

Principal Investigator

Dr. Ryon S. Walker
 University of
 Minnesota
 Extension
 550 Bunker Lake
 Blvd. NW
 Andover, MN
 55304
 763-767-3847
[Walke375@
 umn.edu](mailto:Walke375@umn.edu)
 Carlton and Itasca
 Counties

Project Duration

2008 to 2010

Award Amount

\$24,960.00

Staff Contact

Wayne Mosen
 651-201-6260

Keywords

annual cool
 and warm
 season forages,
 establishment,
 grazing, winter
 feeding areas

Methods to Establish Grazing of Annual Forages for Beef Cows on Winter Feeding Areas

Project Summary

This project evaluates annual forages and forage establishment methods for grazing in winter feeding areas. Winter feeding areas for beef cattle typically create buildup of manure that is often underutilized during the forage growing season and can cause some concerns with manure contaminated runoff into waters of the state. Due to the nature of most annual forages, their vigorous growth characteristics can compete with potential weed establishment in these winter feeding areas. This project will be conducted at two producer farms and on two sites at the University of Minnesota research center in Grand Rapids. The winter feeding sites will be moved around the farms each year.

We want to demonstrate that by establishing annual forages in these winter feeding areas, a producer can eliminate the additional cost and labor of hauling manure from these feeding areas out to pastures and use the nutrients available for newly seeded forages. By comparing three different seeding methods with a cool and warm season annual forage, our goal is to evaluate the effectiveness and efficiency of these forage establishment systems so that we can provide

recommendations for renovating winter feeding areas to reduce or eliminate hauling of manure to pastures, increase use of manure as fertilizer in the feeding area, increase total season forage production, and reduce manure contaminated runoff.

Project Description

Farm Descriptions. Troy Salzer and his family own and operate Sandy Hills Ranch, a commercial beef cow/calf and backgrounding operation. Sandy Hills Ranch consists of mostly improved cool season grass and grass/legume mix pastures, grown on a sandy soil, for grazing and haying. Troy uses intensive management practices for grazing these pastures as well as grazing alternative forages such as corn, brassicas, oats, peas, and sorghum-sudangrass to improve production efficiency on his operation.

Bob Staskivige has owned and operated B&G Ranch, a commercial beef cow/calf operation consisting of mainly shorthorn genetics, for 38 years. Bob grazes both naturalized and improved cool season grass/legume mix pastures grown on a clay soil, while intensively managing improved grass/legume

*Ryon observing
 the conventionally
 seeded BMR
 sorghum-sudangrass
 on the Sandy Hills
 Ranch winter feeding
 area.*



and legume pastures for hay production. Bob uses intensive rotational grazing while trying new methods to improve production efficiency.

The North Central Research and Outreach Center (NCROC), a cooperating location in this project, is approximately 380 acres of grazing land on a silty loam soil with 250 purebred Angus cattle. There are two sites at NCROC, South Farm and Main Farm.

Because the forage growing season is short in the Upper Midwest, beef cattle are typically fed in smaller, more confined areas for an extended period of time during the winter months. The feeding of cattle in a confined area creates excessive manure buildup. Manure buildup is a concern because it can lead to manure runoff into waters of the state. Most producers haul off the manure for fertilizer in pastures; however, this is not a very cost effective practice. By establishing annual forages in these winter feeding areas, a producer can greatly reduce manure hauling out to pastures and use the nutrients more efficiently for newly planted forages. Annual forages are of interest as they express characteristics for vigorous growth and can compete with weed growth in these wintering areas, providing a substantial amount of forage to alleviate grazing pressure on other pastures.

At each of the locations, there were six treatments established. We evaluated two forage species (cool season annual ryegrass and warm season Brown Mid Rib (BMR) sorghum-sudangrass) using three different forage establishment methods: conventional seeding (with heavy tillage), no-till inter-seeding, and broadcast seeding followed by light tillage for seed incorporation into the soil. Treatment sizes ranged from .5 acres to 3 acres in size.

In 2009, a separate experiment was conducted at the NCROC Main Farm evaluating only conventional tillage and no-till inter-seeding of annual ryegrass and sorghum-sudangrass on either a heavily wintered area or a sod base where no winter feeding was allowed.

All pastures used in the study were heavily wintered the previous winter with beef cattle. Cooperators managed each of the pastures so that winter feeding was rotated throughout the pastures as much as possible. Once cattle came off these winter feeding areas in late spring, soil samples were collected and pastures were divided and assigned to a treatment.

Evaluation of stand establishment was measured in early summer to determine if the annual forage used and the seeding methods were successful. During the forage growing season, forage yield, prior to cattle

turnout, and stocking rate data were collected for all three locations, based on forage establishment success. If stand establishment was less than 50% in a particular treatment, forage yield was not collected. Pregnant beef cows and/or pairs were used to graze each treatment paddock. After each grazing, pastures were allowed to rest for a minimum of 21 days before cattle were allowed to re-graze the treatment pastures.

In addition, the costs associated with each treatment were evaluated and used to determine which method(s) can be recommended to effectively and efficiently provide additional grazing in winter feeding areas during the forage growing season.

2008 Results

Soils

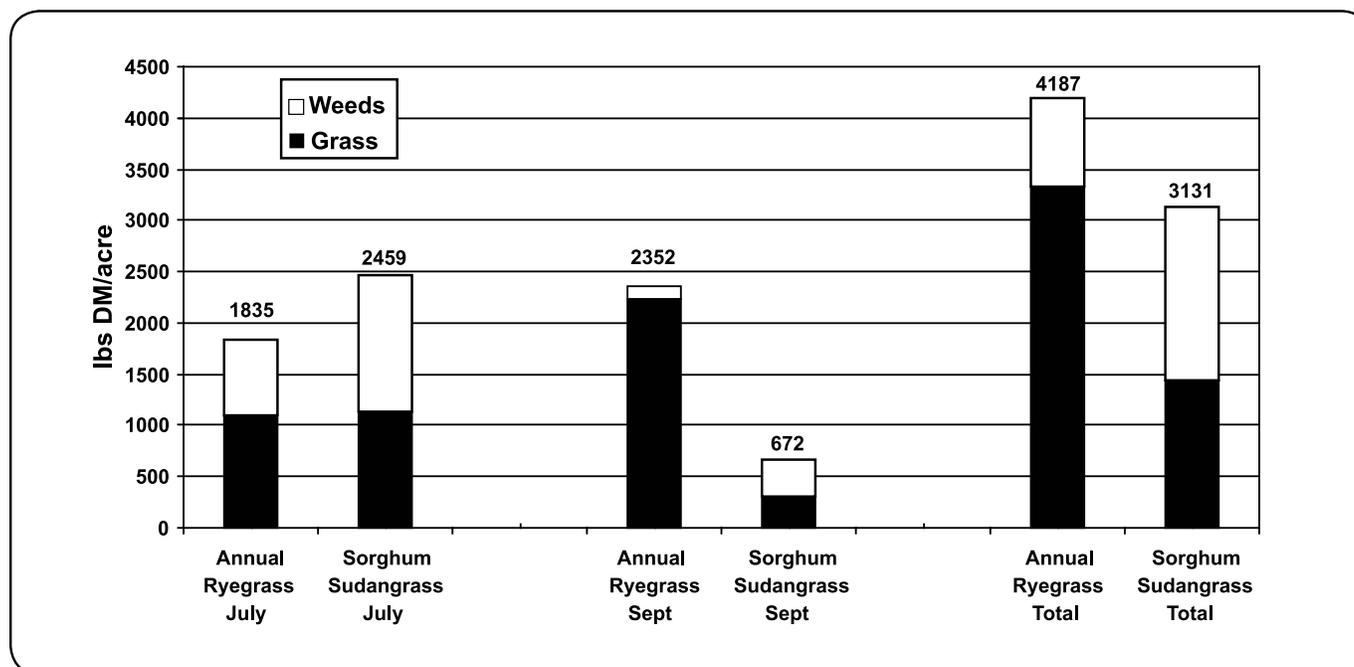
Soil samples were collected from each pasture at each location to establish critical soil nutrient values prior to pasture establishment in May. The concentrations for phosphorus (P) and potassium (K) ranged from 45 to 230ppm (P) and 300 to 2,200ppm (K) and were well above the maximum levels (P=21ppm and K=160ppm) recommended for root growth and development. It was evident that wintering cattle in confined feeding areas for any length of time creates rich sources of nutrients that can be used as fertilizer. The pH levels for all three project sites were greater than 6.0 indicating that soils were not too acidic.

Stand Establishment

Cool season pastures were seeded on May 27 at Sandy Hills Ranch and May 29 at B&G Ranch and NCROC. Warm season pastures were seeded on June 9 at Sandy Hills Ranch and June 11 at B&G Ranch and NCROC. Stand establishment was evaluated for each treatment at all three project locations in mid-July, estimating visually newly seeded forage cover as a percent of pasture cover.

- Broadcast seeding did not work with either forage species - all locations had less than 5% seed establishment.
- Inter-seeding had mixed results. Sorghum-sudangrass was poor at all three locations with 10% or less actual stand establishment. Annual ryegrass had good success at B&G Ranch with 70%, fair with 25% at NCROC, but poor with 5% at Sandy Hills Ranch.
- Conventional seeding was the most successful method. Sorghum-sudangrass had excellent success with 95% at Sandy Hills Ranch, good with 50% at NCROC, but poor with 5% at B&G Ranch. Annual ryegrass had great success with 90% and 80% at B&G Ranch and NCROC, respectively, and 70% at Sandy Hills Ranch.

Figure 1. 2008 Forage yield of each annual forage, weeds, and combination of forage and weeds for the conventional tillage method collected prior to each grazing at the North Central Research and Outreach Center.



Forage Yield

Forage yield was only collected at NCROC due to emergency use of pastures for grazing during the summer at the two cooperator locations because of drought. Forage yield was collected prior to each of the two grazing periods at NCROC. Figure 1 shows that forage yield of sorghum-sudangrass alone (no weeds weighed) was slightly greater (37 lb/A) than annual ryegrass in July, but significantly less (1,920 lb/A) than annual ryegrass in September. Annual ryegrass had a total season forage yield advantage of 1,883 lb/A. These numbers reflect yield of the forage species alone, without weeds.

Figure 1 also shows total forage production, including weeds, was greater for the warm season annual sorghum-sudangrass treatment during the first yield collection. This could be explained by the slow cool season annual ryegrass response to warmer temperatures, delayed planting to late May, and its limited ability to compete with weeds for establishment, if planted later in the season. Forage production of sorghum-sudangrass then tapered off due to cooler temperatures later in the summer, offering more advantage to the annual ryegrass.

Over the course of the summer, cattle grazed the B&G Ranch pastures three times whereas Sandy Hills Ranch and NCROC were grazed twice. Due to the setup at B&G Ranch, and with only annual ryegrass having limited success, cattle had access to all six treatments at the same time; therefore, stocking rate and number of grazing days

for each treatment were not collected for that location. Based on the stocking rate and number of grazing days recorded, and assuming that cow and calf weights are similar for both locations, we can estimate the number of grazing days/A that each annual forage provided for one animal unit (1 animal unit = 1,000 lb):

- At Sandy Hills Ranch, sorghum-sudangrass provided 180 days of grazing whereas annual ryegrass provided 40 days for one animal unit. Troy had great success with sorghum-sudangrass establishment and growth with less than 5% weed population in the stand; however, annual ryegrass established well, but growth was poor during the growing season.
- At NCROC, sorghum-sudangrass provided 152 days of grazing whereas annual ryegrass provided 162 days of grazing for one animal unit. The sorghum-sudangrass pasture provided more yield (with a high percentage of weeds) for the first grazing; however, annual ryegrass took off prior to the second grazing due to its vigorous cool season growth potential.

One of the things observed at NCROC was weed invasiveness in both conventional seeding treatments. These heavily wintered areas offer an optimal environment for weed growth. During the grazing period though, cattle consumed most of the weeds. By managing weed growth and maturity, palatability levels were acceptable to cattle if grazed at the right stage of production.

Table 1. 2009 stand establishment for all treatments at Sandy Hills Ranch, B&G Ranch, and NCROC South Farm.

Project Location	Broadcast		Inter-seeding		Conventional	
	AR*	SS*	AR*	SS*	AR*	SS*
Sandy Hills Ranch	30%	<5%	65%	90%	15%	80%
B&G Ranch	65%	<5%	85%	50%	80%	50%
NCROC (<i>South Farm</i>)	30%	<5%	75%	50%	95%	80%

*AR = annual ryegrass, SS = sorghum-sudangrass

Economics

Cost associated with each seeding method was not calculated in 2008 due to establishment failure of both broadcasting and inter-seeding methods at all three locations. In terms of the conventional method, the question is still unknown, is it worth using a conventional tillage system to seed annual forages?

- At Sandy Hills Ranch, sorghum-sudangrass was the best option for Troy as sorghum-sudangrass was cheaper to seed (\$22.50/A) vs. annual ryegrass (\$26.50/A) and based on grazing data produced 140 more days of grazing/A for one animal unit.
- At NCROC, annual ryegrass was the best option. Even though sorghum-sudangrass seed was \$4.00/A cheaper, annual ryegrass produced 1,883 lb/A more forage than sorghum-sudangrass.

2009 Results

Soils

New project locations were established in 2009. Soil samples were collected in May to establish critical soil nutrient values prior to pasture establishment. Concentrations for phosphorus (P) at all locations were >100ppm, well above the maximum levels (P=21ppm) recommended for root growth and development. Potassium levels at all locations ranged from 155 to 2,200ppm and were well above the maximum level for growth and development (K=160ppm), except at the NCROC *South Farm* where K levels were below the maximum threshold (142ppm), but still adequate. The pH levels for all project sites were greater than 6.0 indicating that soils were not too acidic, with the exception of NCROC *Main Farm*, where soils ranged from 5.4 to 5.9.

There were noticeable differences in pH and organic matter at the NCROC *Main Farm*. Areas that were heavily wintered on had higher pH and organic matter while areas where there was no winter feeding had a lower pH

and percent organic matter, which could be attributed to differences in manure accumulation. It is evident that wintering cattle in confined feeding areas for any length of time creates rich sources of nutrients, such as P and K, which can be utilized as fertilizer, as well as potentially increasing the organic matter concentration in those soils.

Stand Establishment

Annual ryegrass was seeded on May 5 at Sandy Hills Ranch, June 2 at B&G Ranch, and June 3 at NCROC *South Farm*.

BMR sorghum-sudangrass was seeded on June 11 at NCROC *South Farm*, June 13 (broadcast and inter-seeding treatments) and June 19 (conventional treatment) at Sandy Hills Ranch, and all treatments June 16 at B&G Ranch.

It is evident that, in 2009 as in 2008, the broadcast method had limited establishment success with annual ryegrass and did not work with sorghum-sudangrass (Table 1). Inter-seeding and conventional tillage in general had good success while location impacted species success. Annual



Shows difficulty of establishing annual ryegrass on an area consistently used for winter feeding at the NCROC Main Farm.



Strip grazing annual ryegrass on winter feeding area at Sandy Hills Ranch.

ryegrass grew well at B&G Ranch and at both NCROC sites, but establishment was low for the conventional tillage treatment at Sandy Hills Ranch.

Much thought went into why the establishment of annual ryegrass with conventional tillage was so low at Sandy Hills Ranch in 2009 and was so good at the other locations. In previous years Sandy Hills Ranch has had success conventionally seeding annual ryegrass; however, forage yield has been poor. It is logical that because Sandy Hills Ranch has a sandy soil, when preparing the soil with heavy conventional tillage, some organic matter is broken down; allowing moisture to evaporate or drain at a faster rate than if the soil was not broken. Breaking down organic matter in this soil type reduces the capacity of the soil to hold moisture for forage development and growth. Annual ryegrass requires significant amounts of moisture for establishment. The spring of 2009 was unusually dry, making it difficult to get newly seeded pastures established.

Sorghum-sudangrass grew well at Sandy Hills Ranch; however, establishment was only fair at B&G Ranch and at

both NCROC sites. It is not clear why sorghum-sudangrass had good establishment at Sandy Hills Ranch only, but with their location further south, it may have a longitudinal barrier for production due to its warm-season nature.

The results of the separate experiment at the NCROC *Main Farm* show that inter-seeding into sod did not work as well as conventional seeding. Annual ryegrass was seeded on May 21 and the sorghum-sudangrass was seeded on June 9.

Inter-seeding in the sod area did not work well for either annual ryegrass (5% success) or sorghum-sudangrass (0% success). In the winter feeding area there was better success with 75% establishment for annual ryegrass and 30% establishment for sorghum-sudangrass.

Conventional seeding at the *Main Farm* had great success with annual ryegrass at 85% in both sod and winter feeding areas and good success with sorghum-sudangrass at 50% in both the sod and winter feeding area.

It is important to discuss differences seen in establishment success at the NCROC *Main Farm* based on soil management. Success for the inter-seeding method was very low for both annual ryegrass and sorghum-sudangrass in the areas where a heavy sod was present at seeding. Success may be limited as existing sod had the advantage once soil and air temperatures permit cool season forage growth. However, inter-seeding success may have improved if seeded earlier, allowing for the seed to be in place at the first opportunity for growth. Obviously, areas that were heavily manured had higher establishment success, similar to the conventional tillage method.

Forage Yield

Forage yield data were collected prior to each of the two grazing periods (Table 2). As a reminder, if stand establishment was less than 50% in a particular treatment, forage yield was not collected. As with 2008, the

Table 2. Total 2009 season forage yields for all treatments at each site.

Project Location	Broadcast (lb dry matter/A)		Inter-seeding (lb dry matter/A)		Conventional (lb dry matter/A)	
	AR*	SS*	AR*	SS*	AR*	SS*
Sandy Hills Ranch	0	0	4,050	2,880	0	5,117
B&G Ranch	312	0	5,186	5,619	1,969	0
NCROC (<i>South Farm</i>)	0	0	3,600	360	5,065	1,079
NCROC (<i>Main Farm</i>)			8,110	0	7,266	3,359

*AR = annual ryegrass, SS = sorghum-sudangrass

**Forage yield values collected from the winter feeding area only.

Treatments with stand establishment estimates of <50% have a value of 0 for forage yield.

Table 3. Number of animal unit months for each treatment at each location in 2009.

Project Location	Broadcast		Inter-seeding		Conventional	
	AR*	SS*	AR*	SS*	AR*	SS*
Sandy Hills Ranch	0	0	5.9	4.2	0	7.4
B&G Ranch	0.5	0	7.5	8.1	2.9	0
NCROC (<i>South Farm</i>)	0	0	8.2	3.9	11.7	4.5
NCROC (<i>Main Farm</i>)	0		12.0	0	11.1	6.7

*AR = annual ryegrass, SS = sorghum-sudangrass

broadcasting treatment had very little success producing insignificant yields. Surprisingly, inter-seeded annual ryegrass consistently yielded more than inter-seeding sorghum-sudangrass and both conventional treatments. Over 2 tons of dry matter/A were produced with inter-seeding annual ryegrass at B&G and Sandy Hills Ranch, with an impressive 4 tons of dry matter/A at the NCROC *Main Farm*.

Inter-seeded sorghum-sudangrass was highly successful at B&G Ranch, yielding over 2 tons of dry matter/A. However, we have consistently seen poor production at the NCROC site.

Conventional annual ryegrass has consistently been successful at the NCROC site with yields of 2.5 (NCROC *South Farm*) and over 3.5 (NCROC *Main Farm*) tons of dry matter/A. However, success was limited at the other two cooperator locations.

Conventional sorghum-sudangrass at Sandy Hills Ranch was excellent yielding over 2.5 tons of dry matter/A, as seen in the previous year, but has had poor production at both NCROC and B&G Ranch.

We were able to separate the weeds from the forage of interest and determine yields for each at both NCROC locations. The ratio of grass to weeds was higher for annual ryegrass seeding treatments vs. the sorghum-sudangrass seeding, particularly in the conventional treatments. As seen for the second year in a row, there is a large population of weed seeds in these winter feeding areas. However, if managed correctly, cattle will consume the majority of the established weeds. Pastures in the conventional sorghum-sudangrass treatments were tilled at the same time as the annual ryegrass treatments, however were seeded 8 to 44 days later. It is likely that in that time, some of the annual weeds developed and had a head start over the sorghum.

Over the course of the summer, cattle were allowed to graze each treatment twice at all locations. Based on forage yields collected for each treatment at each location, we estimated stocking rates/A based on animal unit months (AUM, 1 animal unit month = 1,000 lb animal eating 2.3% of their body weight in dry matter for 30 days) (Table 3). For example, if you take the highest stocking rate of 12 AUM/A (inter-seeding annual ryegrass) and spread that over a 5 month grazing period, you have a stocking rate of 2.4 AUM/A/year.

Economics

Costs associated with each seeding method were not calculated for some of the treatments due to establishment failure. Using the 2009 Iowa Farm Custom Rate Survey and current hay prices for November 19, 2009 (Sauke Centre Hay Auction) hay prices at \$80.00/ton dry matter, we estimated the seeding and harvesting cost and subtracted the value of hay produced/acre to get the value of standing hay (Table 4).

Seeding Cost

The cost of broadcast seeding is \$16.60/A (broadcast seeding w/tractor plus harrowing), no-till inter-seeding is \$15.80/A (no-till planter w/tractor), and conventional tillage is \$34.80/A without land rolling (disking-tandem, harrowing, and no-till planter w/tractor) or \$42.70 with land rolling (only used at Sandy Hills Ranch for conventional treatments). Seed cost/A this year was \$23.50/A for sorghum-sudangrass and \$18.75/A for annual ryegrass.

Harvesting Cost

Harvesting cost is \$15.90/acre (includes mowing and raking) and \$9.70/bale (baling large rounds without plastic wrap). Baling cost figured per ton is \$16.20 at 85% dry matter.

Looking at the value of standing forage after seeding and harvesting costs have been deducted, it is easy to see that while certain seeding methods and forage species work well

at certain locations, inter-seeding had the most consistent positive value for standing forage, with annual ryegrass having the highest average standing forage value for all locations combined.

After 2 years of trials, both conventional and no-till inter-seeding methods are proving to be good methods of establishing cool and warm season annuals into winter feeding areas. What is important is that there is good seed to soil contact. Broadcasting onto the existing sod or manure pack does not allow enough soil contact for good stand establishment.

Management Tips

1. Inter-seeding appears to be a good low-cost option but will depend on exposure of soil, reducing sod competition, and winter feeding management.
2. Match up your goals to the advantages of each forage species you are considering. Both warm and cool season annuals have different advantages.
3. Weed competition can become an issue in winter feeding areas where feeding is concentrated and sod is broken up. However, weeds may not be a total disadvantage. If you allow cattle to graze weeds at an early stage of development, the weeds are quite palatable, offering more total season forage yield.
4. Managing winter feeding areas by rotating the feeding sites evenly throughout the feeding area offers many advantages: exposure to more soil increases success for newly seeded forages, reduces buildup of manure and runoff, and improves efficient use of manure for forages to be seeded vs. hauling off manure.

Cooperators

Troy Salzer, Sandy Hills Ranch, Producer and Extension Educator, Barnum, MN

Bob Staskivige, B&G Ranch, Producer, Bovey, MN

Russ Mathison, University of Minnesota North Central Research and Outreach Center, Agronomist, Grand Rapids, MN

Paul Peterson, University of Minnesota Department of Agronomy and Plant Genetics, Agronomist, St. Paul, MN

Project Locations

Sandy Hills Ranch is located east of Barnum, MN. From Barnum go 6 miles on Cty. Rd. 6. Then take Sandy Lake Dr. north for .3 miles. The field site is located on the west side.

B&G Ranch is located northwest of Warba, MN. From Warba, go west on Hwy. 2 for .5 miles to Cty. Rd. 10. Go north on Cty. Rd. 10 for 5.7 miles. Go east on Cty. Rd. 445 for .3 miles, the field site is located on the north side of Cty. Rd. 445.

The NCROC *South Farm* is located 4 miles south of Grand Rapids. From Grand Rapids, take Hwy. 169 south for 4 miles. Go east on Harris Town Rd. (Cty. Rd. 64) for .5 miles. The field site is on the north side of Harris Town Rd.

The NCROC *Main Farm* is located 1.5 miles northeast of Grand Rapids on Hwy 169. Take left at second entrance to Itasca Community College (U of M Extension Service and North Central Research & Outreach Center).

Table 4. The value of standing forage, after seeding and harvesting costs, for each seeding method at each location in 2009.

Project Location	\$/A					
	Broadcast		Inter-seeding		Conventional	
	AR*	SS*	AR*	SS*	AR*	SS*
Sandy Hills Ranch	-51.25	-56.00	72.96	32.56	-77.35	73.90
B&G Ranch	-41.74	-56.00	107.57	116.01	-9.45	-74.20
NCROC (<i>South Farm</i>)	-51.25	-56.00	122.84	26.67	177.09	20.78
NCROC (<i>Main Farm</i>)	0		201.05	-55.20	162.92	66.88

*AR = annual ryegrass, SS = sorghum-sudangrass

Other Resources

Iowa State University. A publication on “2010 Iowa Farm Custom Rate Survey” at:

www.extension.iastate.edu/publications/FM1698.pdf

Minnesota Pollution Control Agency. Publication #8.45. October 2002. “Best Management Practices for Supplemental Feeding Areas” at:

www.pca.state.mn.us/index.php/download-document/3731-pastures-winter-supplemental-feeding.html

University of Minnesota Beef Center. A publication on “Establishing Winter Feeding Areas for Grazing” at:

www.extension.umn.edu/beef/components/pdfs/WinterFeeding_Walker.pdf