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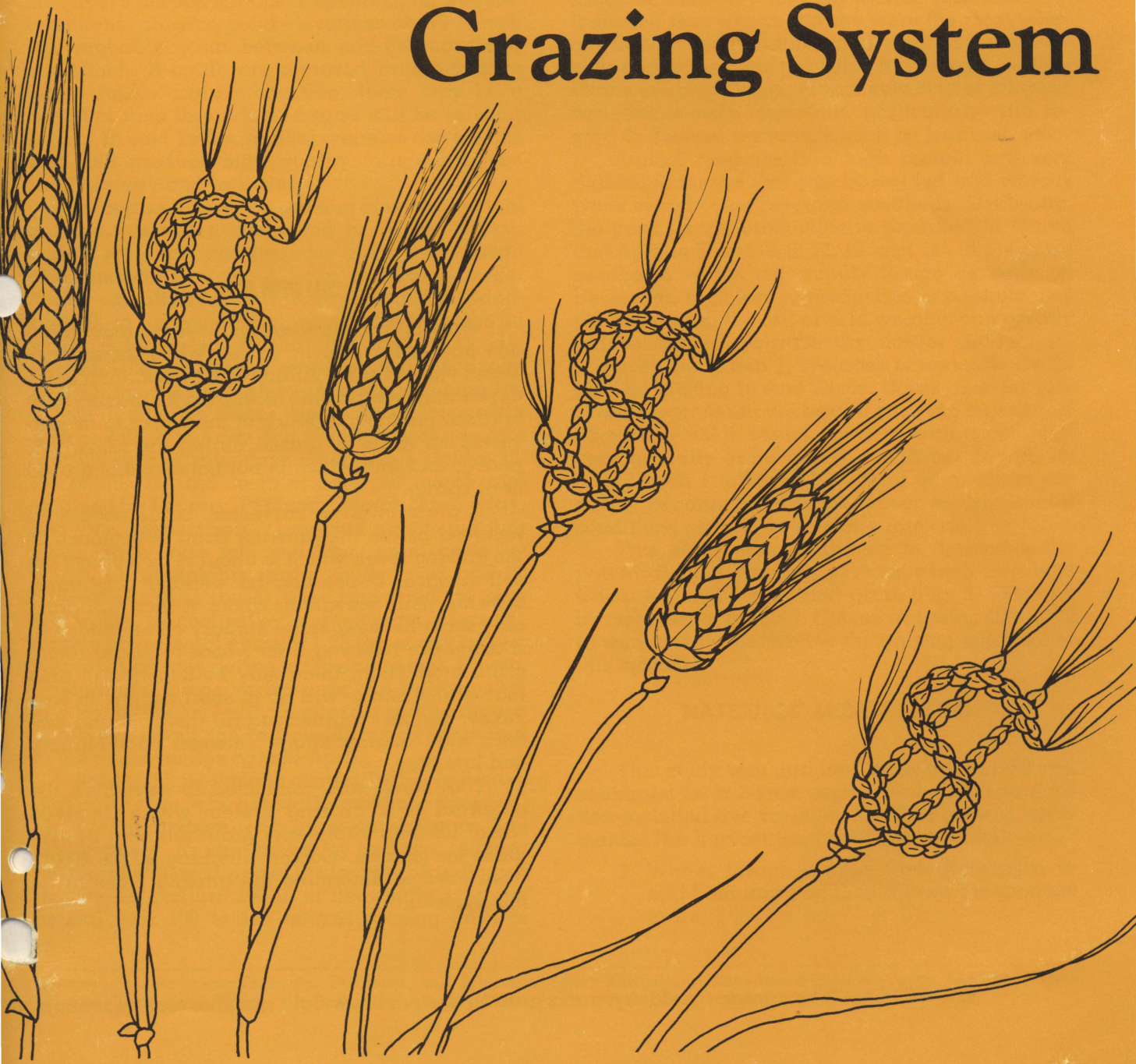

THE TEXAS AGRICULTURAL EXPERIMENT STATION / Neville P. Clarke, Director / The Texas A&M University System / College Station, Texas

SUMMARY

Wheat is an important cool-season annual forage and grain crop in Texas. Wheat acreage in Texas varies from 5 million to over 8 million acres depending on economic incentives for grazing and/or grain production. Much of the wheat to be harvested for grain is grazed during the fall-winter period, and that which is not harvested is grazed until spring.

If grain is to be harvested, cattle should be removed before the growing point is extended to the grazing level, which is about ½ inch above the soil surface. Depending on weather conditions, growing point elevations about ½ inch will probably occur between mid-February and mid-March. If cattle are removed from wheat to insure future grain production, there may be a period of time that winter forage will be in short supply. In east Texas, annual ryegrass can fill this void and produce high quality forage between mid-February and late May.

This study was conducted to determine the potential of a grazing system which involved wheat for both forage and grain followed by ryegrass for grazing. Calves weighing 400 to 600 lb were used to determine the grazing potential of this system.

KEYWORDS: Wheat/forage yields/ryegrass/grazing system/liveweight gain/harvest treatments.

Cash Wheat in a Wheat-Ryegrass Grazing System

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Wheat is an important cool-season annual forage and grain crop in Texas. Wheat acreage in Texas varies from 5 million to over 8 million acres (11) depending on economic incentives for grazing and/or grain production. Much of the wheat to be harvested for grain is grazed during the fall-winter period, and that which is not harvested is grazed until spring. If grain is to be harvested, cattle should be removed before the growing point (maristamatic tissue) is extended to the grazing level, which is about ½ inch above the soil surface. Depending on weather conditions, growing point elevations above ½ inch will probably occur between mid-February and mid-March. If cattle are removed from wheat to insure future grain production, there may be a period of time that winter forage will be in short supply. In east Texas, annual ryegrass can fill this void and produce high quality forage between mid-February and late May.

Numerous studies on grazing of winter annual grasses have been conducted in Texas. Wheat, barley, rye, oats, and ryegrass alone and in various combinations have been evaluated under grazed conditions (1, 2, 4, 7, 8, 17, and 21). Gangstad (6), at Renner, Texas, reported beef gains on wheat, oats, barley, and hardinggrass of 135, 119, 103, and 105 pounds per acre (lb/A), respectively. He also reported that while grazing a combination of oats and button clover, steers had a liveweight gain of 2.21 lb per day and 309 lb of beef per acre over 139 steer grazing days. An average yield of 25, 49, 74, 76, 72, and 16 lb of beef per month was obtained for January, February, March, April, May, and June, respectively. Gangstad also found that when cattle were removed from small grain by March 10, acceptable grain yields of 37 and 20 bushels per acre (bu/A) were harvested for oats and wheat, respectively. Rouquette and others (20) reported liveweight gains of 1.73 lb per day on rye-ryegrass pastures during a 170-day period. Protein levels in the forage varied from 25% in November to a low of 16% in April. *In vitro* dry matter digestibility was about 85% in November and decreased to the midseventies by mid-April.

Norris (15), working in central Texas, indicated that oat forage was generally preferred over barley, rye, and wheat for a graze-out program. The use of wheat, as well as barley and rye, reduced the risk of winter-killing of the forage. He indicated that on oat pasture 200 lb of liveweight gain per animal over 100 to 125 animal grazing days or about 2 lb per day can be expected. Norris (16) also obtained steer gains of 1.7 lb per day from oats grazed until March 1.

Conrad (3) observed that in south Texas, average total forage yields (over 2 years and 3 locations) for oats, barley, wheat, and rye were 3,500, 3,200, 3,400, and 3,200 lb of dry forage per acre, respectively. Earlier results at Overton in northeast Texas (9, 12, 13, and 14), have indicated annual forage dry matter (DM) yields of about 5,000 lb of forage for wheat with over 2,000 lb/A being produced in February through March. McDaniel (10) indicated that wheat and rye were the most tolerant to cold temperatures and were favored over oats and barley on the High Plains and Rolling Plains areas of Texas. Proper selection of adapted varieties is very important, particularly with regard to disease resistance such as leaf rust, etc.

Annual ryegrass is a high protein and very digestible forage that can be seeded into various types of sod or on prepared seedbeds. Generally, the peak forage production is produced in March and April in Texas (5, 9, 12, 13, and 14). In prepared seedbeds, which can supply forage as early as December, high forage production is possible. Dry periods during the fall or cold weather can greatly reduce winter ryegrass dry matter production, however, by March 1, ryegrass is normally available for grazing in east Texas. Under good fertility levels ryegrass should have a carrying capacity of about two 500-lb steers per acre with a potential average daily grain (ADG) of 2 lb per day (9, 18) from March 1 to May 15. Rate of gain, either per acre or per animal, is dependent on environmental conditions as well as stocking rate (19).

This study was conducted to determine the potential of a grazing system which involved wheat for both forage and grain (Fig. 1) followed by ryegrass for grazing. Calves weighing 400 to 600 lb were used to determine the grazing potential of this system.

MATERIALS AND METHODS

This study was initiated in the fall of 1980 and continued for a 2-year period. The wheat evaluation included five varieties and four harvest treatments. The harvest treatments were as follows:

1. Wheat forage grazed from November to mid-February and then allowed to produce grain;

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Figure 1. Wheat plots on left were for forage and plots on right for grain.

Figure 2. Cattle on grazed wheat plots with cages.

2. Wheat forage clipped from November to mid-February and then allowed to produce grain;
3. Wheat forage clipped from November throughout its active growing period; and
4. Wheat forage not clipped or grazed and harvested only for grain.

The wheat lines planted in each of the four treatments in 1980 were Coker 68-15, McNair 1003, Arthur 71, and breeding lines Tx-73-93 and Tx-72-9. In 1981, two of these lines (Arthur 71 and Tx-72-9) were replaced by TAM-W-106 and Northrup King 812 in an effort to increase grain yields.

In addition, a 34-acre field was planted to three wheat varieties for grazing. Cattle weights were monitored at regular intervals until mid-February when the cattle were removed and placed on a ryegrass pasture. The total amount of grain was measured to determine mean yields per acre. The wheat varieties were not replicated in the 34-acre field.

All wheat treatments were planted into a prepared seed bed. A preplant fertilizer application rate of 60 lb/A each of N, P_2O_5, and K_2O was applied each year. Prior to the first year of the study, agricultural limestone was applied at a rate of 1.5 tons/A. Nitrogen was topdressed at 100 lb N/A in October to all clipped and grazed plots, but not to the grain-only treatment. A 60-lb N/A rate was applied to all wheat treatments in February.

In 1980, plots were established in late September; whereas, in 1981, wheat was planted in early September. Forage yields were taken with a flail-type harvester on the clipped plots. On the grazed plots, wire cages were employed to protect the forage and an estimate of yield was obtained by hand clipping an area within the caged area on a monthly basis (Fig. 2). Cages were moved after each harvest and placed on a new site.

'Gulf' ryegrass was drilled at a seeding rate of 30 lb/A into a common bermudagrass sod in late October of both years. Fertilizer application to the ryegrass consisted of 50 lb/A each of N, P_2O_5, and K_2O applied at planting and 100 lb/A of N (total) in a split application applied in February and late March each year.

RESULTS

Forage yields. The forage yields from the wheat plots for the entire growing season are shown in Table 1. The yields in 1980-81 were quite low with a total mean yield of 4,362 lb/A. This was due primarily to the late planting date and the dry conditions that persisted during most of the growing season. In addition, there was some damage caused by the lessor corn stalk borer (during the fall) and greenbugs (in the spring). In 1980-81, the three higher yielding lines were Tx-73-93, McNair 1003, and Coker 68-15.

In 1981-82 (Table 1), higher yields were obtained because of early fall moisture availability. The mean total forage yield for all varieties was 7,162 lb/A. The highest yielding varieties were Tx-73-93 and McNair 1003.

On these plots, which were clipped at monthly intervals until mid-February (Table 2), very little forage was produced in 1980-81; however, in 1981-82 (Table 3), about 1.5 tons DM/A were harvested. Higher yields were obtained from plots grazed to mid-February (Table 2 and 3) compared to clipped plots in 1980-81, but not in 1981-82. There are two reasons why plots that were grazed produced higher yields in 1980-81. First, grazing pressure (and defoliation) probably was not as severe on the grazed area as it was on the clipped area. Therefore, less photosynthetic area (leaf surface) was present on the clipped plots to produce new foliage. Second, the grazed area may have had more total fertilizer nutrients available due to recycling of plant food nutrients. Another possible explanation is error in sampling due to different methods of harvesting. On the grazed area sampling error was very high and comparisons between varieties were not significant.

TABLE 1. FORAGE YIELD (LB OVENDRY WT/A) OF 5 WHEAT VARIETIES MECHANICALLY CLIPPED DURING TWO GROWING SEASONS

	1980-81 Harvest Date						
Variety	Dec. 12	Jan. 23	Feb. 16	Mar. 13	Apr. 7	May 7	Total
Coker 68-15	894	409	179	1711	920	613	4726
McNair 1003	715	588	204	1607	741	919	4774
Arthur 71	486	0	102	1430	996	537	3551
Tx-72-9	460	128	102	1558	996	537	3781
Tx-73-93	843	460	154	1686	1124	716	4983
Mean	680	317	148	1598	955	664	4362
CV	19	51	37	12	9	23	8
LSD (10% level)	169	206	70	237	105	191	460

	1981-82					
Variety	Dec. 16	Jan. 25	Feb. 18	Mar. 15	Apr. 28	Total
TAM-106	2018	1252	307	1252	2018	6847
Coker 68-15	2247	1048	307	1405	1839	6846
Northrup King 812	2452	843	256	1150	1890	6591
McNair 1003	2809	1073	256	1354	2222	7714
TX-73-93	3064	1047	333	1328	2043	7815
Mean	2518	1052	291	1297	2002	7162
CV	19	31	20	15	28	13
LSD (10%)	600	NS[1]	NS	NS	NS	1180

[1]NS = means are not significantly different at the 10% level of probability.

Cattle gains. In the 1980-81 season, 37 head of cattle with an average weight each of 371 lb started grazing wheat on November 21. Three weigh periods of about 30 days each were utilized and the calves were removed after 89 days. The ADG for the 1st, 2nd, and 3rd weigh periods were 0.29, 1.08, and 1.65 lb, respectively, for a mean ADG of 1.06 lb for the 89 days. The low ADG for the first period was the result of the calves becoming adjusted to the pasture situation and also because of limited forage due to a lack of rainfall. Rainfall amounts in inches for 1980-81 were: September—1.4; October—2.5; November—0.6; December—2.9; January—2.7; February—0.9; March—1.2; and April—2.5. The 2nd and 3rd weigh period gains were more respectable and indicate a fairly good gain for January and February. The calves were purebred Brangus and Brahman heifers and bulls. The total gain of 3,803 lb on the 34 acres resulted in a gain of about 112 lb of animal gain per acre.

In 1981-82, tester animals were made up of 10 Brahman heifers, 15 Brangus heifers (mean weight 400 lb), and 12 Simmental crossbred steers (mean weight 600 lb). Grazing was initiated on the wheat on November 3rd with ample forage being available. The ADG for the three groups of cattle (Table 4) indicate good gains in November and December but only small gains were made in January.

The total animal gain was 5,060 lb or an average of 150 lb/A during 1981-82. Low ADG in January was the result of a 10-inch snowfall which covered the forage for several days. In addition, due to the stress caused by the cold weather, several of the Brahman heifers became sick; the study was

TABLE 2. FORAGE YIELD (LB OVENDRY WT/A) OF 5 WHEAT VARIETIES CLIPPED THROUGH MID-FEBRUARY VERSUS REGROWTH OF GRAZED PLOTS IN 1980-81

	Mechanically clipped until Feb. 16 (not grazed) Harvest Date			
Variety	Dec. 12	Jan. 23	Feb. 16	Total Yield
Coker 68-15	639	358	205	1202
McNair 1003	664	562	307	1533
Arthur 71	486	77	26	589
Tx-72-9	333	102	0	435
Tx-73-93	588	384	205	1177
Mean	542	297	148	987
CV	18	39	32	19
LSD (10% level)	125	147	59	230

	Clipped after regrowth of grazed plots Harvest Date				
	1980		1981		
Variety	Nov. 19	Dec. 17	Jan. 14	Feb. 13	Total Yield
Coker 68-15	1415	672	791	97	2975
McNair 1003	1247	1008	863	664	3762
Arthur 71	1151	696	600	385	2832
Tx-72-9	983	792	144	447	2366
TX-73-93	1223	624	408	369	2624
Mean	1204	758	561	388	2912
CV	17	36	67	127	21
LSD (10%level)	NS[1]	NS	NS	NS	819

[1]NS = means are not significantly different at the 10% level of probability.

TABLE 3. FORAGE YIELDS (LB OVENDRY WT/A) OF 5 WHEAT VARIETIES MECHANICALLY CLIPPED UNTIL MID-FEBRUARY VERSUS REGROWTH OF GRAZED PLOTS IN 1981-82

Variety	Dec. 16	Jan. 25	Feb. 18	Total Yield
Mechanically clipped until Feb. 18, not grazed				
TAM-W-106	2324	1252	333	3909
Coker 68-15	1839	1047	330	3216
NK 812	1864	996	335	3195
McNair 1003	1788	970	330	3088
Tx-73-93	1584	996	281	2861
Mean	1879	1052	322	3253
CV	46	20	16	27
LSD	NS[1]	NS	NS	1126

Variety	Nov. 5	Dec. 2	Jan. 12	Feb. 4	Total Yield
Clipped after regrowth of grazed plots					
TAM-W-106	577	814	983	292	2666
Coker 68-15	529	886	767	401	2575
NK 812	804	587	984	288	2663
McNair 1003	493	994	678	336	2501
Tx-73-93	420	1043	1561	468	3492
Mean	565	864	995	357	2779
CV	20	30	47	32	21
LSD (10% level)	144	NS	NS	NS	1097

[1]NS = means are not significantly different at the 10% level of probability.

TABLE 4. CATTLE ADG (LB.) OF 3 WEIGH PERIODS AT OVERTON, TEXAS FOR 1981-82.

Type Animals	Nov. 3-Dec. 1	Dec. 1-Jan. 5	Jan. 5-Jan. 29	Total Period
Brahman heifers	1.3	1.3	0.2	0.9
Brangus heifers	1.2	1.3	0.9	1.2
Crossbred steers	3.9	2.3	0.7	2.3
Mean over all animals	2.2	1.7	0.6	—

TABLE 5. GRAIN YIELD OF 5 WHEAT VARIETIES IN BU/A OVER 2 YEARS UNDER THREE FORAGE TREATMENTS

Variety	1980-81 Forage Treatment: Grain Only	Clipped to mid-Feb.	Grazed to mid-Feb.
Coker 68-15	55	48	32
McNair 1003	52	53	47
Arthur—71	31	43	38
Tx 72-9	40	45	42
Tx-73-93	59	59	57
Mean	47	50	43
CV	18	14	24
LSD	11	10	16

Variety	1981-82 Forage Treatment: Grain Only	Clipped to mid-Feb.	Grazed to mid-Feb.
Coker 68-1	32	23	17
McNair 1003	38	24	28
TAM-W-106	25	25	16
Northrup King	31	20	14
Tx-73-93	46	42	30
Mean	34	27	21
CV	28	26	19
LSD	14	9	5

terminated early (Jan. 29) to facilitate the administration of antibiotics to these cattle. The Texas Veterinary Medical Diagnostic Laboratory report indicated Fibrinopurulent pneumonia (which may have been viral) was the cause of the illness. Neither the Brangus nor crossbreed cattle were affected by the illness.

Grain yields. The grain yields in 1980-81 averaged 37 bu/A (Table 5) and were near average for east Texas. Through small samples, estimated yields were 43, 32, and 24 bu/A for McNair 1003, Coker 68-15, and Arthur 71, respectively. Since only Coker 68-15, Arthur 71, and McNair 1003 were planted in the large field, a large portion of the grain was produced by McNair 1003, and a small proportion was produced by Arthur 71. The small plot data indicated that if the Tx-73-93 experimental line had been planted over the entire large field in 1980-81, the average yield would have been in excess of 50 bu/A.

In comparing the treatments in Table 5 for 1980-81, the mean yield for the grain only plots (unclipped) was 47 bu/A. Highest yields were from Tx-73-93, Coker 68-15, and McNair 1003. Grain yield produced after the clipping treatment was 50 bu/A, or an increase of about 2 bu/A over the unclipped plots. Grain production following grazing decreased to 43 bu/A.

In 1981-82, extremely low grain yields were harvested from all treatments. The primary reason for this was that an extreme fungus disease epidemic, which was caused by frequent wet weather patterns, occurred during the head filling period. Secondly, a heavy ryegrass weed problem developed during the second year of continuous wheat. The most important diseases were leaf rust and *Septoria nodorum* blotch. A new race of leaf rust caused significant yield losses, particularly with Coker 68-15 and McNair 1003. *Septoria nodorum* blotch was severe on TAM-W-106 and Northrup King 812 as well as Coker 68-15 and McNair 1003. The mean wheat yield for the 34-acre area was 19 bu/A, which is certainly below the average expected yield (35 bu/A). Somewhat higher yields were obtained under plot conditions. For the grain only treatment (unclipped), a mean yield of 34 bu/A was harvested. The mean yields for the grain after clipping and after grazing decreased to 27 and 21 bu/A, respectively. This was a decrease of 21 and 38%, respectively, compared to the unclipped treatment. The highest yielding varieties were Tx-73-93 and McNair 1003 on all three harvesting treatments. The mean 2-year yield for the 34-acre field was 28 bu/A.

Cattle gains from ryegrass forage. In 1980-81, cattle grazed the ryegrass pasture for 87 days before the study was terminated, at which time there was ample forage available for an additional 30 days grazing. The ADG for each of the 3 monthly weigh periods were 1.05, 1.98, and 2.35 lb per day, respectively. The total ADG was 1.64 lb per day. The weight gain was about 4,522 lb or 150.7 lb/A. The estimated cost of growing the ryegrass pasture (overseeded on bermudagrass) was about $75.00 per acre.

In 1981-82, cattle grazed the ryegrass from February 4 for 113 days to late May. The ADG for the Brahman heifers was 1.43 lb. The Brangus heifers had 1.30 lb ADG while the crossbred steers had an ADG of 2.21 for the period. The total poundage of beef produced over the entire acreage was 7,448 lb for an average of about 500 lb/A during the 113-day period.

Profitability of this system. The cost of growing an acre of wheat in east Texas under the management system utilized in this study was about $161.00. During the first year of the study, income including animal gains, (112 lb/A × $.65/lb = $72.80) and grain yields (37 bu/A × $4.25/bu = $157.00 per acre) was $229.80. Therefore, the wheat crop should have produced a profit of $68.80/A. Even in a disastrous year when severe epidemics of fungus diseases cause extremely low grain yields, the wheat made a profit. In the second year of the study, animal gains of 150 lb/A (at $.65/lb = $97.50) and only 19 bu of grain/A (at $3.75/bu = $71.25), resulted in an income of $168.75 per acre. The net profit would have been about $7.75 per acre. Data from this study indicate that by using wheat as a dual purpose grazing-grain crop, there is a high probability of making a profit.

Disadvantages of producing wheat in a grazing/grain system in east Texas are:

1. There is a lack of soil moisture for planting in September.
2. Fungus disease, which may occur on wheat, can greatly reduce grain yields.
3. Availability of grain handling, drying, and storage equipment may be problematic.
4. Weed problems (cheat and ryegrass) will reduce grain yields and increase harvesting difficulties.
5. There is a shortage of local wheat markets.

Advantages of producing wheat in a grazing/grain system are:

1. Costs of a dual purpose crop remain about the same while the cash crop (wheat grain) is a bonus.
2. The system provides an option that does not have to be decided until February.
3. There is increased efficiency of land, fertilizer, and equipment.
4. Risk is reduced, particularly for a grain only crop.
5. Acreage harvested for grain will qualify for federal farm programs.

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