Improving Forage-Legume Stand Establishment with New Seeding Methods

Patrick M. Carr, G.B. Martin, and B.A. Melchior

North Dakota State University
Dickinson Research Extension Center
Dickinson, ND

Research Summary

Forage legumes offer many benefits if incorporated into rotations with grain and seed crops. Many producers are hesitant to incorporate forage legumes into rotations with wheat and other grain crops in southwestern North Dakota, in part because of the inability to establish stands of forage legumes consistently using conventional seeding methods. The objective of this study is to develop seeding methods which result in consistent establishment of forage legume stands across North Dakota.

Introduction

Forage legumes are difficult to establish compared with many other crops. The small seed size of most forage legumes necessitates seeding at shallow depths, where the seed is vulnerable to soil water deficits (Sheaffer, 1989). Death from dehydration can occur once the seed germinates and radicle emergence occurs.

Improved emergence of alfalfa seedlings occurred as planting depth increased because soil water and seed-soil contact increased progressively with depth in a study by Triplett and Tesar (1960). No-tillage (NT) systems may offer advantages compared with conventional till-plant (CT) systems for forage legume establishment, since soil water and soil compaction increase when tillage is decreased (Gauer et al., 1982). Superior establishment of alfalfa occurred in NT compared with CT seedbeds in Manitoba (Allen and Entz, 1994).

Recommended planting dates for forage legumes vary by location. Early spring (mid-to late-April) generally is considered the optimal period for forage legume establishment in North Dakota. Frost- or dormant-seeding may be an alternative to early spring seeding in North Dakota. This practice (seeding before the soil freezes but late enough so that seed does not germinate) can be advantageous when early spring seeding is not possible because of wet soils or other constraints. Preliminary data from a 6-yr study suggest that dormant seeding is a risky practice with forage legumes in eastern North Dakota (D. Meyer, 1999). The development of polymer seed-coatings which delay the imbibition of water by seed until targeted environmental conditions develop suggests that forage legumes may be dormant-seeded successfully.

The objective of this study is to develop seeding methods which result in consistent establishment of forage legume stands. Specifically, this study is designed to: (i) demonstrate that establishing forage legumes successfully is improved as tillage is reduced; (ii) demonstrate that a polymer seed-coating improves dormant-seeding success of forage legumes; and (iii) determine if the same of several competing methods produces the greatest establishment success among representatives of annual, biennial, and perennial forage-legume species.

Materials and Methods

Demonstrate that establishing forage legumes successfully is improved as tillage is reduced.

Forage legume species were sown in NT and CT seedbeds in late-fall/early winter in plots arranged in a randomized and replicated experimental design near Dickinson, ND, in 2001.

Plant population was visually assessed at 10 and 20 days after spring warmup. Emerged legume plants were counted at 12 locations in a 21.5-ft^2 (2-m^2) area in NT and CT plots at 30, 45, and 60 days after spring warmup.

Data were analyzed by the ANOVA procedure from SAS. Tillage, establishment methods, and legume cultivars were considered fixed effects while blocks were considered random. Where *F* tests indicated that significant differences between whole plots, subplots, and sub-subplots occurred, means were separated using Fischer's protected LSD at $P < .05$.

Demonstrate that a polymer seed-coating improves dormant-seeding success of forage legumes.

Forage legume species were sown using 4 different strategies in both NT and CT plots: (i) dormant-seeding polymer-coated seed when soil temperature at a 1-in (2.5-cm) depth remained # 40°F over a 3-d period or by 15 November, whichever occurred first; (ii) dormant-seeding non-coated seed at the same depth as in (i) but when the soil temperature remained # 36°F over a 5-d period preceding sowing or by 1 December, whichever

occurred first; (iii) seeding non-coated seed at spring warm-up (soil temperature at a 1-in depth remained $ 40°F over a 3-d period preceding sowing); and (iv) seeding non-coated seed when soil temperature at a 1-in depth remained $ 50°F over a 3-d period preceding sowing. Planting-date subplots were 40 x 30 ft.

Soil temperature at a 1-in depth was recorded at 6-h intervals from the date of dormant seeding until 30 d after the late-spring seeding date from dormant-seeded polymer-coated treatments in both NT and CT plots in two blocks (Hobo® H8 Pro Series, Onset Computer Corp., Bourne, MA). Plant population was determined as described for Objective a, but from 3 locations in each planting-date subplot (vs. 12 locations in each tillage whole plot). Data were analyzed as described under objective a.

Determine if the same of several competing methods produces the greatest establishment success among representatives of annual, biennial, and perennial forage-legume species.

Alfalfa (cv. Ladak), common yellow-flowered sweetclover, and black medic (cv. George) were established in forage-legume species sub-subplots. Legume plant population were determined from the center of each forage-legume species sub-subplot as described under Objective a.

Results and Discussion

Fewer than one plant/ft^2 resulted from dormant seeding in the fall, whether seed was coated with a protective polymer or not (data not presented). Around two plants/ft^2 resulted from the early spring planting because of killing frosts that occurred after seedlings had emerged. Acceptable stands of forage legume seedlings resulted only when seeded in late-spring. The study was terminated because of low plant populations in most plots included in the study. The field experiment will be repeated: dormant seeded plots will be established in late-fall/early winter in 2002.

Acknowledgments

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