Progress and Final Report for Farm Bureau

Grazing corn in an integrated crop and livestock management system

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Introduction:

Combining no-till corn production with steer grazing could increase benefits to landowners by integrating livestock production and wildlife management on private lands in Mississippi. As cattle graze corn in the field, open area, residual grain, and bare ground is created for preferable mourning dove foraging. No-till farming allows for the emergence of plants that drop seed desirable to doves. While steers gain weight, a dove field is created providing the landowner with fee/ lease hunting possibilities. Two different sets of steers were used in this project. One set was produced at the Brown Loam Branch Experiment Station and used on the station. The other set of steers were purchased from Farm Bureau member Joe Bell at Lena, MS, and represent typical southern winter grazed steers. These steers had an initial average weight of 875 lbs and were held on summer grazing until corn was ready to begin grazing in late July 2005 and Mid-August 2006.

Site differences:

Mississippi State University houses the university farm, which is located in Starkville, and is in far north central Mississippi. The soils are typically heavier soils with textures ranging from loams to clays and tend to be highly eroded. The terrain is rolling and steep slopes are not common. The ideal corn planting period is the first of April.

Brown Loam Branch Experiment Station is located in Raymond, which is in central Mississippi, southwest of Jackson. The soils are loamy and derived from wind blown deposits. The terrain is gently rolling. Ideal planting period is mid to late March.

Objectives:

1. Determine animal and economic performance of steers grazed on standing corn at two different stocking rates, 2 steers/acre or 1.25 steers/acre, based on 100 bu/acre yield.
2. Evaluate feedlot performance, carcass quality and acceptance of steers produced in these systems.
3. Evaluate corn yield response to rate and sources of N (Ammonium Nitrate, Urea, NureaNPK and Agrotain) at two locations for no-tillage corn in southern pasture species.

Year 1 (2005):

Planting at both locations were delayed due to extreme weather. At Brown Loam the planting did not occur until early-April and at MSU planting was delayed until mid-April. Corn was planted using no-till techniques into existing pastures. Ideal growing conditions were experienced at both sites during the remainder of the growing season. Corn was sampled for yield and productivity was 140 bu/acre at Brown Loam and 120 bu/acre at MSU. Sites were divided into two approximately equal size paddocks using electric fence. Grazing was initiated on both sites during the last week in July using controlled grazing to limit access to 1 to 3 acres depending on location. Once the animals had consumed most of the corn in that area they were allowed access to a new 1 to 3 acre area with continued access to the area they had just grazed. Due to previous problems with the soybeans as a protein source this was changed to providing the steers extra protein in the form of corn gluten pellets at a rate of 2 lbs per head per day and loose mineral was provided free choice. During the 2005 study period, 32 steers grazed a 21-acre site located at the Leveck Animal Research Center (LARC) in Starkville, Mississippi (high stocking rate side n=21 and low stocking rate side n=11). In 2005, grazing began in late July ending in late October yielding 90 days of corn grazing by the steers. At MSU, average weight of cattle pre-grazing was 1029 lbs, while weight post-grazing was 1229 lbs. Average daily gains of 1.81 were recorded in 2005. During 2005, a total of 58 steers grazed a 30-acre site located at Brown Loam (high stocking rate side n=39 and low stocking rate side n=19). At Brown Loam, average weight of cattle prior to corn grazing was 915 lbs and at the end of corn grazing was 1107 lbs, with average daily gains of 2.2 lbs were recorded.

Hurricane Katrina did have a major impact on both sites. At the Brown Loam station approximately 40% of the corn on the high stocking density paddock and 65% of the low stocking

density paddock was knocked down by the storm. Differences were because of the various slopes in each of the paddocks and the direction of the high intensity winds. Corn losses were lower at MSU but still exceeded 15% in the high density paddock and 20% in the low density paddock. Steers at Brown Loam had to be sent to the feedlot much sooner than anticipated. The Brown Loam high density steers were terminated approximately 3 weeks early and the low density steers were terminated at least one month early and well before they had reached slaughter weights. The MSU high-density steers were terminated approximately two weeks early and the low density steers were closer to target grazing time. Steers were sent and fed out at Hondo Creek Cattle Co, in Edroy, TX. The steers were on feed at the feedlot for about 88 days and then harvested. The South Farm steers had USDA quality grades as follows: Choice 42%, Select 47% and Hard boned 11%. The Brown Loam steers had USDA quality grades as follows: Choice 65%, Select 33% and Standard 2%.

Year 2 (2006):

Corn was planted at approximately the same time as the previous year. Sites were divided into two approximately equal size paddocks using electric fence. Grazing was initiated on both sites during the mid August due to drought conditions using controlled grazing to limit access to 1 to 3 acres depending on location. Once the animals had consumed most of the corn in that area they were allowed access to a new 1 to 3 acre area with continued access to the area they had just grazed. Due to previous problems with the soybeans as a protein source this was changed to providing the steers extra protein in the form of corn gluten pellets at a rate of 2 lbs per head per day and loose mineral was available free choice. In addition, the stocking density was rotated from the previous year, if the north site was high stocking last year it was low stocking this year and vice versa. However, due to extreme drought conditions throughout the state grazing was delayed due to the nitrate levels in the corn. Corn stalks and leaves had to be at safe levels (below 5000 ppm) for the cattle before they were allowed to graze the plants, thus the plants were more mature at the initiation of the grazing by the cattle which in turn took the cattle a little longer to learn how to eat the corn than the previous year. In 2006, grazing began in mid-August ending in mid-October yielding 60 grazing days. Days of grazing were reduced from 90 days in 2005 due to drought conditions, which caused concerns with nitrate toxicity in the corn plant. Nitrate testing was performed until plants reached nitrate tolerable levels for steers to begin grazing. At MSU the average weight of cattle pre-grazing was 942 lbs, while weight post-grazing was 1040 lbs.

Average daily gains of 1.90 were reported in 2006. At Brown Loam the average weight of cattle pre-corn grazing was 864 lbs and after grazing corn 60 days was 1033 lbs, with average daily gains of 2.4 lbs per day. Cattle were shipped and fed at the same feedlot in Edroy, TX and cattle were on feed about 90 days and then harvested. The South Farm steers (n=34 steers total) had quality grades as follows: Choice 24%, Select 71%, Standard 3% and Hard Boned 2%. The Brown Loam steers (n=31 total) had USDA quality grades as follows: Choice 71% and Select 29%. In 2006 from the MSU South Farm, six steers were harvested from the high stocking rate side of the field, two from the low stocking rate side and 2 steers from Starr Forest were harvested (Table 3). However, seven out of the ten steers had yellow fat, even though that should not impact taste of the beef, many consumers believe this to be unsightly and will not purchase beef with yellow looking fat. In addition, as shown in Table 3 the quality grades on these steers were not that impressive, they graded 70% Standard and 30% Select. Although due to drought conditions grazing in 2006 was reduced by 30 days, this would indicate that corn grazing for a longer period of time might be necessary to get more desirable carcass characteristics or have cattle with the genetic potential to mature and grade well (over 70% Choice) off of grass or corn grazing.

Corn Production/Yields:

Corn yield estimates were taken on the LARC and Brown Loam cattle-grazed sites (SHS) when corn reached the milk-ear stage of production. In 2005, corn yield on LARC was estimated at 120 bu/acre. By comparison, a conventionally- harvested site (CHS) in Starkville, MS located 8 miles from the LARC site yielded 115 bu/acre after combine harvest. Due to drought conditions in 2006, 78 bu/acre were estimated on the SHS; whereas, 81 bu/ac was the yield after combine harvest of the same CHS of the previous year. Corn yield decreased 30% – 35% from 2005 to 2006 at the MSU site. On Brown Loam SHS, corn yield estimates for 2005 were 140 bu/acre and in 2006 corn yield estimates were about 70 bu/acre. Brown Loam CHS, located on the experiment station approximately 2 miles from the SHS, yielded about 70 bu/acre in 2005 and 80 bu/acre in 2006. Corn yield decreased about 50% from 2005 to 2006 at Brown Loam and thus animal stocking rate per year was based on corn yield for that year. In 2005 at Brown Loam after the completion of corn grazing a remaining corn check was performed to estimate corn left on the ground by the steers. Six randomly selected sites on each side were used and corn counted that

was located in a 13’ 9” foot space at that site. For the low stocking rate site it was estimated that a total of 42 bushels was left on the ground and for the high stocking rate site it was estimated that a total of 5 bushels was left on the ground.

Mourning Dove Use/ Residual Grain/ Desirable Wildlife Food Plants:

Vegetation conditions and waste grain availability in corn fields grazed by cattle may attract selected species of granivorous wildlife. Foraging and cover conditions in corn fields planted with no-till seed drill technologies may also yield greater availability of naturally colonizing food and cover plants. This work is part of an ongoing study (2005-2008) in which we are measuring vegetation characteristics, residual grain and other seeds, and use by mourning doves in two types of corn production systems: clean-farmed and conventionally harvested corn sites (CHS) and no-till planted and steer harvested sites (SHS).

Mourning dove numbers were greater on SHS when compared to CHS ($P < 0.05$) on both LARC and Brown Loam sites in 2005 and 2006. Surveys began in June of each year ending in January of each year, and dove numbers were averaged across both sites. Doves per survey during 2005 ranged from 0 – 600 on SHS with a mean of 111. By comparison, number of doves per survey on CHS, ranged from 0 – 29 with a mean of 3. Doves per survey during 2006 ranged from 0 - 207 on SHS with a mean of 40. By comparison, number of doves per survey on CHS, ranged from 0 – 3 with a mean of 0.5. Lower numbers of doves in the 2006 season may be attributed to the existence of more severe drought conditions than the previous year.

Residual corn kernels were collected, weighed, and averaged across both LARC and Brown Loam sites for the 2005 and 2006 seasons. Biomass of residual corn kernels on the soil surface were greater on SHS when compared to CHS in late summer ($P < 0.05$) and late fall ($P < 0.025$) averaging 13 bu/acre in September, 7 bu/acre in October, and 1 bu/acre in January. By comparison, biomass of residual corn in CHS was estimated at 4 bu/acre in September, 2 bu/acre in October, and 1 bu/acre in January.

Mean percent coverage of desirable dove food plants; such as, crabgrass, croton, spiny pigweed, panicgrass, etc., and amount of bare ground were calculated for SHS and CHS and averaged across both sites and seasons. Percent coverage of grasses and forbs was higher in SHS than CHS in late fall following harvest of corn with coverages of grasses and forbs >10% in SHS

and < 5% in CHS. Throughout both seasons, percentage of bare ground was greater on CHS (50% - 80%) when compared to SHS (1%-13%).

Conclusions/ Implications:

In no-till, steer grazed corn fields, cattle weight gains during 2005 and 2006 were comparable to average daily gains associated with traditional production systems, such as pasture grazing followed by finishing cattle on energy-dense grain in feedlots. An alternative option that might be able to yield a greater profit potential is to use cull cows on the corn grazing, adding value to cull cows through enhanced weight gain could possibly be a good option for utilizing corn grazing. In addition, cull cows would potentially harvest more of the dry stalks than the steers, which would traditionally consume fewer stalks once corn has reached maturity. Another bonus would be that the cull cows could be sold directly off of corn grazing and would not need to be sent to a feedlot until harvested. No-till steer grazed corn fields have the potential to attract mourning doves due to residual grain, natural foods, and open foraging conditions while producing weight gains in steers managed for beef production. Landowners using this production system can potentially increase income in the form of fee/lease hunting of dove fields and production of quality cattle.

Table 1. Growth and Carcass data from steers at the Brown Loam Experiment station from corn grazing studies in years 1 and 2.

	Year 1 (2005)		**Year 2 (2006)**		
Item	**High**	**Low**	**High**	**Low**	**P-value**
Beginning weight (lbs)	1071 ± 15	1116 ± 22	1081 ± 21	1043 ± 28	= 0.056
Ending weight (lbs)	1591 ± 22	1523 ± 33	1478 ±31	1412 ± 42	NS
Carcass weight (lbs)	969 ± 14	940 ± 20	863 ± 19	856 ± 26	NS
Average Daily Gain (lbs)	5.20 ± 0.14	4.06 ±0.21	4.41 ± 0.20	4.10 ± 0.27	=0.053
Dressing Percent*	63.4 ± 0.32	64.4 ± 0.48	60.9 ± 0.45	63.1 ± 0.61	NS
Rib fat thickness (in.)*	0.62 ± 0.03	0.61 ± 0.05	0.44 ± 0.04	0.55 ± 0.06	NS
Ribeye area (sq. in.)*	15.0 ± 0.22	14.8 ± 0.32	14.7 ± 0.31	14.6 ± 0.41	NS
Ribeye area/cwt*	1.55 ± 0.03	1.58 ± 0.04	1.71 ± 0.04	1.73 ± 0.05	NS
KPH (%)*	2.45 ± 0.06	2.39 ± 0.09	2.43 ± 0.09	2.41 ± 0.12	NS
Marbling Score*	517.7 ± 18.2	528.9 ±26.8	489.5 ± 25.4	491.8 ± 34.3	NS
USDA Yield Grade	2.7 ± 0.1	2.5 ± 0.2	2.5 ± 0.2	2.7 ± 0.2	NS

*Dressing percent or the percentage of the live animal that is actually carcass weight; Rib fat thickness measurement between the 12^{th} and 13^{th} ribs, used to determine USDA yield grade; Ribeye area measurement at the 12^{th} and 13^{th} rib interface; Ribeye area/cwt is equal to ribeye area per hundred pounds of carcass weight; KPH is equal to kidney, pelvic and heart fat expressed as a percentage of carcass weight; Marbling score is equal to USDA marbling score assigned by carcass data collectors: 200=Traces, 300=Slight, 400=Small, 500=Modest, 600=Moderate.

Table 2. USDA quality grade analysis of corn grazing cattle from the Brown Loam Experiment Station based on high or low stocking density grazing treatment in years 1 and 2.

	Year 1 (2005)		**Year 2 (2006)**	
Item	**High Stocking**	**Low Stocking**	**High Stocking**	**Low Stocking**
Choice (%)	42	23	48	23
Select (%)	26	7	16	13
Standard (%)	0	2	0	0

Table 3. Carcass data results from steers harvested in three different groups in 2006 from MSU South Farm directly off of corn grazing.

Animal ID	Live weight (lbs)	Carcass Weight (lbs)	Ribeye Area (sq.in)	KPH*	Yield Grade	Marbling Score*
70	1150	609	10.5	1.0	1.9	390
72	1070	632	10.9	1.5	2.2	280
S045	1215	677	10.3	1.5	2.7	340
S078	1235	679	10.9	1.5	2.5	300
75	1115	619	11.1	1.0	1.7	240
S156	1170	657	9.7	1.0	2.6	270
S053	1130	614	9.2	1.0	2.3	260
S092	1245	701	10.0	1.5	2.6	290
56	1135	632	9.2	1.0	2.2	220
66	1185	618	9.0	1.0	2.2	290

*Seven out of the ten steers had yellow fat as indicated by the grader, which is undesirable by many consumers. The quality grades of the steers were as follows: 70% Standard and 30% Select. KPH is equal to kidney, pelvic and heart fat expressed as a percentage of carcass weight. Marbling score is equal to USDA marbling score assigned by carcass data collectors: 200=Traces, 300=Slight, 400=Small, 500=Modest, 600=Moderate.

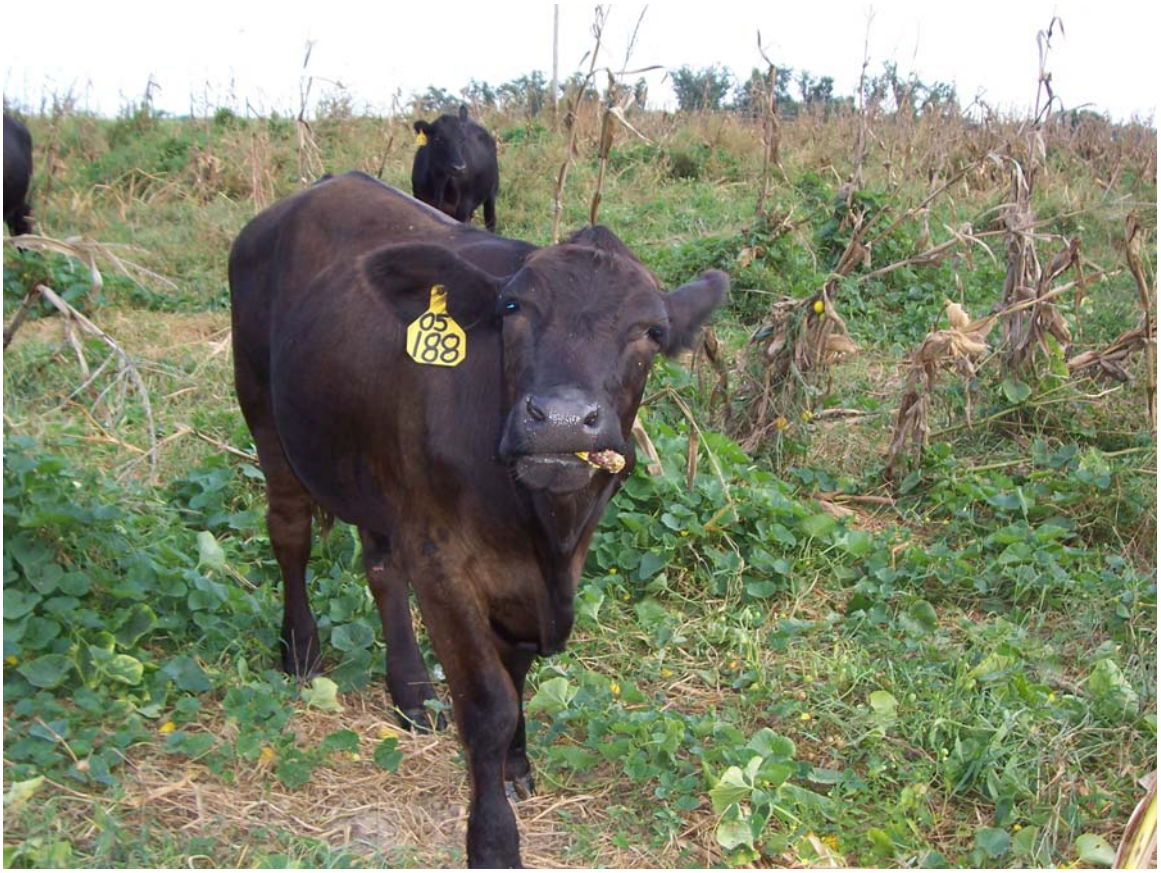
Corn grazed site that was currently being grazed by cattle at the Brown Loam Experiment Station.

Corn grazing site at Brown Loam Experiment Station, this indicates one of the areas where the site was divided into approximately 3 acre paddocks.

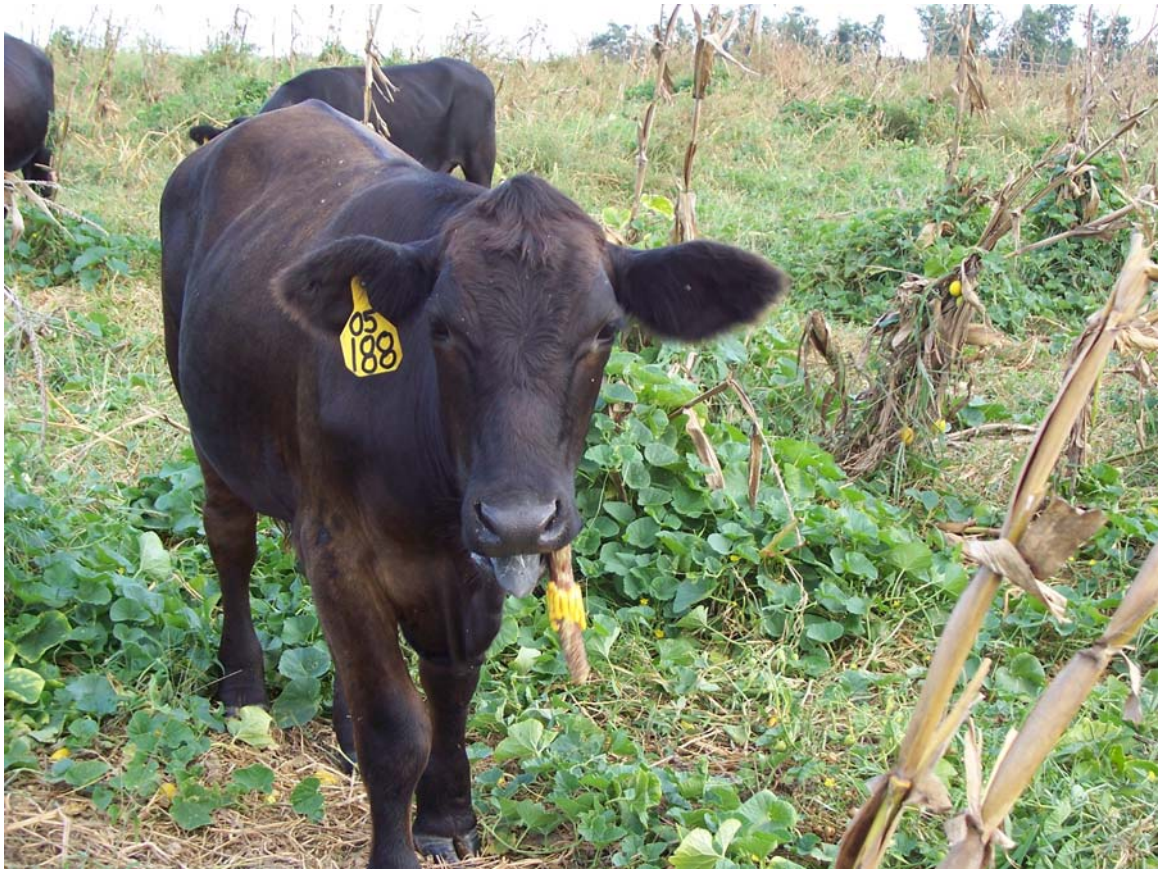
Steer grazing corn at Brown Loam Experiment station (low stocking density site).

Steer enjoying corn on the cob at Brown Loam Experiment Station.

Steers on the corn grazing site.



Steers in corn site (paddock 1) about to allowed access to next site (paddock 2).



Steer disposing of corn cob after eating most of corn off cob.

Corn grazing site at Brown Loam Experiment Station 2006.