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Norman A. Berg National Plant Materials Center
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Bermudagrass For Heavy Use Areas and Pastures

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ABSTRACT

Bermudagrass (*Cynodon dactylon*), with its ability to withstand high grazing pressure and the high nutrient load in animal waste, is ideally suited for planting in high use areas. Bermudagrass can reduce erosion, take up nitrogen, reduce compaction, improve soil health, and provide summer forage where other forage species would not persist. The objective of this study was to evaluate species selection, various establishment and management practices, and to provide guidance to farmers unfamiliar with bermudagrass growing practices. This study was conducted by the USDA-Natural Resources Conservation Service (NRCS) Norman A. Berg National Plant Materials Center (NPMC) and the University of Maryland Cooperative Extension at high animal use farms in Maryland, Virginia, Pennsylvania, and at the NPMC to evaluate seeded and sprigged varieties primarily for establishment and durability. Seeded varieties initially evaluated for establishment and persistence at farm sites were found to have poor and inconsistence persistence through the first winter after planting. 'Ozark' was the highest yielding and hardiest variety tested in a simulated hay yield trial of turf type and forage type varieties conducted at the PMC. Turf type varieties with denser lateral growth were more suited for high use areas. Based on these initial studies, 'Quickstand', 'Tuffcote' and 'Patriot' varieties were selected for further evaluation at four farms. 'Quickstand' demonstrated the best combination of quick establishment and yield potential. 'Quickstand' was evaluated further at eleven high use area plantings, each with different challenges, to further elucidate the site conditions and planting techniques that can be used for successful plantings. The most significant factors contributing to the success of bermudagrass plantings in heavy use areas included proper planting, low weed pressure, sufficient grazing intensity, and good soil fertility.

INTRODUCTION

Landowners with livestock will very often have heavy use areas (HUA) that have become devoid of plant cover from overuse. These areas not only produce negligible forage but also can be significant sources of sediment and nutrient pollution through water runoff as well as dust. Elmer Dengler, the former Maryland state grazing land specialist and Lester Vough, former forage extension specialist with the University of Maryland, identified naturally occurring common bermudagrass as the only forage species to survive in highly degraded heavy use areas. Although common bermudagrass had shown potential as plant cover and forage for high use areas, more information was needed on the performance of cultivated varieties and their

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establishment and growth requirements that could aid adoption by farmers in Maryland, Virginia, Delaware. Initial test plantings by NRCS and University of Maryland Cooperative Extension (unreported) focused on seeded varieties as it was thought that the greater availability, reduced perishability, and ease of planting would be an advantage over sprigged varieties. However, it was found that seeded bermudagrass varieties often failed to establish or overwinter. Further studies as reported here, included a simulated grazing trial evaluating forage yield of eleven sprigged and seeded varieties at the NPMC, as well as trials using 3 readily available sprigged varieties to evaluate establishment and management methods in actual heavy use areas that address the many and varied challenges of farm operations. Establishment trials assisted farmers with in-field planting challenges as well as serving as demonstration sites. Due to widely varying farm conditions, effort was made to adapt establishment techniques to the wide range of unique situations and develop wide-ranging recommendations.

Figure 1. Harvesting 'Quickstand' bermudagrass sprigs for use in trial plantings.

FORAGE YIELD - MATERIALS AND METHODS

Eleven varieties of bermudagrass were evaluated for forage yield potential in a simulated rotational grazing trial. Seed and sprigs were purchased from commercial sources, and NRCS released varieties were harvested at and supplied by the NPMC (figure 1). Cold tolerant varieties of bermudagrass were included in the trials and are listed in Table 1. Seeded varieties were planted in 3 ft. × 20 ft. plots with a 6-row cone seeder with 6-inch row spacing at a rate of 8 lbs pure live seed (PLS) per acre. Sprigged varieties were established by hand spreading sprigs over freshly tilled plots, lightly tilling sprigs into the soil and firmly packing the soil with a Brillion seeder manufactured by Landoll. The seeding/sprigging year was treated as an establishment period and yield data was not collected. Nine varieties were seeded or sprigged in 2007 in a completely randomized block with 4 replications (Table 1).

Table 1. Five sprigged and four seeded, turf or forage type bermudagrass varieties evaluated at the Norm A. Berg Plant Materials Center, Beltsville, MD.

Variety	Type	Propagation
Quickstand	Turf	Sprigs
Tufcote	Turf	Sprigs
Ozark	Forage	Sprigs
Midland 99	Forage	Sprigs
Tifton 44	Forage	Sprigs
Mohawk	Turf	Seed
Wrangler	Forage	Seed
Sungrazer Plus	Forage Blend	Seed
Riata	Forage Blend	Seed

The study was planted at the NPMC, located about 10 miles north-east of the District of Columbia, on Christiana-Downer Complex silt loam soil. Average season total rainfall is 43 inches for the study location. Fertilizer applications of phosphorous and potash were applied to meet soil test recommendations. Nitrogen fertilizer was applied at a rate of 225 lb N/acre/season in three equal split applications of 75 lb each using urea as a Nitrogen source. Yield was taken from the entire 3 ft. x 20 ft plot area. Cuttings were made using a flail-type harvester, made by Cater Manufacturing, and cut to a height of 3 inches to simulate recommended grazing to a height of 2 to 4 inches (Lee 2017).

FORAGE YIELD - RESULTS AND DISCUSSION

As was expected, the bermudagrass varieties selected for forage yielded higher dry matter than the turf type bermudagrass varieties (Table 2). ‘Mowhawk’ and ‘Wrangler’ had very poor establishment and were not evaluated for forage yield. The forage varieties ‘Midland 99’ and ‘Ozark’ were highest yielding. Both had comparable yield. ‘Ozark’ with greater freeze tolerance than ‘Midland 99’ (Anderson 2011) would be the preferred choice in the region for hay or rotationally grazed pasture and therefore was chosen for further testing.

This initial trial gave some insight to potential hay yield, but little insight to the yield under heavy animal pressure, which would be challenging to measure. For high use areas, quick establishment, dense and durable cover are of higher concern than yield.

Seeded varieties were not reliably winter hardy even with good initial establishment. Low winter survival appears related to failure of the plant to produce either rhizomes or stolons prior to winter. These seedings were planted early since it is known that bermudagrass planted early is more likely to develop the rhizomes necessary for winter survival (Lee 2017). However, it is possible, depending on the weather, variety and other site conditions, that an early planting in Maryland may not provide a long enough growing season for sufficient rhizome production.

High seeding rate and/or low grazing pressure may also have discouraged the lateral bermudagrass growth necessary for overwintering, but further testing of seeding rates and mowing heights at the PMC was not able to confirm this relationship. It should be possible to increase winter survival by maximizing the time and space for plant and rhizome growth with early seedings at low to moderate seeding densities and low weed pressure. It is possible that mowing or grazing to a very low height may also encourage lateral growth, but this was not confirmed in the study. Following good planting practices, sprigged varieties were more reliable and faster to establish, allowing farmers to graze the bermudagrass sooner after planting.

Table 2. Forage yield of bermudagrass varieties in 2009 and 2010 and 2-year average, Beltsville, MD.

	Year		
Variety	2009	2010	2 yr. avg.
	----------lb/acre----------		
Midland 99	11476	9596	10536
Ozark	11571	8593	10082
Tifton	9364	8463	8914
Sungrazer plus	9285	6729	8007
Riata	8643	6954	7799
Quickstand	7327	5661	6494
Tufcote	6570	5699	6134
Mean	9199	7442	8321
SD[1/]	2445	1782	1987

[1/] Standard deviation.

HUA VARIETY TRIALS - MATERIALS AND METHODS

Further trial and demonstration plantings were established to test the establishment and performance of the sprigged turf-type bermudagrass varieties ‘Quickstand’, ‘Patriot’, and ‘Tufcote’ under HUA conditions. This trial was restricted to the most promising sprigged varieties that were available within reasonable travel distance. Two replicated and two non-replicated comparison plantings were planted at 4 separate farms in Maryland’s Howard and Frederick counties. Sprigs were established by hand-spreading sprigs on to either disked or rototilled soil, followed by light disking or roto-tilling to cover the sprigs with 1 to 3 inches of soil, and packing the soil with a cultipacker or Brillion seeder (figure 2). Care was taken to quickly cover the spread sprigs to avoid lengthy exposure to desiccating air and sun. Where possible, small sprinklers were used to water after planting.

Figure 2. Hand spreading sprigs and covering with disks at a Howard county horse farm.

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HUA VARIETY TRIALS - RESULTS AND DISCUSSION

The sprigged plantings initially did well, with the Howard county planting doing exceptionally well (nearly 100% cover after at the end of the first season (figure 3)). The Frederick county plantings had greater difficulty establishing due to more challenging conditions and greater weed pressure, as well as suffering greater losses during a particularly harsh winter. Several exceptionally wet summers favored vigorous crab grass growth that outcompeted the bermudagrass when it wasn't grazed or mowed low enough. Crabgrass (*Digitaria haller*) pressure and harsher winters negatively impacted establishment and stand density across varieties equally, far outweighing differences between the cultivars. Nonetheless, based on our general observations, 'Quickstand' had faster coverage then 'Tufcote' and was more durable than 'Patriot'. The greater durability of 'Quickstand' over 'Patriot' was demonstrated by persistent growth into very high traffic paths along fences and entrances.

Figure 3. Near complete cover, by end of first season at Howard County horse farm.

ESATBLISHMENT TRIALS - MATERIALS AND METHODS

Trial and demonstration plantings were established at 11 farms to further explore the unique challenges to establishing bermudagrass often found on each farm. This was necessary to learn and provide guidance to farmers in a variety of situations. These trials were planted with best of the varieties identified in the previous trials. Primarily 'Quickstand' as well as 'Patriot' were planted in HUAs and 'Ozark' was planted in pastures. 'Ozark' was chosen for testing in pasture since it had the best combination of hardiness, yield, and fine stems.

Many of these plantings required alternative establishment methods based on available equipment, soil conditions, and other site-specific considerations. Several sites were planted in strips alternating with undisturbed pasture to mitigate erosion and provide some undisturbed pasture for grazing. At other sites, alternatives to covering sprigs were used, including applying several inches of mushroom compost, applying composted manure and straw, hand digging into compacted laneway and using horses to trample the sprigs into wet soil.

ESTABLISHMENT TRIALS - RESULTS AND DISCUSSION

Establishing sprigs into tilled strips showed promise. Ideally, strips would be tilled several weeks prior to planting and again the day of planting to express and subsequently suppress weeds within the seedbank. However, in both plantings the landowners were unable to rototill the strips prior to planting and tilling was only accomplished the day of planting. Consequently, weed competition was much greater than expected. One site was unable to water after planting and received very little precipitation, which greatly limited establishment. Both sites had sprig survival and establishment, but bermudagrass density was sparse due to weed competition and/or limited water.

At a horse farm that was converted from an old gravel mine, the first planting attempt failed due to equipment not penetrating the soil and covering the sprigs adequately to prevent drying out between watering. In the following year, we used an alternative planting method in which the sprigs were spread on the soil, covered with several inches of mushroom compost, and watered. Mushroom compost provided good coverage of sprigs and provided much needed water and nutrient holding capacity, which led to excellent results. At this same farm, an additional alternative planting method was devised to successfully plant a feeding area without the use of equipment or amendments. Sprigs were spread over the feeding areas where mud and/or manure were present. The horses were allowed to trample the sprigs into the soil. The drawback of this method is horses will eat some of the sprigs. This resulted in moderately sparse establishment, but with little weed competition, the bermudagrass would not have difficulty spreading and stabilizing the site. This trample planting method also successfully occurred on a portion of a cattle HUA that could not be disked due to excessively wet conditions.

'Quickstand' was also established on riding ring area that had been amended with bluestone. To provide greater organic matter and higher water and nutrient holding capacity, manure was spread and incorporated by rototilling. After planting, the area was kept very well-watered during establishment to mitigate the sharp drainage, and additional manure was spread periodically to increase the organic matter. Weeds were not much of an issue in these conditions and the bermudagrass was successfully established.

In a winter heavy use area in Pennsylvania, 'Quickstand' was not successfully established because of a lack of summer grazing allowed competing vegetation to flourish. This site was disked before and after spreading the sprigs and manure and hay were spread afterwards to further cover the sprigs. Because the site was not grazed during the summer, the bermudagrass was very sparse with a few stems struggling among heavy vegetation. In contrast some sprigs were successfully hand dug along the edges of a nearby bare and compacted laneway. Later that first season, the plants grew several feet into the bare and compacted laneway. The initial growth was slow but expected to improve over time as the bermudagrass establishes and protects the soil from erosion.

'Ozark' had excellent establishment with good spread and cover on several well-prepared new pasture plantings with only moderate weed competition. This contrasted greatly with very poor establishment on sites where 'Ozark' was planted into old pastures where adequate weed control was not achievable. In comparison, near one of these failed 'Ozark' pastures, the 'Quickstand' that was planted into a HUA achieved very good establishment due to the very little weed competition.

Where 'Ozark' and 'Quickstand' were planted in adjacent new pasture and HUAs, and treated similarly during establishment, 'Quickstand' spread quicker and grew much denser than 'Ozark'. 'Ozark' prioritized vertical growth, whereas 'Quickstand prioritized horizontal growth to rapidly spread into and fill in empty ground.

CONCLUSION

Bermudagrass can provide significant cover and forage in high animal use areas if managed properly. The establishment and management of bermudagrass is very different than the cool-season forages that farmers are more familiar with. Some of the best management practices for bermudagrass are counter to how cool-season forages are managed. Unlike cool-season forage, bermudagrass is shade intolerant, and survives under frequent and low grazing heights and may even require this management to maintain its competitive advantage over cool-season grasses and weeds that would otherwise shade it out. In these trials, while we were able to avoid some of the causes of failures noted in the literature (Stichler 2003, Lee 2017), such as not planting at the right depth, not using enough sprigs, not using sprigs that had dried, and not firming soil after planting, other failure modes were harder to avoid due to site specific constraints such as equipment and water availability. The most common difficulties were encountered with the ability to apply adequate water after planting, preparing a relatively weed free planting bed, and weed control after planting. Tilling or disking was ideally done 3-7 days prior to planting to allow existing vegetation to die. If tilling was delayed until planting, many weeds would survive since the soil had to be packed and watered after planting the bermudagrass sprigs. Bermudagrass is especially vulnerable to early overtopping growth of cool season plants as well as overtopping growth of crabgrass especially in wet summers. It was critical that low grazing or mowing heights were maintained to control weeds for successful establishment as well as to maintain a full stand. Whereas farmers need to be careful not to overgraze their cool-season grass pastures, they may need to graze bermudagrass pastures heavily to suppress cool-season grasses and warm-season annual grass weeds during establishment and to maintain the density of

the bermudagrass. In many high use areas this is not a problem, but one of the biggest obstacles we had in these trials was to convince the landowners to purposefully heavily graze and essentially "abuse" their new bermudagrass plantings as soon as the sprigs were rooted and growing. For larger pastures that were not high use areas, weed control was especially critical to successful establishment and maintenance of bermudagrass stands. Planting bermudagrass into old pastures was largely not successful due to subsequent heavy competition of returning forages and weeds that were difficult to control adequately with mowing or herbicides. Bermudagrass had very little to no spread into existing vegetation and competing vegetation was able to reduce bermudagrass cover. Well-established stands of bermudagrass can decline if weeds are not managed with grazing and/or herbicides. Planting sites that had the best success were sites with low weed competition, from either animal pressure, site prep or previous cropping. The best success occurred in newly established pastures with low weed pressure.

Low fertility was also another limiting factor especially for hay plantings where nutrients were removed with each harvest but not adequately replenished. Bermudagrass is a heavy user of not only nitrogen but also of potassium and phosphorous. Especially the reduction of soil K levels can cause bermudagrass stands to lose vigor and decline (Lee 2017). Potassium deficiency can lower yields and increase susceptibility to leaf spot disease and winterkill (Conrad-Acuna 2013). There were several sites where the bermudagrass hay stands yellowed and declined prior to correcting the deficiency. Fertility management is important for achieving the vigorous Bermudagrass growth necessary to maintain thick stands resistant to weed competition. Watering was often essential for establishing new plantings, but once established bermudagrass was very drought tolerant.

Bermudagrass can be a valuable tool to reduce runoff, improve soil, provide forage in conditions where other forages would survive. Bermudagrass can be used to reduce the need for or the amount of gravel areas. Because bermudagrass grows well in sandy soils, it may be used to stabilize riding areas that have had sand or bluestone applied provided that some organic matter or manure is incorporated and there is adequate water during establishment.

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