm-Season Grasses" and "Cool-Season Grasses."

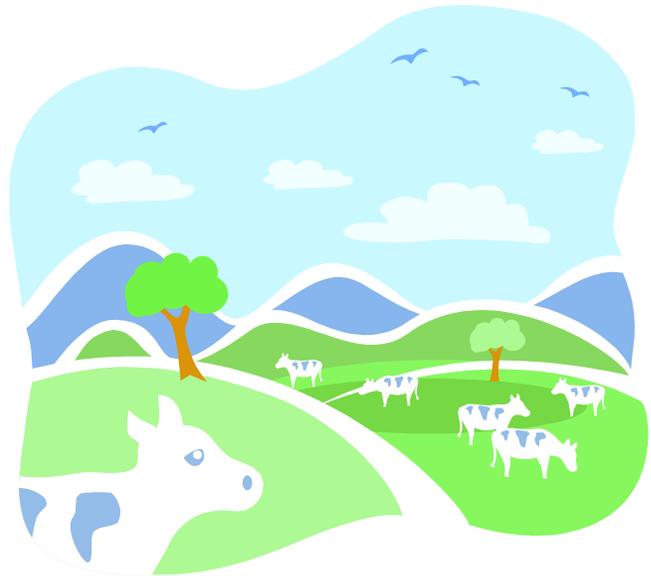
Your local NRCS Field Service Center or University of Maryland Extension office can also provide you with specific recommendations concerning management of your pasture or hay planting.

ADDITIONAL REFERENCES

Marvin Hall and Jerry Cherney. *Agronomy Facts 20-28*. Penn State University, College of Agricultural Sciences. This collection includes fact sheets for many of the commonly planted species of grasses and legumes. Available free on the Internet at <http://cropsoil.psu.edu/resources/pubindex.cfm>

R. David Myers. *Forage Production*. Fact Sheet 470, Maryland Cooperative Extension. This fact sheet includes forage recommendations that were developed specifically for Southern Maryland. Available free at <http://extension.umd.edu/publications/PDFs/FS470.pdf>

Penn State University,. *The Agronomy Guide*, College of Agricultural Sciences. This is an excellent, comprehensive reference for a wide variety of agronomic topics, including forage production. Available free on the Internet at <http://extension.psu.edu/agronomy-guide>



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TABLE 1a: Selected Mixes for Cool-Season Forage and Biomass Planting (<i>Piedmont and Western Maryland</i>) ^{1/}			
Mix	Seeding Rate ^{2/} (lbs/ac)		Remarks
	Pasture	Hay	
Grass-Legume Mixes			
<input type="checkbox"/> A. SELECT ONE GRASS: <input type="checkbox"/> Orchardgrass <i>Dactylis glomerata</i> <input type="checkbox"/> Tall fescue <i>Lolium arundinaceum</i> <input type="checkbox"/> Perennial ryegrass <i>Lolium perenne</i> <input type="checkbox"/> Smooth brome grass <i>Bromus inermis</i> <input type="checkbox"/> Timothy <i>Phleum pretense</i> <input type="checkbox"/> AND ADD ONE LEGUME: <input type="checkbox"/> Alfalfa <i>Medicago sativa</i> <input type="checkbox"/> Birdsfoot trefoil <i>Lotus corniculatus</i> <input type="checkbox"/> Ladino clover <i>Trifolium repens</i> <input type="checkbox"/> Red clover <i>Trifolium pretense</i>	8 - 10 10 - 15 10 - 15 8 - 15 5 - 10	2 - 6 5 - 10 4 - 8 6 - 10 2 - 6	Use a low-endophyte or novel endophyte-infected variety of Tall fescue. Low-endophyte varieties are generally less persistent. Perennial ryegrass is useful for quick reseeding, high quality pasture, but is short-lived and is generally not recommended as the primary grass species. Smooth brome grass and Timothy are suitable for one-cut hay and less intensive pasturing. Use Alfalfa only on well-drained sites. Birdsfoot trefoil, Ladino clover, and Red clover can be planted on well- to poorly drained sites. If desired, both Ladino and Red clover can be used in the mix, but plant Ladino at half the rate listed. A fungus associated with red clover can cause livestock (especially horses) to slobber or drool excessively. When used in horse pastures, plant red clover at 50% of the specified rate if "slobbers" is a concern, or use a grass-only mix instead.
<input type="checkbox"/> B. USE TWO GRASSES: Tall fescue <i>Lolium arundinaceum</i> Kentucky bluegrass <i>Poa pratensis</i> <input type="checkbox"/> AND ADD Birdsfoot trefoil <i>Lotus corniculatus</i>	15 - 20 5 - 10 6 - 10	N/A	Especially good for moderately wet areas and horse pastures. "No bloat" mix.
<input type="checkbox"/> C. USE THREE GRASSES: Orchardgrass <i>Dactylis glomerata</i> Kentucky bluegrass <i>Poa pratensis</i> Perennial ryegrass <i>Lolium perenne</i> <input type="checkbox"/> AND ADD TWO LEGUMES Ladino clover <i>Trifolium repens</i> Red clover <i>Trifolium pretense</i>	5 - 10 4 - 6 4 - 6 1 - 2 2 - 4	N/A	Tall fescue (low-endophyte or novel endophyte-infected variety) can be substituted for Perennial ryegrass. For Red clover in horse pastures, see Remarks listed above for Mix A.
Grass Mix without Legumes			
<input type="checkbox"/> D. USE TWO GRASSES: Tall fescue <i>Lolium arundinaceum</i> Kentucky bluegrass <i>Poa pratensis</i>	15 - 20 5 - 10	N/A	For heavily grazed horse pastures or other loafing lots, use this mix with a <u>novel endophyte</u> variety of tall fescue. It will withstand abuse better than the endophyte - free varieties. Follow the tall fescue manufacturer's guidelines for establishment.

NOTES for TABLE 1a:

- 1. Selected Mixes:** These mixes have been selected based primarily on recommendations in Establishing Forage Stands (Chapter 7) in Forage Production for Pasture Based Livestock Production, NRAES-172. Due to page limitations, this list of mixes is not all-inclusive. There are many other combinations of grasses and/or legumes that may be suitable for pasture or hay, depending on site conditions and the producer's needs. All legume seeds shall be inoculated before planting with the appropriate *Rhizobium* bacteria.
- 2. Seeding Rates:** Whenever possible, optimize seed distribution by using a cultipacker-seeder. If drilling, it is recommended to split rates and apply seed twice, with the second pass going perpendicular across the first drill rows. If broadcast overseeding, increase the seeding rate by 50%, except for clovers.

TABLE 1b: Selected Mixes for Cool-Season Pasture and Hay Plantings (Eastern Shore and Southern Maryland)^{1/}

Mix	Seeding Rate ^{2/} (lbs/ac)		Site Suitability and Other Remarks
	Pasture	Hay	
Grass-Legume Mixes			
<input type="checkbox"/> A. SELECT ONE GRASS: <input type="checkbox"/> Orchardgrass <i>Dactylis glomerata</i> <input type="checkbox"/> Tall fescue <i>Lolium arundinaceum</i> <input type="checkbox"/> AND ADD ONE LEGUME: <input type="checkbox"/> Alfalfa <i>Medicago sativa</i> <input type="checkbox"/> Ladino clover <i>Trifolium repens</i> <input type="checkbox"/> Red clover <i>Trifolium pratense</i>	8 - 10 10 - 15	4 - 6 5 - 10 8 - 12 N/A 6 - 8	<p>Orchardgrass is not well adapted to the high summer temperatures of these regions and should not be planted on light, sandy or shallow, droughty soils.</p> <p>Use a low-endophyte or novel endophyte-infected variety of Tall fescue.</p> <p>Use Alfalfa only on well-drained sites. Birdsfoot trefoil, Ladino clover, and Red clover can be planted on well- to poorly drained sites. If desired, both Ladino and Red clover can be used in the mix; but plant Ladino at half the rate listed.</p> <p>A fungus associated with Red clover can cause livestock (especially horses) to slobber or drool excessively. When used in horse pastures, plant Red clover at only 1 - 2 lbs/ac if "slobbers" is a concern, or use a grass-only mix instead.</p>
<input type="checkbox"/> B. SELECT ONE GRASS: <input type="checkbox"/> Orchardgrass <i>Dactylis glomerata</i> <input type="checkbox"/> Tall fescue <i>Lolium arundinaceum</i> <input type="checkbox"/> AND ADD TWO LEGUMES: Korean lespedeza <i>K. stipulacea</i> Red clover <i>Trifolium pratense</i>	8 - 10 10- 15 10 - 15 4 - 6	N/A	<p>Orchardgrass is not well adapted to the high summer temperatures of these regions and should not be planted on light, sandy or shallow, droughty soils.</p> <p>This mix has a higher seeding rate for legumes and a lower rate for grass than the other mixes.</p> <p>Use a low-endophyte or novel endophyte-infected variety of Tall fescue.</p> <p>The Lespedeza component makes this an especially good mix for the Coastal Plain. Lespedeza is more heat-tolerant than most of the other legumes.</p>
Grass Mix without Legumes			
<input type="checkbox"/> C. USE TWO GRASSES: Kentucky bluegrass <i>Poa pratensis</i> Tall fescue <i>Lolium arundinaceum</i>	5 - 10 15 - 20	N/A	<p>For heavily grazed horse pastures or other loafing lots, use this mix with a novel endophyte variety of Tall fescue. It will withstand abuse better than the endophyte - free varieties. Follow the Tall fescue manufacturer's guidelines for establishment</p>

NOTES for TABLE 1b:

1. Selected Mixes: These mixes have been selected based primarily on recommendations in Establishing Forage Stands (Chapter 7) in Forage Production for Pasture Based Livestock Production, NRAES-172. Due to page limitations, this list of mixes is not all-inclusive. There are many other combinations of grasses and/or legumes that may be suitable for pasture or hay, depending on site conditions and the producer's needs.

All legume seeds shall be inoculated before planting with the appropriate *Rhizobium* bacteria.

2. Seeding Rates: Whenever possible, optimize seed distribution by using a cultipacker-seeder. If drilling, it is recommended to split rates and apply seed twice, with the second pass going perpendicular across the first drill rows. If broadcast overseeding, increase the seeding rate by 50%, except for clovers.

TABLE 2: Selected Species for Warm-Season Pasture and Hay Plantings				
Plant Species	Recommended Cultivar(s)	Seeding Rate (PLS lbs/ac) ^{1/}	Planting Implement and Seeding Depth	Remarks
<input type="checkbox"/> Bermudagrass ^{2/} <i>Cynodon dactylon</i>	Quickstand, Ozark, Tifton 44	20 bushels/acre, sprigged	Sprigger	Sod-forming. Good for rotational and continuous grazing. Highly palatable, moderately digestible. Matures late in the season. Good for hay and silage. Use Tifton 44 only south of I-70.
<input type="checkbox"/> Big bluestem <i>Andropogon gerardii</i>	Niagara	8 - 10	Warm-Season Grass Drill; 0.25 - 0.5 inch	Bunch grass, slow to establish. Highly palatable and digestible. Matures very late in the season. Good for rotational grazing, not for continuous grazing. Good for hay, not for silage.
<input type="checkbox"/> Caucasian bluestem <i>Bothriochloa bladhii</i> (<i>B. caucasica</i>)	Common	6 - 8	Warm-Season Grass Drill; 0.25 - 0.5 inch	Bunch grass, slow to establish. Highly palatable and digestible. Late maturing. Good for rotational grazing, not for continuous grazing. Good for hay, not for silage.
<input type="checkbox"/> Eastern gamagrass ^{3/} <i>Tripsacum dactyloides</i>	Pete, Iuka, PMK-24	10	Corn Planter; 0.75 - 1.0 inch	Bunch grass, slow to establish. Very highly palatable and highly digestible. Matures very late in the season. Good for rotational grazing, not for continuous grazing. Good for hay and silage.
<input type="checkbox"/> Indiangrass <i>Sorghastrum nutans</i>	Rumsey	8 - 10	Warm-Season Grass Drill; 0.25 - 0.5 inch	Bunch grass, slow to establish. Highly palatable and moderately digestible. Matures very late in the season. Good for rotational grazing, not for continuous grazing. Good for hay, not for silage.
<input type="checkbox"/> Little bluestem <i>Schizachyrium scoparium</i>	Blaze, Camper	7	Warm-Season Grass Drill; 0.25 - 0.5 inch	Bunch grass, slow to establish. Moderately palatable and digestible. Matures very late in the season. Fair for rotational grazing, not for continuous grazing. Poor for hay or silage.
<input type="checkbox"/> Switchgrass <i>Panicum virgatum</i>	<u>Lowland Ecotypes:</u> Cave-in-Rock, Kanlow <u>Upland Ecotypes:</u> Blackwell, Carthage	8 - 10	Conventional Grass Drill, or Broadcast and Cultipack; 0.25 - 0.5 inch	Bunch grass, slow to establish. Moderately palatable and highly digestible. Matures very late in the season. Good for rotational grazing, not for continuous grazing. Good for hay, not for silage.

TABLE 2 NOTES:

1. **Seeding Rate:** Seeding rates for the warm-season grasses are in pounds of Pure Live Seed (PLS). Actual planting rates must be adjusted to reflect percent seed germination and purity, as tested.

It is important to verify proper seeding depth for species of grass planted. When drilling, it is recommended to split rates and apply seed twice, with the second pass going perpendicular across the first drill rows.

2. **Bermudagrass:** Caution--This species can spread into other pasture plantings, lawns, and cropland fields. **Do not plant unless containment of the planting is feasible, as determined and approved by NRCS.**

3. For **Eastern Gamagrass**, recommend using dry, stable seed that is pre-treated to break dormancy.

FORAGE AND BIOMASS PLANTING (512) - PRACTICE IMPLEMENTATION CHECKLIST

Name:	Farm No./Tract No.:
Address:	Field Number(s):
Cost-Share Program:	Contract Number:

Description of Management Units
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Field No(s):	Total Acres:	Forage Species:
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Purpose of the planting (and type of livestock, if applicable): **New Planting** **Overseeding**

Pre-Planting Activities

Soil tested? Yes No If *Yes*, date when tested:

pH
 1. Soil pH: Lime needed? Yes No If *Yes*, recommended amount: T/ac

Planned treatment(s) (preplant activities):

Applied (what and when) (preplant activities):

2. Fertilizer

<i>Nutrient Levels</i>	<i>Planned Treatment(s)</i>	<i>Applied (what and when)</i>
N:		
P:		
K:		

3. Vegetation present? Yes No If *Yes*, describe:

Need to destroy existing vegetation? Yes No

Planned Method(s): <input type="checkbox"/> Herbicide (describe): <input type="checkbox"/> Mechanical (describe): <input type="checkbox"/> Animal (over graze for frost seeding)	Applied Method(s)/dates: <input type="checkbox"/> Herbicide (describe): <input type="checkbox"/> Mechanical (describe): <input type="checkbox"/> Animal (overgraze for frost seeding)
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Forage and Biomass Planting Job Sheet - 8

<i>Seeding Mix</i>							
Planned				Applied ¹			
Species	Variety	Seeding Rate (lbs/ac) PLS	Total PLS (lbs)	Bulk PLS	Germination (%)	Purity (%)	Actual PLS

Calculate actual amount needed as follows: $\frac{\text{Seeding Rate in PLS lbs/acre}}{(\text{Germination} \times \text{Purity})} = \text{Actual Amount Needed in lbs/ac}$

Example: Plant Switchgrass at 8 lbs/ac PLS on 5 acres. Germination is listed as 75%, and purity is listed as 95%.
 $\frac{8 \text{ lbs/ac PLS}}{(0.75 \times 0.95)} = 11.2$ lbs of bulk seed needed per acre. $11.2 \text{ lbs/ac} \times 5 \text{ ac} = 56$ lbs, the total amount needed.

<i>Method of Seeding</i> ✓ <i>for Planned</i> ○ <i>Circle for Applied</i>
<input type="checkbox"/> No-till (into crop residue or cover crop) <input type="checkbox"/> No-till (into sod) <input type="checkbox"/> Drilled into conventionally tilled seedbed <input type="checkbox"/> Broadcast onto conventionally tilled seedbed <input type="checkbox"/> Frost seeding (overseed an existing stand) <input type="checkbox"/> Seeding with a nurse crop or companion planting <input type="checkbox"/> Corn planter <input type="checkbox"/> Other (describe):
Drill Calibrated? <input type="checkbox"/> Yes <input type="checkbox"/> No Setting: _____ Checked seed placement? <input type="checkbox"/> Yes <input type="checkbox"/> No <div style="float: right; width: 45%;"> Recommended Seeding Depth: Recommended Planting Date: Applied Planting Date: </div>

Post-Planting Activities

Weeds present? Yes No Weed control needed? Yes No

MD Cooperative Extension recommendations:

Planned treatment(s):

Applied (what and when):

CERTIFICATION

Practice field-checked by: _____
Designated Conservationist Date

Practice meets the Maryland NRCS standard for Forage and Biomass Planting (512): Yes No
 Comments:

¹ From seed tags