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BLACK MEDICS FROM TEXAS

J.P. Muir[1], W.R. Ocumpaugh[2] and J.C. Read[3]

[1]Corresponding author, j-muir@tamu.edu; Texas Agricultural Experiment Station, 1229 North US HWY 281, Stephenville, TX 76401. [2]Texas Agricultural Experiment Station, 3507 HWY 59E, Beeville, TX 78102-9410. [3]Texas Agricultural Experiment Station, 17360 Coit Rd., Dallas, TX 75252-6599.

Summary and Application

Black medic (*Medicago lupulina* L.) has become naturalized throughout Texas where it acts as a cool-season annual. Cultivation for wildlife and livestock forage and seed has not been fully realized, as cultivars adapted to warm and dry climates have not been developed. This study evaluated forage yields and nutritive value of black medic accessions collected in Texas. March, April and May forage yield, acid detergent fiber (ADF), and crude protein (CP) concentrations of eleven black medic accessions collected in Texas were compared with cv. 'George' at Stephenville, TX during establishment and first self-reseeding years. Entries exhibited no frost damage and insignificant insect damage but some Texas accessions were more vigorous in February and flowered earlier than other Texas accessions and George. Some Texas accessions were also more productive (*P*<0.01) than others as well as George. Forage yields among entries ranged from 530 to 1340 lbs acre^{-1} year^{-1} when averaged over years and harvest months. Harvest month affected all entry yields equally and peaked at 2050 lbs acre^{-1} yr^{-1} during May of the first season but declined the second, self-reseeding year despite greater rainfall. March ADF concentrations tended to be lower and CP concentrations higher than later harvests while the higher yielding accessions also tended to have greater ADF. The results indicate that forage yield and nutritive value of naturalized black medic germplasm from Texas is variable and a blend should be developed for commercial application in the region.

Abbreviations: CP, crude protein; ADF, acid detergent fiber, LSD, least significant difference, DM, dry matter.

Introduction

Black medic, a cool-season, weak perennial of Eurasian origin, has become naturalized throughout much of the southeastern U. S. where it volunteers as a self-reseeding annual (2; Fig. 1). Reported forage yields in the northern USA vary from 900 (1) to 3200 lbs DM acre^{-1} year^{-1} (5) with production usually concentrated in late spring. Black medic's ability to self-reseed, its high quality forage and its wide adaptation to growing conditions makes it an ideal candidate for wildlife plantings and other low-intensity pasture systems. Despite all its promise, no commercial varieties adapted to Texas are currently available.

One objective of this trial was to compare the adaptation and productivity of locally collected Texas accessions with a commercial black medic presently available, cv. George from Montana (4). The Texas accessions were collected throughout Texas by A&M University Agricultural Experiment Station personnel on the basis of vigor and productivity. The second objective was to compare the relative accumulated yield and quality of entries in March, April, and May.

Fig. 1. Black medic inflorescence with mature seed in late spring.

Methods and Materials

The trial included 11 Texas accessions and George (Table 1) and was located at Stephenville. Soil at the site was a Windthorst fine sandy loam with an initial pH of 6.7, 11 ppm P, 96 ppm K, 970 ppm Ca and 138 ppm Mg. In an effort to emulate native range conditions, the soil was not amended with any nutrients during the trial despite low levels of P.

Rainfall in the first season of the trial was low, totaling 13 in. from October 1999 to May 2000, compared to a 20 in. 30-year average for the same months. Irrigation was applied in months that had less than 50% of the long-term average rainfall, giving a total of 17.7 in. moisture (rainfall and irrigation) for the 1999-2000 winter growing season. Rainfall the second season (October 2000 to May 2001) was greater (26 in.), and well distributed so that no irrigation was applied. The study area was tilled in late November 1999 and kept free of weeds with the November application of Select (clethodim) at 8 fl. oz acre^{-1} and Pursuit (ammonium salt of imazethapyr) at 3 fl. oz acre^{-1} both years.

Table 1. Origin of twelve black medics cultivated at Stephenville and Beeville, TX.

Entry	Latitude	Longitude	Origin
George	45-48° N	105-114° W	Commercial cultivar, Montana
BEBLK	28° N†	97° W	Naturalized in Bee Co., TX
LABLK	29° N	97° W	Naturalized in Lavaca Co., TX
DEBLK	29° N	97° W	Naturalized in DeWitt Co., TX
GRBLK1	32° N	97° W	Naturalized in Grayson Co., TX
GRBLK2	32° N	97° W	Naturalized in Grayson Co., TX
HUBLK	32° N	96° W	Naturalized in Hunt Co., TX
COBLK	33° N	97° W	Naturalized in Collin Co., TX
GRBLK3	33° N	96° W	Naturalized in Grayson Co., TX
NTBLK	32-33° N	96-98° W	Naturalized composite, north Texas
STBLK	32° N	98° W	Naturalized in Erath Co., TX
LUBLK	34° N	102° W	Naturalized in Lubbock Co., TX

†To closest degree

Eleven of the black medic entries in the study were collected from around Texas (Table 1) based on vigor and abundant seed production and were compared to George, a cultivar developed in Montana that normally sets seed very late in Texas. All seeds were scarified and inoculated with *Medicago*-specific *Rhizobium*, hand broadcast onto 5 by 10 ft. plots at 10 lbs seed acre^{-1}, and firmly packed with a roller in November 1999. The plots were arranged in a completely randomized block design with three replications. The trial depended solely on self-reseeding for re-establishment in the autumn of 2000 and no tillage took place that second year.

A 3 by 3 ft. area in each plot was harvested at a 1.5 in. height in March, April and May of 2000 and 2001. A different area was used for each harvest so that each month's harvest represented accumulated dry matter (DM) yield up to that point. Each of these sample areas was not harvested prior to or following the assigned harvest month that year. Total N concentrations were measured in the forage and then converted to estimate CP levels. Acid detergent fiber concentration was also analyzed.

Year, entry and harvest were used in the model and the dependent variables (yield as well as ADF and CP concentrations) were submitted to analyses of variance. A least significant difference (LSD) was used to separate means among entries (P<0.05) wherever appropriate.

Results and Discussion

Flowering, Frost damage and Insect Attacks

March flowering in both the establishment and reseeding years was noted for LABLK, DEBLK, GRBLK1, GRBLK3 and STBLK while NTBLK blend and GRBLK2 also initiated flowering in March of the reseeding year (data not presented). Entries that produce significant quantities of forage through the colder winter months (indicated by yields at a March harvest) would be particularly useful since most native forages are dormant during those months. All other entries initiated flowering by April.

No frost damage was observed on any entry throughout the trial despite temperatures that reached down to 16^{o} F and stayed below freezing for more than 48 hr. Also in sharp contrast to an adjacent burr medic (*Medicago polymorpha* L.) trial where insect herbivory nearly destroyed plants (3), only light insect damage by larval alfalfa weevil (*Hypera postica* Gyllenhal) was observed and only during the second season.

Yields

Complete canopy cover (data not reported) was achieved by April in all plots both years. Yield differences (P<0.001) among entries were the same across both year and harvest month. Accessions GRBLK1, GRBLK2, GRBLK3 and BEBLK averaged 1340 lb forage production acre^{-1} year^{-1} during the trial, and had greater forage DM yield than the other entries except COBLK and NTBLK (Fig. 2). Despite lower cumulative rainfall and irrigation levels the first year, yields were greater the first year compared to the second year during the April and May harvests (year by harvest month interaction P<0.001) indicating that self-reseeding was not as effective the second year as broadcast seeding was the first year (Table 2). Seed broadcast the first season was scarified so most seed in the plots the reseeding year were produced the previous season. Another factor that may have influenced year differences in yield may be soil disturbance, as first year production was on cultivated soil, whereas second year production was on undisturbed soil. During both years, however, yields increased as the season progressed and May of 2000 had the greatest average production with more than 2050 lb forage acre^{-1} (Table 2).

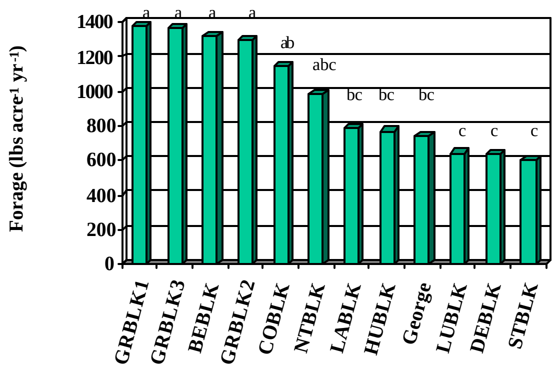

Fig. 2. Forage yields of twelve black medic entries at Stephenville, TX averaged over two years and March, April and May harvests (*P*<0.001; means with the same letter are undifferentiated according to LSD ($LSD_{0.05}$=300) means separation at alpha=0.05).

Table 2. Forage yields of black medic in March, April and May of 2000 and 2001 at Stephenville, TX averaged for 12 entries. Yields are estimates of cumulative yearly forage production up to month of harvest and were clipped from plants that had not been previously harvested that year.

Year	March*	April	May
	------------lb forage acre^{-1}-----------		
2000	278	1096	2105
2001	392	676	1296

*Harvest month by year interaction *P*<0.001, $LSD_{0.05}$=211.

Acid detergent fiber

Acid detergent fiber values in March (data not presented) averaged less than 20% both years and increased to an average 25% in May of both years (year by harvest month by entry interaction *P*=0.02). Differences in entry ADF values between years at the same harvest dates reflected differences in plant development resulting from weather differences between years. However, the values in general indicate high quality forage (as an example, see Fig. 3 for May 2000 ADF values). Forage ADF concentrations increased with maturity and generally were greater in the more productive entries (compare Fig. 2 and 3). However, at peak production in May of both years, even the higher yielding entries averaged only 26% ADF, lower than the average ADF values reported for annual *Medicago* spp. in other trials (5).

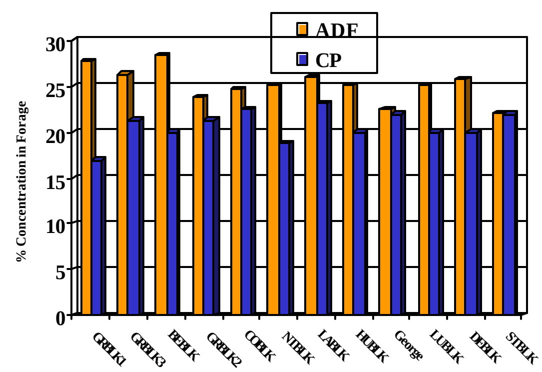

Fig. 3. May 2000 forage acid detergent fiber (ADF) and crude protein (CP) concentrations of twelve black medic entries at Stephenville, TX (ADF year by harvest month by entry interaction *P*=0.04 and $LSD_{0.05}$=3.4; CP year by harvest month by entry interaction *P*=0.05 and $LSD_{0.05}$=2.3).

Crude Protein

There was a year by harvest month by entry interaction (*P*=0.05) for forage CP concentration (data not presented; as an example, see Fig. 3 for May 2000 CP values). Average concentrations peaked in April both years but were generally higher the second year except in May. In April 2000, forage CP concentration reached 23.8% in two Texas accessions, while in April 2001 HUBLK had the highest concentration at 27.5%. The highest yielding entries with the greatest concentration of ADF tended to have lower concentrations of CP, indicating a possible dilution of root-absorbed and atmospherically-fixed N in those entries (compare Fig. 2 and 3). However, even the entries with the lowest May CP concentrations still had levels over 15.0%. BEBLK, for example, averaged 20.6% CP throughout the trial and yielded an average 1300 lb forage acre^{-1} year^{-1}, almost 269 lb CP acre^{-1} year^{-1}.

Conclusion

Black medics of Texas origin grew more and were less dormant during the winter months than the commercial cultivar George and most out-yielded the Montana cultivar, regardless of harvest month and year. The average 2050 lb forage acre^{-1} for a single May harvest in 2000 might be improved if management requirements and multiple-month harvests are imposed on the more productive accessions. Some Texas accessions produced forage that was 25% crude protein and very low ADF concentrations, a highly nutritious forage by any standard.

Because ADF was low, even in May, and CP concentrations high for all entries in this trial, development of a commercial cultivar for Texas should be based on productivity and flowering date rather than forage quality. Since the GRBLK and BEBLK entries were the most consistent high-yielding entries, further trials should concentrate on either a blend or individual development of these, or similar, black medics for drier regions of Texas. These should combine winter productivity, early seed production, stand persistence, and high forage yields in a wide range of Texas climates and soils.

Acknowledgements

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