Establishment of Clovers in Response to Broadcast vs. No-Till Drill Planting Methods

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Story in Brief

The objective of this study initiated in fall of 2008 was to examine the effects of different strategies of crimson clover (Trifolium incarnatum L.) and white clover (T. repens L.) establishment. The experimental design was a randomized complete block with whole plots representing cattle grazing before and after planting to test for effects of hoof action on clover emergence. Within each whole plot, 8 treatments were randomly imposed as a subplot factors; these included no-till drill planting, broadcast planting, and high and low seeding rates for both species. Seedling counts were performed in fall of 2008 after planting and in spring of 2009. No-till planting of clovers resulted in higher (P < 0.05) seedling counts than broadcast in fall of 2008 within a comparable seeding rate, except for the low seeding rate scenario. Maximum seedling values observed for crimson clover and white clover were 13.7 and 11.0, respectively, using no-till planting in fall 2008 with a high seeding rate. In the fall of 2008, seedling numbers in ‘grazed after’ crimson clover plots when broadcasted at a low seeding rate where almost double (P < 0.05) compared with ‘grazed before’ plots. The same effect was observed for white clover at a high seeding rate. Total numbers of seedlings were reduced during winter in plots that were no-till drilled, likely due to increased competition within rows. Therefore, after the first year of a 3-year study, broadcast planting may serve as a low cost alternative to no-till planting.

Introduction

Legumes have been used for centuries by producers and researchers and has led to the adaptation of appropriate legume species for particular requirements. One of the leading desirable effects of legume production is the biological ability of legume plants to use atmospheric N, but with the development of synthetic N fertilizer (McNeill, 2000) early during the last century, the use of legumes, and especially clovers, has been replaced with easily applicable and inexpensive commercial fertilizer. The recent, immense increase in energy costs may reverse this trend as fertilizers, produced from natural gas, have become very expensive and are also problematic from an environmental perspective.

Poor legume establishment can be problematic especially on soils with low water holding capacity, low pH, and unfavorable soil texture that can be detrimental to the large taproot system of some legumes. Therefore, the objective of this study was to test the establishment of white and crimson clover by no-till or broadcast seeding into an existing bermudagrass (Cynodon dactylon L.) sward at 2 seeding rates to determine the effects of canopy removal before or after planting via grazing animals on legume plant persistence.

Experimental Procedures

The study was conducted at the University of Arkansas-Watershed Research and Education Center (WREC) located in Washington County, Fayetteville. The soil at the site was classified as a Captina silt loam soil (fine-silty, siliceous, active, mesic Typic Fragiudults) which is moderately to well drained and slowly permeable. Slopes are 1 to 3% with rolling hills to moderately level land.

Experimental plots were marked at the beginning of October 2008 in an existing ‘Greenfield’ bermudagrass sward. Whole plots (grazed before/grazed after treatments) were sized 0.15 acres with 3 replications of each. Whole plots assigned to the ‘grazed before’ treatment were grazed between October 9 and October 13, 2008 with 3 non-lactating fistulated cows each, resulting in a theoretical stocking rate of approximately 25 animal units (AU)/acre. During the 5 days of grazing, animals were placed on paddocks at 8 am and removed at 5 pm each day. Canopy height was reduced from approximately 5 in at day 1 to 2 in at the end of day 5.

From October 14 through October 17, 2008, subplots were randomly planted within whole plots and included the following treatment combinations each for crimson and white clovers: a) No-till high seeding rate; b) no-till low seeding rate; c) broadcast high seeding rate; d) broadcast low seeding rate. High and low seeding rates, respectively, were 16.8 and 8.4 lb pure live seed (PLS) for crimson clover, respectively, and 6.2 and 3.1 lb PLS for white clover, respectively. No-till planting was performed using a 7-ft wide Tye drill with 0.5-ft row spacing and a planting depth of approximately 0.5 in. Seeds were broadcasted using a hand-held fertilizer spreader. Immediately after planting, cattle were stocked on whole plots assigned to ‘grazed after’ and remained for the same amount of time as in ‘grazed before’ plots (5 days) until October 22, 2008.

Seedling counts were performed randomly 4 times in each plot on November 16 through November 18, 2008, using a metal grid frame (Vogel and Masters, 2001). Seedlings were counted within a total area of 4 square ft at each of the 4 locations. Seedling counts were repeated on March 20 and 21, 2009. Data were analyzed as a randomized block design with factorial treatment arrangement at the subplot level using PROC GLM of SAS (SAS Inst., Cary, N.C.). Differences were considered significant at P < 0.05 unless otherwise indicated.

Results and Discussion

Fall 2008. Seedling counts in the fall of 2008 for crimson clover indicated that no-till drill establishment with a high seeding rate was more (P < 0.05) successful than any other treatment (Fig. 1). Moreover, a canopy that was grazed before and no-tilled with a high seeding rate had approximately 30% more crimson seedlings per unit area than in plots that were grazed after planting. At a low seeding rate, no-till drilling resulted in the same number (P > 0.05) as broadcasting at a high seeding rate, regardless of grazing plots before or after. However, when seeds were broadcasted at a low rate, grazing the canopy afterwards resulted in a larger number (P < 0.05) of seedlings per unit area than grazing plots before seeding. This is an indication that cattle hoof action may provide a better seed-soil

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contact and contribute to a modest planting success in this low-cost establishment method. Lesser seed count in plots that were grazed before broadcasting clover may be explained with a smaller number of seeds reaching the soil surface despite a short canopy. For extensively managed beef cattle operations, this method may be less interruptive than more costly alternatives. In fall of 2008, no-till drilling of white clover resulted in higher numbers of seedlings than other treatments (Fig. 1). Unlike crimson clover, all treatments except broadcasting at a low seeding rate were affected by canopy removal before or after planting.

Spring 2009. Six months after planting, we observed a numerical reduction in the number of seedling counts in crimson clover (Fig. 2), especially in plots established with the no-till drill compared with the previous fall. Seedling counts of no-till drilled plots were almost half of those in the previous fall. Crimson clover plants appear to branch, thus, we concluded that winter survival of particular clover seedlings is reduced within a drilling row due to competition of neighboring seedlings, but long-term survival of the clover stand may actually be increased through diminished competition from other species, especially winter annual weeds. Seedling counts for white clover in spring of 2009 were reduced similarly to crimson clover, especially for no-till drilling at a high seeding rate (Fig. 2). It is likely that both crimson and white clover seedlings were negatively affected by freezing temperatures approximately 2 wk after planting in fall, resulting in lower seedling counts in the spring of 2009.

For both an annual and perennial clover, we demonstrated various establishment strategies with the objective of providing producers with low-cost alternatives with minimal interruptions of their cattle operations. After the first year of this study, broadcasting clover seeds appears feasible, but decisions on the establishment method of choice should include species characteristics.

**Implications**

It appears that grazing the canopy short before planting will benefit the no-till establishment method, while grazing the canopy after seeding may be better when using the broadcasting method. Because high seeding rates will result in better stand establishment, producers should choose that scenario if financially feasible.

**References**


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**Fig. 1.** Effect of no-till drill and broadcast planting methods on seedling counts/sq foot in crimson clover and white clover grazed before and after planting in fall of 2008. Treatments were crimson no-till high seeding rate (CNTH), crimson no-till low seeding rate (CNTL), crimson broadcast high seeding rate (CBH), crimson broadcast low seeding rate (CBL), white no-till high seeding rate (WNTH), white no-till low seeding rate (WNTL) white broadcast high seeding rate (WBH), and white broadcast low seeding rate (WBL).

Means within same species displaying any letter in common are not different ($P < 0.05$).

Species were analyzed separately.
Fig. 2. Effect of no-till drill and broadcast planting methods on seedling counts/sq foot in crimson clover and white clover grazed before and after planting in spring of 2009. Treatments were crimson no-till high seeding rate (CNTH), crimson no-till low seeding rate (CNTL), crimson broadcast high seeding rate (CBH), crimson broadcast low seeding rate (CBL), white no-till high seeding rate (WNTH), white no-till low seeding rate (WNTL), white broadcast high seeding rate (WBH), and white broadcast low seeding rate (WBL).

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