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No-till seeding chicory into bermudagrass sod results in poor chicory stands in south-central Oklahoma

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Abstract

In the Southern Plains, bermudagrass [*Cynodon dactylon* (L.) Pers.] is an important warm-season introduced forage. Chicory (*Cichorium intybus* L.) is a cool-season perennial which can produce early fall forage and complement bermudagrass in extending the grazing season. Our objectives were to determine species compatibility, yield, seasonal productivity, nutritive value and nitrogen (N) response of no-till chicory-bermudagrass mixtures compared to no-till annual ryegrass- (*Lolium multiflorum Lam.*) bermudagrass mixtures. Therefore, a field study was conducted at two locations near Ardmore, Okla. Treatments were two varieties of chicory and one variety of annual ryegrass. Treatments were no-tilled into established bermudagrass and fertilized with one of six nitrogen treatments. Chicory establishment was poor at location one in years 1 and 2, and failed to establish in location two both years. Chicory presence did improve forage nutritive values at location one. In summary, results of this study show that no-till seeding chicory into existing bermudagrass sod without bermudagrass suppression resulted in poor chicory stands with both the varieties tested and would not be recommended in the Southern Plains environment.

Conclusion

Results of this study show that no-till seeding chicory into existing bermudagrass sod without suppression resulted in poor chicory stands with both the varieties tested and would not be recommended in this environment. Chicory presence did improve forage quality, but establishment techniques need improvement and a cost-benefit analysis completed to determine actual benefit of chicory inclusion in bermudagrass.

Materials and Methods

- Factorial RCBD with plot size 1.5m X 7.6m
- Three replications
- Two locations on established (< 10 yrs bermudagrass (spp. common)
  - Normangee loam (Fine, smectitic, thermic Udertic Haplustalfs) with 3-5% slope
  - Wilson silt loam (Fine, smectitic, thermic Oxyaquic Vertic Haplustalfs) with 0 to 1% slope
- Interseeding treatments:
  - 1. Ceres Grouse chicory (GRBG; Ceres, Inc., Thousand Oaks, Calif., USA)
  - 2. VNS chicory (VNSBG; Noble Foundation, Ardmore, Okla.)
  - 3. Marshall annual ryegrass (RGBG; Wax Seed Co., Amory, Miss., USA)
- Seeding rates:
  - chicory 6 kg/ha PLS
  - ryegrass 22 kg/ha
- N treatments:
  - 0 (control)
  - 56, 112 , 168 kg N/ha applied once in fall
  - 112 kg N/ha with split application in fall and winter
  - 168 kg N/ha with split application in fall, winter and spring
- Prior to planting, bermudagrass was mown to 10 cm.
- Prior to planting, locations were soil-tested (15 cm depth).
  - Location one received 224 kg/ha of 0-46-0.
  - Location two received 224 kg/ha of 0-46-0 plus 56 kg/ha of 0-0-60.
  - Treatments were interseeded using a Hege 1000 plot drill.
- Planting dates:
  - October 2010
  - September 2011
- Due to lack of fall and winter chicory forage production, end of the season harvests were taken on June 1, 2011, and May 9, 2012.
- Forage nutritive values for CP and IVDMD were estimated using the Foss 6500 near-infrared reflectance spectroscopy instrument.
- Chicory establishment at location two failed both years of the study; as a result:
  - Location one results were analyzed using a mixed-model analysis of variance (PROC MIXED) in SAS (version 9.3; SAS Institute, Cary, N.C.) to determine the effects of variety, N rate, N rate split and their interactions on forage dry matter yield and nutritive value.
  - Variety and N rate were fixed effects; year and replication were random effects. To test the effect of 100 and 150 lb N/acre rate split, a data subset was created, including split and single application of 100 and 150 lb N/acre treatments and excluding the 0 and 50 lb N/acre single application treatments. To test the N rate effect, all N rate split treatments were excluded.
  - For location two, the variety effect was excluded from the model, then statistical procedures used for location one were repeated.
- LS MEANS statement with DIFF option was used to separate treatment effects. Differences were declared significant at $P \leq 0.05$.

Results

- Stand counts
  - February 2011 stand counts:
    - Chicory stand count at location one was 6.9% and 0% at location two.
    - Ryegrass stands were over 80% at both locations.
  - Plots were re-established in September 2011, and stand counts taken in February 2012.
    - The chicory stand count at location one was 24.4% and 0% at location two.
    - Annual ryegrass stands were over 80% at both locations.
- As a result of the failure of chicory to establish at location two, only BGRG for location two is presented. Location one presents data for both BGRG and chicory/bermudagrass.

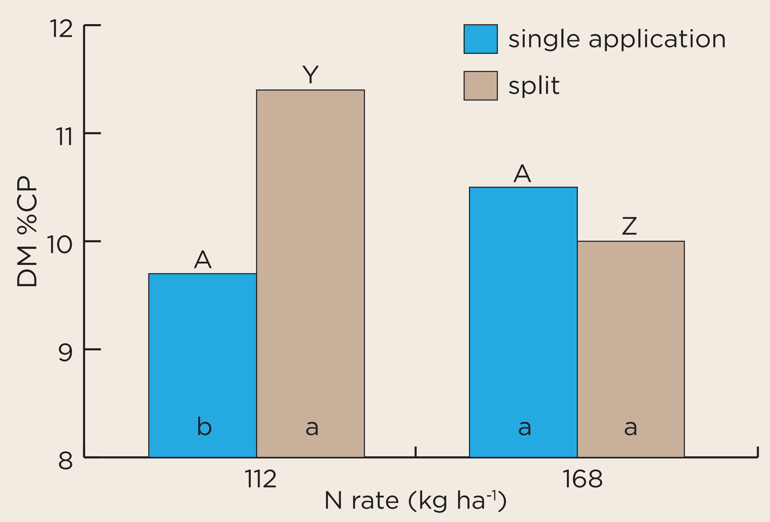

Fig. 3. Split 112 and 168 kg ha-1 N treatment effect on dry matter % CP at location one near Ardmore, Okla., USA.
Upper case letters test across single N rate application (A, B) and across split applications (Y, Z). Columns with the same letter are not significantly different at $P = 0.05$.
Lower case letters test the split N rate effect within N rate treatment. Columns with the same letter are not significantly different at $P = 0.05$.

Location one results

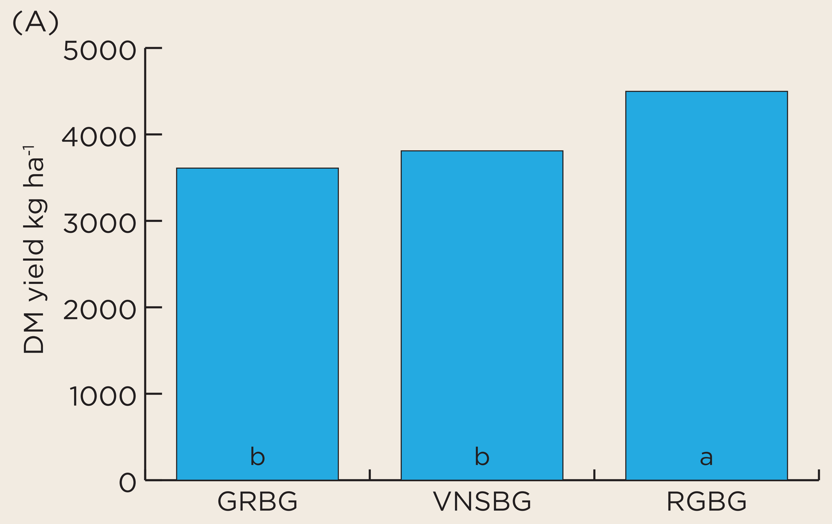

Fig. 1A. Variety effect at location one near Ardmore, Okla., USA, on dry matter yield (kg ha-1) of grouse chicory-bermudagrass (GRBG), variety not stated chicory-bermudagrass (VNSBG) and ryegrass-bermudagrass (RGBG). Columns with the same letter are not significantly different at $P = 0.05$.

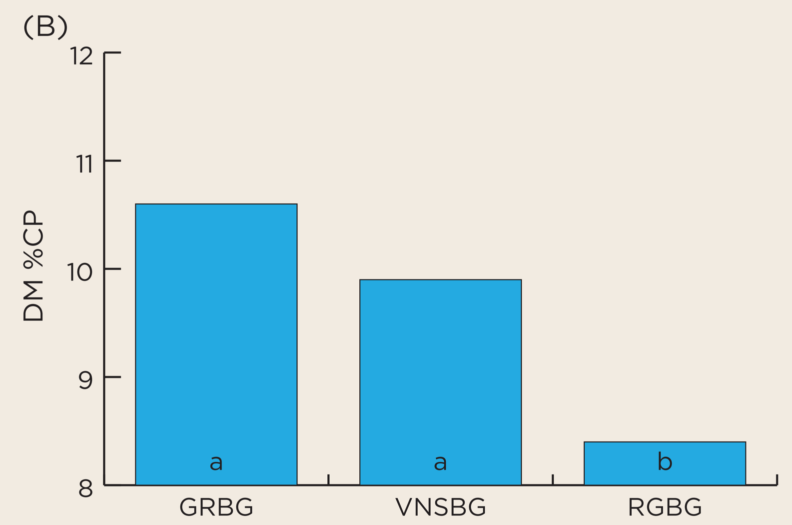

Fig. 1B. Variety effect at location one near Ardmore, Okla., USA, on dry matter percent crude protein (% CP) of grouse chicory-bermudagrass (GRBG), variety not stated chicory-bermudagrass (VNSBG) and ryegrass-bermudagrass (RGBG). Columns with the same letter are not significantly different at $P = 0.05$.

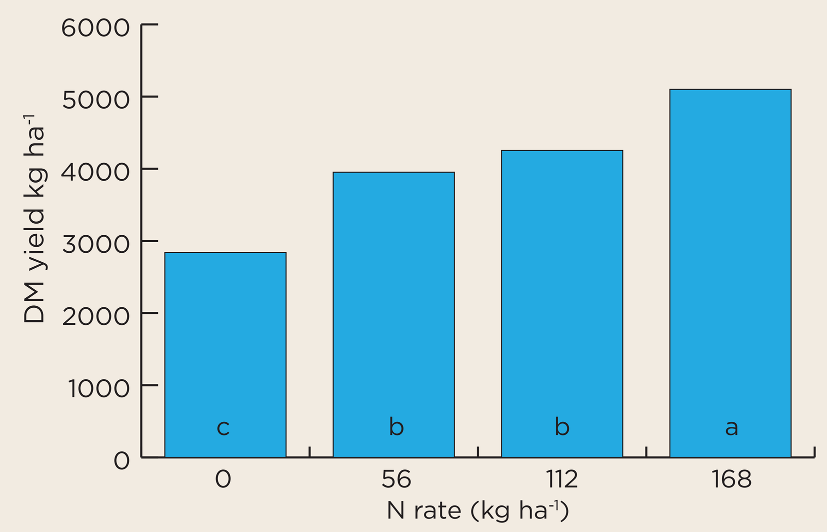

Fig. 2. N rate effect on dry matter yield (kg/ha) at location one near Ardmore, Okla., USA. Columns with the same letter are not significantly different at $P = 0.05$.

Location two results

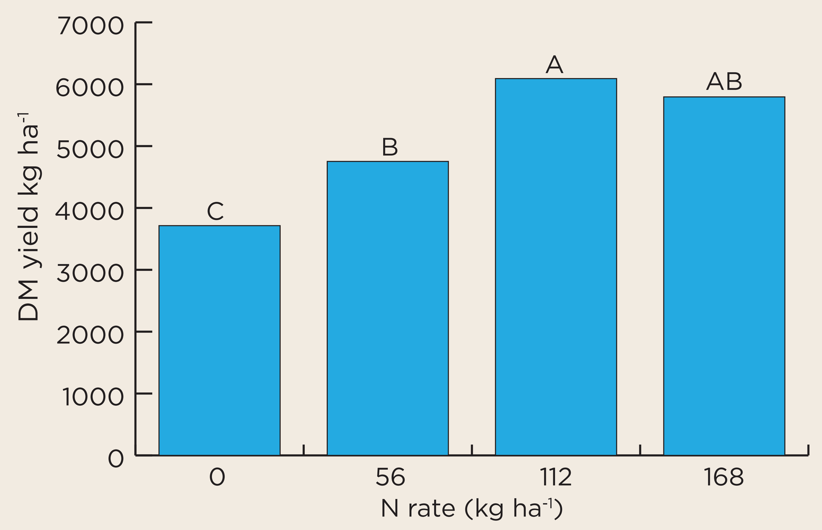

Fig. 4. N rate effect on dry matter yield (kg ha-1) of BGRG at location two near Ardmore, Okla., USA. Columns with the same letter are not significantly different at $P = 0.05$.

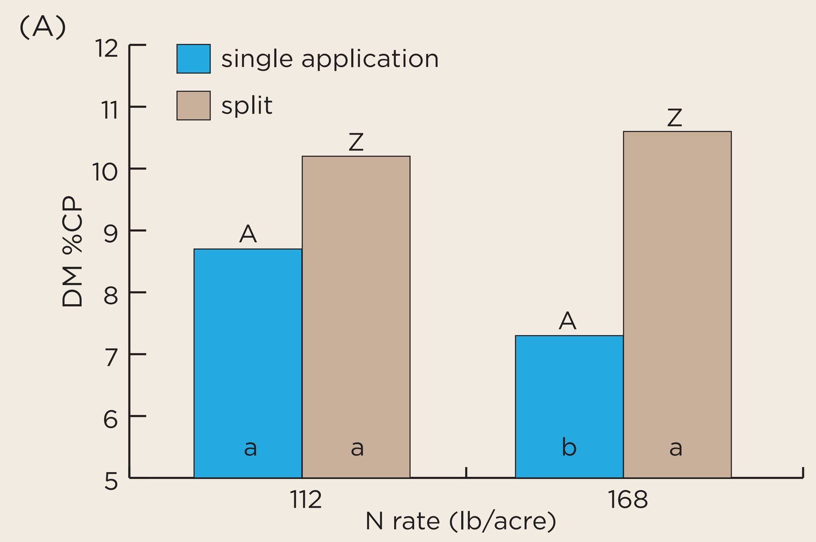

Fig. 5a. Split 112 and 168 kg ha-1 N treatment effect on dry matter % CP at location two near Ardmore, Okla., USA
Upper case letters (A, B) test the single application N rate effect, (Y, Z) test the split application N rate effect. Columns with the same letter are not significantly different at $P = 0.05$.
Lower case letters test the split N rate effect within N rate treatment. Columns with the same letter are not significantly different at $P = 0.05$.

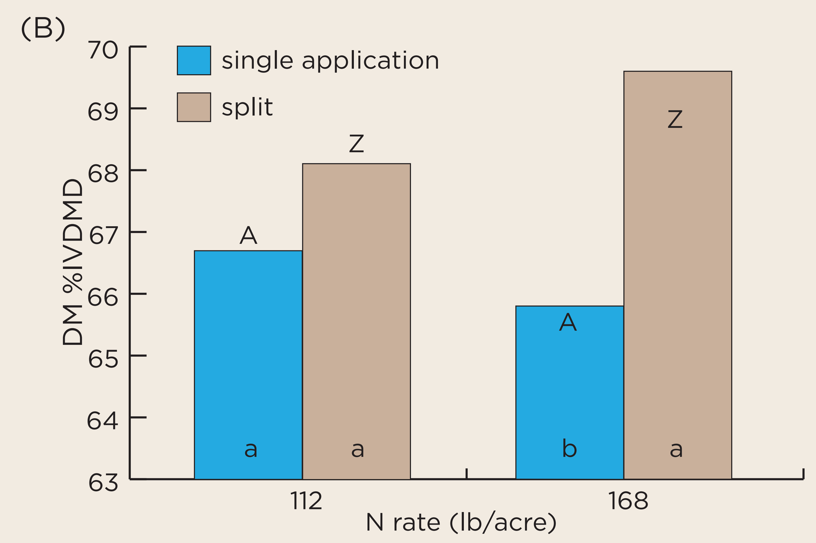

Fig. 5b. Split 112 and 168 kg ha-1 N treatment effect on dry matter % IVDMD at location one near Ardmore, Okla., USA.
Upper case letters (A, B) test the single application N rate effect, (Y, Z) test the split application N rate effect. Columns with the same letter are not significantly different at $P = 0.05$.
Lower case letters test the split N rate effect within N rate treatment. Columns with the same letter are not significantly different at $P = 0.05$.