Obstacles to Sod-Seeding Winter Annual Forages in Mississippi

***David J. Lang, Robert Elmore, and Billy Johnson**

INTRODUCTION

Winter annuals such as ryegrass *(Lolium multiflorum)* provide outstanding forage during the fall, winter, and spring months (October through May) throughout the southeastem United States. Tillage invariably increases the earliness and fall yield production of ryegrass compared with any type of no-till or sod-seeding (Lang and Elmore, 1995; Lang etal., 1992; Lang, 1989). A general pattern of two to three months of reduced growth of sod-seeded ryegrass in the fall followed by equal or slightly increased growth in the late winter and early spring as compared with ryegrass seeded into plots that were disked has been observed (Lang, 1989; Brock et al., 1992; Ingram et al., 1993; Lang and Elmore, 1995).

Various factors such as summer growth removal, *sod* type and density, soil moisture, nutrient immobilization (particularly N), insects, seedling disease soil type, and allelopathy may affect the success or failure of sod-seeded ryegrass (Lang, 1993). Although tillage may stimulate fall ryegrass growth, soil moisture may be lost by exposing the bare soil to wind and solar evaporation. Chemical summer fallow with glyphosate or paraquat may conserve soil moisture; this has been observed on the Prentiss sandy loam soil at Newton, MS. In fact, seeding ryegrass into a killed volunteer annual grass on the Prentiss soil has been found to be equal to or greater than seeding into a disked seedbed, particularly when late summer and early fall rainfall was limited (Brock et al., 1992). Insects such as crickets *(Gryllus* spp.), grasshoppers *(Melanoplus* spp.), and armyworms *(Pseudaletia* spp.) have been suspected (but not verified) of adversely affecting stand establishment in one out of every four years according to a recently completed researcher *survey* (Lang, 1997, unpublished). However, stand density is generally observed to be similar in both sod-seeded and tilled plots (Lang, 1989; Lang, 1993; Lang and Elmore, 1995).

The objective of this study was to compare results of several experiments over a number of years at multiple locations from various ryegrass sod-seeding experiments in order to identify various factors which may be obstacles (challenges) to successful sod-seeding of winter annuals.

[1]D. J. Lang, [1]R. Elmore, and [2]B. Johnson, [1]Mississippi State University, Mississippi State, MS and [2]Coastal Plain Branch Exp. Station Newton, MS. Manuscript received 10 March 1997. * Corresponding author.

MATERIALS *AND* METHODS

Various sites, tillage practices, and summer forage systems were utilized over several years at different locations. Particular details about each study are contained in the footnotes of each table along with its reference citation if previously published. Sod type was either volunteer annual grasses such as crabgrass *(Digitaria* sp.), broadleaf signalgrass *(Brachiaria platyphylla),* or permanent sod with bermudagrass *(Cynodon daclylon).* Tillage practices included single or double disking at 0, 30, or 60 d prior to seeding, moldboard plow followed by disking and cultipackmg, rototilling followed by disking and packing or seeding directly into *sod.* Sod suppression and summer growth removal treatments included herbage removal by haying or grazing, herbicide bumdown 1 to 30 d prior to seeding, herbicide bumdown followed by herbage removal by mowing or fire, or sod-seeding without herbage removal. Sites and soil types were Starkville, MS (Savanna sandy loam orManetta silt loam), Newton, MS (Prentiss sandy loam), and Raymond, MS (Loring silt loam). Each treatment was replicated four times and experimental design was generally a randomized complete block in small plots (6 ft x 18-24 ft) strips within pastures, or replicated pastures. Analysis of variance (ANOVA) was determined at each location by year and over multiple years. Means were separated by LSD(p=0.05).

RESULTS AND DISCUSSION

Tillage improves the growth of winter annuals sown into either summer annual sod (Tables 1 and 2) or into bermudagrass (Table 3). Yield of winter annuals is generally greater when sown into volunteer annual grasses as compared with sowing into permanent *sod* (Lang et al., 1992), which is in agreement with current work reported in Tables 1-3. Permanent sods of bermudagrass tend to be denser than annual sods which may provide greater hindrance to seed to soil contact. However, stand density has generally been reported to be excellent regardless of the type of sod involved (Lang, 1989; Lang et al., 1992; Ingram et al., 1993; Lang and

Elmore, 1995). The difference in winter annual forage growth between annual sods and permanent sods is most likely due to the quantity of herbage and root mass remaining after hay removal and herbicide burndown. This material may contribute to nutrient immobilization (e.g., N), contain inhibitory substances (allelochemicals), or reduce soil atmospheric oxygen during decomposition (Lang, 1993).

Herbicide burndown and herbage removal were shown to stimulate winter annual growth compared with no herbicide burndown in some, but not all years (Tables 1-3). Lang and Elmore (1995) concluded that herbicide bumdown of volunteer annual grasses was beneficial in a wet year (1992), but not in a dry year (1993). There was no difference between using paraquat or glyphosate. In 1994-95, all plots were irrigated during establishment and the ryegrass growing in the burndown plots yielded more than the ryegrass sown into live annual sod indicating that soil moisture can be conserved by using a burndown herbicide. However, yield response in individual years was small (800 to 1000 lb/a) and may not be economical compared with removing the herbage with a final hay harvest or late summer grazing. Averaged over three yr, there was no advantage to using a burndown herbicide at the Starkville site (Table 1). No advantage to using a burndown herbicide was also not found in the small plots at the Newton site (Table 2); production pastures at Newton, however, have been routinely sod-seeded into volunteer annual grasses following herbicide bumdown 30 d prior to planting ryegrass in order to eliminate the herbage and conserve soil moisture.

Fall growth of summer annual grasses generally diminishes, although in wet, warm years, growth may be quite vigorous until first frost. Bermudagrass growth rate, however, reduces rapidly in the fall after about 15 September even when well fertilized and irrigated (Burton et al., 1988). Yields of winter annuals growing in live or suppressed bermudagrass were equal (Table 3) and this was in agreement with previous work (Lang et al., 1992; Johnson and Lang, 1997). However, plants sown in tilled plots yielded significantly more than those sown into sod.

Total winter annual forage growth enhanced by tillage has been found to be primarily due to enhanced fall growth (Lang, 1989; Brock et al., 1992; Lang et al., 1992; Lang and Elmore, 1995). Early fall enhanced forage growth provides for early fall grazing; average initial grazing date over four yr at the Brown Loam Experiment Station in Raymond, MS was 23 November for pastures seeded to ryegrass in a prepared seedbed, 4 December for those seeded NT into an annual sod, 17 December when seeded NT into an annual sod plus paraquat, 3 or 5 January for bermudagrass pastures seeded to ryegrass following light disking or paraquat, and 24 January for bermudagrass pastures seeded NT without herbicide supression (Ingram et al., 1993). Sod-seeding ryegrass into volunteer annual grasses provided nearly the same economic return ($80.94/a) compared with seeding into a prepared seedbed ($ 99.32/a). Using paraquat for sod-suppression of either the annual or perennial pasture reduced the economic return to $48.09 or $38.83, respectively (Ingram et al., 1993). They concluded that "planting ryegrass into volunteer summer annual grasses is a viable alternative to conventionally tilled ryegrass pastures in Mississippi".

Fully prepared seedbeds may provide additional forage growth particularly early in the seaso, but soil erosion may be high on some soil sites and year-round utilization of the land resource may be reduced. There may be numerous obstacles to sod-seedmg winter annuals, but most of these challenges can be overcome with timely utilization of moderate tillage, herbage removal prior to seeding, and limited herbage suppression with burndown herbicides. Insect control has not been fully investigated. A preliminay study at the Starkville site indicated there was no benefit to applying insecticides, all plots, including the control, had excellent stands. Insect damage, seedling disease, soil to seed contact, and soil moisture may contribute to some winter annual sod-seeding failures; however, there remains an unexplained suppression of sod-seeded winter annual forages that occurs regardless of stand success, N rate, soil moisture, sod type, or forage species.

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Table 1. Effect of burndown herbicide on yield of ryegrass sown into volunteer annual grasses (crabgrass and broadleaf signalgrass) at Starkville, Mississippi.

seedbed	Total Yield by Year			
Preparation	1992-93[1]	1993-94[2]	1994-95[3]	Three-Year Average
	lb dry matter per/a			
Burndown	4694 B	3218 B	5055 A	4322 B
Live Sod	3948 C	3323 B	4767 C	4021 B
Tilled[4]	7586 A	4243 B	4767 B	5532 A
LSD (0.05)	497	308	264	463

Means followed by the same letter within each column do not differ.
[1] Paraquat at 2 pts/a applied 11 Aug. 1992; planted 7 Oct. 1992; (Lang and Elmore, 1995).
'Roundup at 2 qts/a applied 10 Aug. 1993; planted 24 Sept.1993; (Lang and Elmore, 1995).
[3] Roundup at 2 qts/a applied 3 Aug. 1994; planted 16 Sept. 1994; 100 lbs N/a.
[4] Tillage (roto-tilling) was initiated when herbicide was applied on burndown plots

Table 2. Yield of ryegrass as affected by tillage, herbage removal, and burndown herbicide sown into broadleaf signalgrass at Newton, Mississippi, 1994 to 1996.

Seedbed Preparation	1994-1995	1995-1996	Two Year Average
	lb dry matter/a		
Deep Disk (DD) July	4319 AB	5076 A	4698 A
Deep Disk August	4585 A	4388 BC	4487 AB
Light Disk July	4015 BC	4667 AB	4341 ABC
Light Disk August	3967 BCD	4433 ABC	4200 BC
Hay Cut September + DD	4303 AE?	4216 BC	4260 BC
Hay Cut September + RU	3588 CD	3890 C	3739 D
Roundup (RU) September	3798 CD	4288 BC	4043 CD
Hay Cut September	3526 D	3911 C	3719 D
LSD (0.05)	463	649	425

Means followed by the same letter within each column do not differ. 'Marshall' ryegrass was planted the first week of October each year. Roundup at 1 qt/a was applied two to three weeks prior to planting. Final hay harvest was also two to three wk prior to planting as was the deep disking following hay harvest treatment. All plots received 65-65-65 at planting and an additional 34 lb N/a per harvest each yr.

Table 3. Yield of winter forages sown into bermudagrass sod as affected by tillage, herbicide suppression, and subsequent effect on bermudagrass growth and persistence at Newton, MS.

Seedbed Preparation	Three Year Average Total Yield		Final Stand of Bermudagrass
	Winter Forages	Bermudagrass	
	lb dry matter/a		%
No-Till (NT)	4068 AB	3826 A	74 A
NT + Roundup	3961 B	3093 B	63 AB
Single Disk	3956 B	2585 BC	33 B
Double Disk	4471 A	2154 C	27 B
LSD (0.05)	448	626	37

Means followed by the same letter within each column do not differ. Three-year average from 1989 to 1992. Data from Johnson et al., 1991; 1992; 1993. Roundup at 1 pt/a was applied in late August each year. Tillage was done in late August and all plots were seeded by the first wk of October. Winter forages were ryegrass, ryegrass + rye, and ryegrass + red clover. Means presented are the average yield of the three forages.