INFLUENCE OF CONSERVATION TILLAGE SYSTEMS ON RYEGRASS PASTURE AND STEER PERFORMANCE

David M. Ingram, W.K. Addison, and Rick Hardin[1]

INTRODUCTION

The practice of sod-seeding winter annuals has been researched extensively in Mississippi over the past four decades (Dudley and Wise, 1953; Coats, 1957; Lang et al., 1992). Interest in conservation tillage plantings of winter annuals into perennial and volunteer summer annual sod has increased since passage of the 1985 and 1990 Farm Bills, which prohibit establishment of winter forages on highly erodible land by traditional prepared seedbed (conventionally tilled) methods. Although sod-seeding winter annuals into perennial sod is a proven effective method of establishing winter annual forages, usually only late-winter and early-spring grazing are obtained from such establishment methods. The need for fall and early-winter annual forage production is essential to ensure adequate grazing for dairy farmers and cattle stocker operators in the southeastern United States. Ryegrass or ryegrass/small grain mixtures are the winter annuals most commonly utilized in winter grazing programs. Success in establishing winter annual forages into volunteer summer annual sod (primarily crabgrass and broadleaf signalgrass) has been obtained at two locations in central Mississippi (Brock et al., 1992; lngram et al., 1992) where sufficient forage growth for fall and early-winter grazing has been achieved. However, economic analysis comparing these systems with overseeded perennial sod and prepared seedbed ryegrass pastures has not been previously reported.

Management of volunteer summer annual sod prior to seeding ryegrass in the fall is an integral component to the success of conservation tillage winter grazing programs. Excess forage must be removed by clipping, grazing, or hay harvest prior to planting ryegrass. Summer annual forage production has been monitored (Brock et al., 1992) and generally has been grazed or harvested for hay prior to no-till seedings. Fertilization of summer forages might increase high quality forage production, resulting in a longer grazing season for cattlemen in the southeastern United States.

1 Brown Loam Branch Experiment Station, Mississippi State University, Raymond, MS 39154

The objectives of this study were to: (1) compare ryegrass planted into summer annual and Coastal bermuda sod with ryegrass planted into prepared seedbed pastures for stocker steer performance and economic comparison and (2) determine herbage mass accumulation of summer annual grasses at varying rates of nitrogen (N) fertilization.

MATERIALS AND METHODS

Six treatment combinations were compared for backgrounding stocker steer calves from 1988 to 1992 and were as follows: (1) prepared seedbed; (2) annual sod, paraquat burndown, plant no-till; (3) annual sod, plant no-till; (4) bermuda sod, disk lightly, drill; (5) bermuda sod, paraquat burndown, plant no-till; and (6) bermuda sod, plant no-till. Prior to planting ryegrass, excess summer forage on all sod treatments was cut for hay. 'Marshall' ryegrass was seeded at 35 lb/A in the fall of 1988, 1989, and 1991. 'Elbon' rye and 'Marshall' ryegrass were seeded at 120 and 20 lb/A, respectively, in the fall of 1990. Each system of management was applied to 6-acre paddocks, and each system was replicated twice. Paddocks remained in the same tillage treatment throughout the duration of the study. In the 1988 and 1989 grazing seasons, the bermuda sod, no-till treatment was seeded in mid-October, and in the 1990 and 1991 grazing seasons, it was seeded at the same time as the prepared seedbed paddock. Lime, phosphorus, and potassium were applied according to the soil test recommendation each year. Nitrogen was applied as ammonium nitrate to supply 51 lb N/A at planting, 34 lb N/A about mid-February, and 34 lb N/A on April 1 for a total of 119 lb N/A. When ryegrass reached a height of 6 inches, each paddock was stocked with 1.5 English-European cross steer calves/A (approximately 625 lb/A). All calves were wormed and implanted with a growth stimulant when purchased and again in mid-February. Calves for all plots were purchased at the same time and maintained in drylot until placed on ryegrass. In 1990-91, calves for prepared seedbed and annual sod plots were purchased in October and calves for bermuda sod plots were purchased in December. Continuous grazing was practiced; however, grazing pressure was adjusted at periodic intervals as determined by visual assessment of forage availability. Steers were weighed every 28

days and animal grazing days/A, average daily gain, gain/steer, and gain/A were calculated. Economic data were collected from the time of calf purchase to the time of sale. Dollar returns/A were calculated for each planting system.

In a separate study, volunteer summer annual grasses (primarily broadleaf signalgrass) were fertilized at 0, 30, 60, and 90 lb N/A in mid-June and herbage mass accumulation determined in mid-July. Four strips 30 ft wide and spanning the length of a paddock (approximately 150 to 200 ft) were marked for N application. Ammonium nitrate was applied with a spin spreader to the four strips in each of three replicate 6-acre paddocks on June 17, 1992 at the specified rates. On July 10, 1992, total accumulated forage from three 1.0 ft^2 quadrats per strip was harvested. Samples were dried at 140 F (60 C) for 36 hr and weighed for dry matter determination.

RESULTS AND DISCUSSION

Results from grazing studies are presented in Tables 1-5. In the 1988-89 winter grazing season (Table l), the greatest returns/A ($9632) were obtained with the annual sod planted no-till. Data were identical in the prepared seedbed and annual sod, no-till systems; however, pasture costs/A were 16.9% less in the annual sod, no-till plot, resulting in greater dollar returns/A Initial grazing dates occurred on December 7,1988 for these two treatments. All bermuda sod treatments resulted in negative returns/A in 1988-89. Mid-January to mid-February initial grazing dates for the other treatments resulted in low animal grazing days/A, ranging from 147 to 191. Although average daily gains were greater for steers grazing ryegrass planted no-till into bermuda sod, gain/steer and gain/A were lower than the annual sod, no-till and prepared seedbed systems. The lack of sufficient animal grazing days resulted in reduced returns/A. The late planting date for the bermuda sod, no-till system resulted in later initial grazing dates for this treatment.

In 1989-90 (Table 2), annual sod treatments were planted but the emerging ryegrass was destroyed by insects. These two systems were not replanted. All bermuda sod systems performed well in this year with positive returns/A. Sods treated with paraquat or lightly disked outperformed prepared seedbed ryegrass. Calves grazing the prepared seedbed ryegrass paddock were removed for 22 days due to limited available forage, resulting in greater feed cost/steer resulting in lower return/A. Again, the no-till bermuda sod system was planted about 1 month later than other treatments, resulting in fewer grazing days and the lowest return/A ($2656).

In the 1990-91 grazing season (Table 3), the no-till bermuda sod treatment was planted at the same time as prepared seedbed ryegrass. Typical initial grazing dates were obtained in the prepared seedbed and annual sod systems. All treatments resulted in positive dollar returns/A. Prepared seedbed ryegrass netted the most ($124.53), followed by annual sod, paraquat, no-till ($117.02), and annual sod planted no-till ($107.74). Bermuda sod treatments netted returns, ranging from $61 to $67/A. Initial grazing date was the same for all bermuda sod treatments January 11,1991. In the 1990-91 grazing season, different purchase dates for calves grazing prepared seedbed and annual sod plots, and calves for bermuda sod plots, resulted in a greater negative margin for bermuda sod plots at sale time causing lower returns/A. A mixture of rye and ryegrass was utilized in 1990-91 in attempt to increase animal grazing days/A. Growth of rye late in the grazing season made forage availability determinations difficult. Coupled with increased time, labor, and pasture costs, rye was utilized only in 1990-91.

No-till planted ryegrass did not perform as well in 1991-92 as in previous years (Table 4). The bermuda sod no-till systems resulted in negative returns, in contrast with the disked bermuda sod, which yielded the second best return/A ($52.02). In general, earlier grazing dates were obtained in this year, which resulted in higher animal grazing days, gain/steer, and gain/A for all treatments. However, forage became limiting in the bermuda sod no-till systems and steers were removed from paddocks for 22 to 33 days. Animal grazing days/A for these two treatments fell below 200 to about 185. The lack of sufficient days on grass resulted in higher feed costs and negative dollar returns. Prepared seedbed ryegrass produced the greatest return/A ($116.45).

The 4-year average from 1988-92 is presented in Table 5. All systems of planting resulted in positive returns/A; however, three systems produced less than $50/A returns to land and management. Bermuda sod, no-till; bermuda sod, paraquat, no-till; and annual sod, paraquat no-till produced $4.74, $38.83, and $48.09 return/A, respectively. Prepared seedbed ryegrass yielded the greatest net return/A ($9932). Annual sod planted no-till resulted in $80.94/A while the bermuda sod, disk, drill system produced $58.17/A Annual sod utilizing paraquat burndown before planting resulted in about 40% less return/A when compared with annual sod planted no-till. The cost of paraquat alone was not

Table 1. Conservation tillage systems for winter grazing stocker steer calves, Raymond, MS, 1988-89.

Sod-Seeding Treatment[x]	Animal Grazing Days/Acre	Initial Grazing Date[y]	ADG	Gain/ Steer	Gain/ Acre	Returns/ Acre[z]
			--lb--	--lb--	--lb--	--$--
Prepared Seedbed	250	12/07/88	2.52	421	632	72.88
Annual Sod Paraquat, No-till	191	01/16/89	2.72	345	518	8.01
Annual Sod No-Ti11	250	12/07/80	2.53	422	633	96.32
Bermuda Sod Paraquat, No-Till	191	01/16/89	2.65	337	506	-6.42
Bermuda Sod Disk, Drill	191	01/16/89	2.75	349	524	-15.04
Bermuda Sod No-Till	147	02/14/89	2.85	279	418	-47.24

x- Prepared seedbed disked two times, field cultivated and planted with a JD 8300 series grain drill. All sod plots were planted with a Marliss no-till drill. Paraquat applied at 0.3125 lb ai/A approximately 5-7 days prior to planting. Excess forage on all sod paddocks was removed as hay. All paddocks were seeded with 'Marshall' ryegrass at 35 lb/A. Average planting date 9/15/80 except for bermuda sod, no-till which was seeded on 10/17/88.

y- Paddocks were initially stocked with nine steer calves/6 acres (approximately 625 lb beef/A).

z- Dollar values are calculated from the time of purchase to the time of sale and reflect all feed costs, vet medicine, interest, pasture costs, death loss, shrinkage, and marketing.

Table 2. Conservation tillage systems for winter grazing stocker steer calves, Raymond, MS, 1989-90.

Sod-Seeding Treatment[x]	Animal Grazing Days/Acre	Initial Grazing Date[y]	ADG	Gain/ Steer	Gain/ Acre	Returns/ Acre.
			--lb--	--lb--	--lb--	--$--
Prepared Seedbed	252	11/20/8 9	2.03	341	512	83.43
Annual Sod Paraquat, No-till	---	--/--/--	----	---	---	-----
Annual Sod No-Ti11	---	--/--/--	----	---	---	-----
Bermuda Sod Paraquat, No-Till	207	01/11/90	2.18	301	452	168.48
Bermuda Sod Disk, Drill	207	01/11/90	1.96	270	405	134.14
Bermuda Sod No-Til1	147	02/20/90	2.27	222	333	26.56

x- Prepared seedbed disked two times, field cultivated and planted with a JD 8300 series grain drill. All sod plots were planted with a Marliss no-till drill. Paraquat applied at 0.3125 lb ai/A approximately 5-7 days prior to planting. Excess forage on all sod paddocks was removed as hay. All paddocks were seeded with 'Marshall' ryegrass at 35 lb/A. Annual sod paddocks were planted but were destroyed by insects. Average planting date 9/15/90 except for bermuda sod, no-till which was seeded on 10/19/90.

y- Paddocks were initially stocked with nine steer calves/6 acres (approximately 625 lb beef/A).

z- Dollar values are calculated from the time of purchase to the time of sale and reflect all feed costs, vet medicine, interest, pasture costs, death loss, shrinkage, and marketing.

Table 3. Conservation tillage systems for winter grazing stocker steer calves, Raymond, MS, 1990-91.

Sod-Seeding Treatment[x]	Animal Grazing Days/Acre	Initial Grazing Date[y]	ADG	Gain/ Steer	Gain/ Acre	Returns/ Acre[z]
			--lb--	--lb--	--1b--	--$--
Prepared Seedbed	259	11/23/90	2.30	418	594	124.53
Annual Sod Paraquat, No-till	240	11/26/90	2.32	416	591	117.02
Annual Sod No-Till	240	11/26/90	2.25	402	570	107.74
Bermuda Sod Paraquat, No-Ti11	210	01/11/9 1	2.47	338	517	64.29
Bermuda Sod Disk, Drill	218	01/11/91	2.46	336	534	61.56
Bermuda Sod No-Till	206	01/11/91	2.55	349	524	66.92

x- Prepared seedbed disked two times, field cultivated and planted with a JD 8300 series grain drill. All sod plots were planted with a Marliss no-till drill. Paraquat applied at 0.3125 lb ai/A approximately 5-7 days prior to planting. Excess forage on all sod paddocks was removed as hay. All paddocks were seeded with 'Marshall' ryegrass at 20 lb/A and 'Elbon' rye at 120 lb/A. Annual sod paddocks were planted but were destroyed by insects. Average planting date for all plots was 9/22/91.

y- Paddocks were initially stocked with nine steer calves/6 acres (approximately 625 lb beef/A).

z- Dollar values are calculated from the time of purchase to the time of sale and reflect all feed costs, vet medicine, interest, pasture costs, death loss, shrinkage, and marketing.

Table 4. Conservation tillage systems for winter grazing stocker steer calves, Raymond, MS, 1991-92.

Sod-Seeding Treatment'	Animal Grazing Days/Acre	Initial Grazing Date[y]	ADG	Gain/ Steer	Gain/ Acre	Returns/ Acre'
			--lb--	--lb--	--lb--	--$--
Prepared Seedbed	272	11/13/91	3.07	467	700	116.45
Annual Sod Paraquat, No-till	232	12/09/91	2.85	441	661	19.23
Annual Sod No-Till	202	12/09/91	3.00	465	698	38.76
Bermuda Sod Paraquat, No-Till	181	12/11/91	2.92	387	581	71.04
Bermuda Sod Disk, Drill	242	12/04/91	2.97	477	716	52.02
Bermuda Sod No-Till	185	12/19/91	3.28	439	658	27.29

x- Prepared seedbed disked two times, field cultivated and planted with a JD 8300 series grain drill. Paraquat applied at 0.3125 lb ai/A approximately 5-7 days prior to planting. Excess forage on all sod paddocks was removed as hay. All paddocks were seeded with 'Marshall' ryegrass at 35 lb/A. Average planting date for all plots was 9/20/91.

y- Paddocks were initially stocked with nine steer calves/6 acres (approximately 625 lb beef/A).

z- Dollar values are calculated from the time of purchase to the time of sale and reflect all feed costs, vet medicine, interest, pasture costs, death loss, shrinkage, and marketing.

Table 5. Conservation tillage systems for winter grazing stocker steer calves, 4-year average, Raymond, MS, *1988-92.*

Sod-Seeding Treatment"	Animal Grazing Days/Acre	Initial Grazing Date[x]	ADG	Gain/ Steer	Gain/ Acre	Returns/ Acrey
			--Ib--	--lb--	--lb--	--$--
Prepared Seedbed	*258*	*11/23*	*2.48*	*412*	610	*99.32*
Annual Sod Paraquat, No-till'	*221*	*12/17*	*2.63*	*401*	*590*	*48.09*
Annual Sod No-Ti11'	*231*	*12/04*	*2.59*	*430*	*634*	*80.94*
Bermuda Sod Paraquat, No-Till	*197*	*01/05*	*2.76*	*341*	*514*	*38.83*
Bermuda Sod Disk, Drill	*215*	*01/03*	*2.72*	*358*	*545*	*58.17*
Bermuda Sod No-Ti11	171	*01/24*	*2.74*	*322*	*483*	*4.74*

w- Prepared seedbed disked two times, field cultivated and all plots planted with a JD *8300* series grain drill. Paraquat applied at *0.3125* lb ai/A approximately *5-7* days prior to planting. Excess forage on all sod paddocks was removed as hay. Average planting date 9/17 (except bermuda sod, no-till).

x- Paddocks were initially stocked with nine steer calves/6 acres (approximately *625* lb beef/A).

y- Dollar values are calculated from the time of purchase to the time of sale and reflect all feed costs, vet medicine, interest, pasture costs, death loss, shrinkage, and marketing.

z- Three-year average.

sufficient to result in differences in returns/A of this magnitude. Lang (1990) reported that significant concentrations of ethylene were present in soil of both perennial and annual sods harvested for hay or chemically killed just prior to planting. It appears the concentration of ethylene may he high enough to retard ryegrass growth, and this may explain forage growth and animal performance differences among the annual sod systems. A similar condition may exist in bermuda sod plots; however, later planting dates in 2 of 4 years for bermuda sod planted no-till were responsible for lower returns/A for this treatment.

Data from this study indicate no-till seeding ryegrass into summer annual sod is a viable alternative to prepared seedbed (conventionally tilled) ryegrass pastures. In addition, the traditional method of overseeding perennial sods by lightly disking before planting still remains the best management system of planting ryegrass into permanent pastures. Data for the 4-year period suggest that average initial grazing dates of about December 1 and average animal grazing days/A in the range of 215 to 230 will result in steer gains suitable for profit, providing the negative margins from buying to selling are not too great.

Nitrogen fertilization influence on herbage mass accumulation of summer grasses is presented in Table 6. No significant differences were observed in total forage accumulation, regardless of N rate. On the average, forage dry matter ranged from 3,889 to 4,825 lb/A. With 60 lb N/A, only a 3.6% increase in dry matter occurred over the no N treatment. Brock et al. (1992) reported broadleaf signalgrass yields were in the range of 3,400 to 3,800 lb dry matter/A with no added N. The lack of forage growth response to Nmay be explained by the fact that plots used in the study were previously in ryegrass production and received 119 lb N/A annually. Residual soil N levels may have been sufficient to maximize signalgrass growth, thus, masking influence of additional N applications.

LITERATURE CITED

Brock, B., J. Murphy, B. Johnson, D. Lang, and D. Ingram. 1992. Overseeding winter annuals into volunteer summer annual sod. pp 34-37. In: Proceedings of the 1992 Southern Conservation Tillage Conference. Jackson, TN, 21-23, July. TN Ag. Exp. Sta. Special Publication 91-01.

Coats, RE. 1957. Sod seeding in the Brown Loam. Miss. Ag. Exp. Sta. Bull. 554.

Dudley, R.F. and L.N. Wise. 1953. Seeding in permanent pasture for supplementary winter grazing. Miss. AgExp. Sta. Bull. 505.

Ingram, D., E.G. Morrison, and R. Hardin. 1992. Minimum tillage for planting winter pasture. Miss. Ag. and For. Exp. Sta. Information Bull. 218. pp 12.

Lang, DJ. 1990. Utilization of crabgrass and broadleaf signalgrass following winter annuals. Proc. Southern Branch of the American Society of Agronomy. p 13. Abstr.

Lang, D., D. Ingram, B. Brock, and B. Johnson. 1992. Establishment of winter forages into summer annual or perennial sods. pp 94-97. In: Proceedings of the 1992 Southern Conservation Tillage Conference. Jackson, TN, 21-23, July. TN Ag. Exp. Sta. Special Publication 92-01.

Table 6. Influence of Nrate on dry matter accumulation of volunteer summer annual grasses, Raymond, MS, 1992.

Nitrogen Rate (lb/A)[y]	Dry Matter Forage (lb/A)[z]			
	Plot 1	Plot 2	Plot 3	Mean
0	3790	3758	4119	3889
30	4324	3636	4912	4291
60	4062	3703	4318	4028
90	4676	4423	5376	4825
LSD (0.05)	NS	NS	NS	NS
CV %	17.4	16.7	17.4	11.9

y- Nitrogen applied as ammonium nitrate on 6/17/92.

z- Three 1.0 ft^2 quadrat samples were taken per plot/N rate. Samples were cut with hand trimmer to a uniform height of 2 inches on 7/10/92.