**REPORT**

**Multistate Project NC1181:** **Enhancing Resiliency of Beef Production Under Shifting Forage Resources**

**Period Covered: 10/1/18-9/30/19**

**Date: 10/10/19**

**Annual Meeting Date and Location: 8/15/19- 8/16/19 at West Central Research and Extension Center; North Platte,NE**

**Participation:**

 On Location: Karla Wilke, Jerry Volesky, Mitch Stephenson, Daren Redfearn, Mary Drewnowski, University of Nebraska-Lincoln; Walt Fick, Keith Harmoney, Kansas State University.

 Via Zoom Conference: Katana Lippolis, Iowa State University; Jaymelynn Farney, Kansas State University; Jay Parsons, University of Nebraska-Lincoln.

Administrative Advisor Deb Hamernik also joined via Zoom and gave a brief summary of the end reporting process as well as new points of emphasis for the new project going forward. Each participants reviewed their accomplishments and activities for the past year, and are summarized as follows below.

**Objectives**

1. Optimize the utilization of crop residues by grazing and harvesting and determine the effects on agroecosystems.
2. Evaluate strategies to increase efficient use and productivity of range and pasturelands through strategic timing and density of stocking and shifting species composition to more productive species.
3. Evaluate effects of integrating annual forage crops into year-round forage systems for beef production.
4. Develop innovative beef systems that match shifting forage resources.
5. Conduct multi-faceted education/extension program to disseminate research results, to include extension papers as well as regional conferences on the use of crop residues, annual forages, and range and pastureland by livestock.

**Accomplishments**

*Short-term outcomes:*

* Objective 1

A significant amount of progress was made in the area of grazing corn residue in the winter. The research conducted showed that beef producers can graze corn residue as a low cost feed option to improve sustainability without detrimental effects on the soil or subsequent corn grain productivity. However, based on a survey conducted by this group, 17% of farmers that do not allow grazing of corn residue stated that a lack of access to cattle is the major reason for not grazing their corn residue (i.e. no one has asked/ there are no cattle in my area). In fact, 10% farmers that did not allow grazing stated they would allow grazing for free and 35% would allow grazing at a rental rate between $1 -15/ac, which is within the range that 80% of farmers who are renting out grazing are charging. Thus we developed an exchange to assist farmers and cattle producers in finding each other and provide education at the same time. The Crop Residue Exchange came online in August, 2017. To date there are 281 registered users that have posted 45 listings available for grazing. Over 6,000 searches for grazing resources have been conducted on the Exchange and almost 600 views of contact information for available listings have occurred.

Integrated crop–livestock systems have included grazing both perennial grasses during the spring and summer and corn (*Zea mays* L.) residues during the winter. Our group identified opportunities for expanded corn residue use through grazing and provided an economic assessment for value-added grazing. Advantages for increased grazing use of corn residue include managing residue quantity in high-yielding environments, providing a source of supplemental revenue, and expanding integrated crop–livestock systems using a simple, but cost-efficient practice. We estimated the current economic value to the crop sector through grazing leased corn residue at over $95 million for Nebraska, South Dakota, Kansas, and North Dakota under current management. Additionally, gross economic value to the livestock sector in these states was estimated at greater than $191 million.

We evaluated the impacted of a prescribed burn in March or April on K31 fescue plots (96% endophyte infection) and found no difference in forage production among burn plots and a control that had forage mechanically harvested at the time of the March burn. Prescribed fires did not impact ergot alkaloid concentration in fescue (month x trt interaction; *P* = 0.12), but did reduce seedhead production in tall fescue by 50%. Frequency of annual forbs and grasses in the plots were not impacted (P = 0.57) by a winter prescribed burn.

* Objective 2

After 8 years of treatment application on Sandhills meadow, there is no difference in botanical composition and aboveground plant production among grazing systems (mob grazing, simple rotation grazing, and continuous grazing); and trampling of standing live vegetation is the greatest and harvest efficiency and yearling weight gain are the lowest for mob grazing. Overall soil properties did not differ among treatments and did not change over the 8 years of the study.

Working with the USDA Natural Resource Conservation Service, a GIS mapping system was used to complete the first comprehensive estimate of potential perennial forage grazing capacity in Nebraska. The results indicated that, under the assumption of 25 percent harvest efficiency, Nebraska was operating at near 100 percent carrying capacity. The annual supply of annual unit months (AUMs) was estimated at 21.8 million with a grazing value of over $875 million in 2017 dollars.

 We evaluated how precipitation influences plant production functional groups at different

spatial positions across a Sandhills landscape being managed under grazing strategies common in the area. Results indicated that position of the landscape strongly influenced plant production and plant production response to temporal variability in precipitation. Topography influenced variability in the amount of biomass functional groups provided in contribution to the total biomass. Including topographic position in research evaluating grazing strategies is important to track changes in spatially diverse landscapes. Producers can use the estimates provided in the research to better match forage demand with forage availability in wet and dry years.

Legumes were interseeded into tall fescue and Bermuda grass pasture in Kansas and were evaluated for animal performance. Legume addition had little effect on cattle performance. Cattle had greatest gains on pastures with nitrogen fertilization or tall fescue varieties with low endophyte infection or friendly endophytes.

Reproductive cattle in Kansas were stocked to mimic a modified intensive-early stocking (MIES) strategy. Replacement heifers stocked with the MIES strategy produced 34% more beef per acre compared to continuous season-long stocking, with no difference in reproductive performance. Cows stocked with the MIES strategy had calves early weaned half-way through the growing season in order to mimic MIES. Cows in the MIES treatment had greater end of growing season body weights, body condition scores, and final conception rates. End of growing season pasture forage production was not affected by the greater stocking rate of the MIES strategy with either replacement heifers or cow/calf pairs.

* Objective 3

The group explored the use of cover crops as an additional forage resource for growing

weaned calves. The majority of the work explored the opportunity to incorporate winter sensitive annuals into wheat or corn silage systems. Forage production of oats and brassicas typically ranged from 2,500 to 4,500 kg DM/ha when planted in August but timeliness of planting was key. These late summer planted small grains and brassica have high nutritive value and can be used to cost effectively grow calves post weaning. It was also found that they can be stockpiled for winter grazing with little loss in nutritive value. Some feedlot operations have incorporated the use of cover crops on corn silage ground for grazing of newly received calves.

* Objective 4

The group explored the potential for capitalizing on excess feedlot capacity by using intensive cow management systems. Data indicate that confinement of cowherds may be a viable alternative when forage resources for grazing are limited and that corn residues may complement an intensive cow-calf production system. Results from economic analyses of alternative cow-calf systems suggest that incorporating corn residue grazing decreased production costs. It was also found that confinement systems were most profitable when cows were fed a nutrient dense diet with limited intake. Due to lack of availability or high cost of perennial pastures, some cow-calf producers in Nebraska, Kansas, Illinois, and Iowa are using summer confinement of cows with limit feeding of nutrient dense ration.

*Activities*

* Objective 1

The first year of prescribed burning on Kentucky 31 tall fescue plots (96% endophyte infection) was completed at the MU Southwest Research Center in Mount Vernon in 2018. Burning was repeated in 2019 and data are continuing to be collected.

* Objective 2

The eighth and final year of treatment application was completed for a grazing study on upland Sandhills rangeland at UNL’s Barta Brothers Ranch. Final plant and soil data collection to measure the cumulative effects of treatments were completed during the 2018 field season.

The final season of a modified intensive-early stocking (MIES) strategy for reproductive cattle was initiated in Kansas. Cattle weight gains and body condition scores, as well as reproductive parameters, were quantified. Rangeland forage production and plant species composition data were collected.

* Objective 3

The fourth year data evaluating the use of oats planted after corn silage or high moisture corn for background calves and the subsequent impact on summer cash crop productivity was conducted.

Methods to evaluate nitrate and potential livestock toxicity was conducted in two projects: development of chute-side test for methemoglobin and physiologic differences of feeding dry versus wet high-nitrate feed.

Several years and locations worth of data was collected about warm-season and cool-season annual forage production, composition, and forage quality.

Two of three years of data collection for a project evaluating cattle production on forage radishes in a dual-purpose wheat system within a three-crop rotation has been completed, with the final rotation ending summer 2020.

Research finalized on a study researching different seeding rates of oats and spring peas at three locations in Nebraska. A joint project conducting on-farm data collection with producers using annual forages for cover and beef production was finalized in 2019 and results were reported in an MS student thesis.

* Objective 4

A replicated study in which late summer calving cows will be managed using cropland grazing and summer confinement compared to a perennial forage based system was initiated.

Extended dry-lot housing from breeding through weaning in spring-calving cows is being compared to perennial forage based systems.

* Objective 5

Research results were translated for use by producers and disseminated through meetings, electronic newsletters, podcasts, extension publications, and distributed through social media.

Information related to objectives 1 through 4 was disseminated to 712 producers at extension meetings led by the PI’s in this project. Additionally, information was distributed to over 6,500 producers, consultants and advisors through presentations and at other face-to-face meetings

A 10 day trip to Argentina presented research on confined feeding production of cows and annual forage grazing.

Individual rations and consultations were performed for producers feeding in confinement, and two producer meetings were held specifically for confinement cow options.

**Impacts**

Lower feed cost for cow calf producers in the north central region can be achieved with the use of crop residues and cover crops. At a multistate three meeting series organized by members of this project, producers valued the knowledge gained from results presented of crop residue and cover crop grazing studies in this project at $28/cow. The knowledge gained by producers attending meetings where information was distributed on using corn residue or cover crops as a feed resource or using alternative cow systems such as summer confinement was valued at $1 million dollars, based on post-meeting surveys of these producers.

A survey of NE farmers showed that for those not allowing grazing of corn residue, impacts of cattle on the soil was a major concern. Thus, research showing that cattle grazing corn residue does not cause significant amounts of compaction may increase opportunity for beef producers to winter cattle on this feed resource. Advantages for increased grazing use of corn residue include managing residue quantity in high-yielding environments, providing a source of supplemental revenue, and expanding integrated crop–livestock systems using a simple, but cost-efficient practice. We estimated the current economic value to the crop sector through grazing leased corn residue at over $95 million for Nebraska, South Dakota, Kansas, and North Dakota under current management. Additionally, gross economic value to the livestock sector in these states was estimated at greater than $191 million.

Although mob grazing, using ultrahigh stocking density during the growing season, is commonly reported to increase aboveground plant production and to increase soil organic matter and soil depth, we have found no improvement in vegetation characteristics or soil properties relative to other grazing strategies after 8 years on Sandhills meadows. Furthermore, mob grazing has not resulted in an increase in harvest efficiency, carrying capacity, or livestock performance. The additional infrastructure and human resource requirements of mob grazing compared to other grazing strategies does not appear to be justified.

The length of grazing period during the growing season on upland Sandhills rangeland does not affect aboveground plant production, botanical composition, or soil organic matter content after 5 years of treatment application. Stocking rate appears to be the principal management factor affecting vegetation cover regardless the length of grazing period.

Using management practices that mimic modified intensive-early stocking to increase beef cattle stocking density for breeding herds allows producers to maintain or increase cow numbers for beef production on fewer perennial grassland resources.

Distillers grains appears to be the best nutritional option for growing calves grazing corn residue. The addition of feed additives or urea does not appear beneficial. Corn supplementation does not provide the same animal performance as distillers grains.

Feeding lactating cows with calves in confinement when perennial pastures are unavailable can result in high feed costs, especially when using high quality alfalfa to meet animal nutrient needs. Cows can be successfully fed in confinement by substituting ground cornstalk residue, sugar beets, and wet distillers grains at the same nutrient content to replace alfalfa. This results in a feed savings of over 50%, which is a substantial cost reduction for a cattle producer.