**REPORT**

**Multistate Project NC1181:** **Optimizing land use for beef cattle production**

**Period Covered: 9/30/20-10/1/21**

**Date: 10/4/21**

**Annual Meeting Date and Location: 8/13/21 meeting held virtually with Mitch Stephenson hosting.**

**Participants: Mitch Stephenson, Karla Wilke, Jerry Volesky, Andrea Basche, Mary Drewnoski, Daren Redfearn, Jay Parsons, Bruno Pedreira, Keith Harmoney, Jaymelynn Farney, Walter Fick**

**Brief Summary of Annual Meeting:** Participants all joined via zoom connection. Participants shared research results obtained thus far in the project. Additional discussion was conducted on sharing information through webinars and other electronic media as well as getting back into in person meetings. Participants also discussed conducting a series of joint meetings across state lines as was done with the last project, after more results are finalized.

**Objectives**

* Enhance productivity and efficient use of pasture, rangeland, and other forage resources
* Create and evaluate opportunities to incorporate forage production within cropping systems
* Develop management strategies for cows/calf systems that use limited or no perennial pasture
* Assess economic performance, resiliency, and adaptability of the systems and management practices explored
* Improve stakeholder understanding of the systems and management practices evaluated

**Accomplishments**

*Short-term outcomes:*

* Objective 1: Enhance productivity and efficient use of pasture, rangeland, and other forage resources

The amount of forage that disappears when grazing late summer planted cool season cover crops in the fall/winter using set stocking suggests that there is a high rate of trampling losses which results in a reduction the amount of grazing days captured and lows the potential profitability. Allocating late summer planted cover crops improves forage utilization but lowers rate of gain for growing steers. However, the greater forage utilization, still resulted in greater gain per unit of land and a lower cost of gain, suggesting that strip grazing is can be a beneficial management strategy.

A study was conducted to introduce warm-season annual grass species into perennial cool-season grass pastures to increase dry matter production during mid-summer when perennial cool-season grasses would be more dormant. Establishing sorghum sudangrass in cool-season western wheatgrass improved forage production with a net increase of nearly 3 ton forage/acre greater than the cool-season grass alone. With timely precipitation occurring, vast improvements in production with limited pasture land resources is possible.

Rangelands that have been invaded by Old World Bluestem (OWB) are known to have a well populated OWB seedbank. Because of this, multiple years of herbicide application are likely needed to reduce established OWB populations and to control new seedlings that may try to establish in the second growing season following initial herbicide application. The control of established OWB and any potential injury to native vegetation following two years of herbicide application may result in more exposed soil surface area. A benign cover crop (pearl millet) to cover soil and provide erosion control may be beneficial on herbicide treated areas. An experiment was formulated to test the development of a possible system to control OWB, to prevent new seedling establishment, and to minimize subsequent erosion potential. Old World Bluestem is a heavy competitor with other vegetation. Establishing a cover crop to suppress OWB is unlikely, as remnant OWB becomes competitive before a summer cover crop is able to establish.

In 2021, a study interseeding warm season annuals into cool-season perennials was conducted to compare replacement heifer growth and development as compared to a warm season annual (crabgrass) and a warm-season perennial (bermudagrass). Heifers on the interseeded fescue treatment had the greatest total gains and gain per acre for the grazing period.

* Objective 2: Create and evaluate opportunities to incorporate forage production within cropping systems

Cover crops planted after corn silage harvest, spring wheat, or hybrid seed corn harvest provide an opportunity for grazing growing calves or cows in late fall and into winter. In the fall/winter of 2020, the final year of a three year study in which an oat monoculture planted in late summer at 100 lb/ac was compared to oats planted at 50 lb/ac with rapeseed included at 3 lb/ac. If was found that inclusion of rapeseed improved calf gain and lowers the cost of gain of growing steers grazing in late fall and winter. Thus, including rapeseed in late summer planted oats may be beneficial for producers who want to graze growing calves in the fall/winter.

In 2020, a multi-university (KSU and UNL) study was initiated to evaluate the effect of seeding rate and fertilizer on oat production in the spring and fall. Newer varieties of oats for forage have not been extensively evaluated in the central Great Plains and with increased opportunities to incorporate forage within established cropping systems, oats provide a potentially valuable alternative crop. Research was conducted at four locations across diverse environments. In 2021, year 2 of the study was completed at multiple locations in Nebraska and Kansas. More recent varieties of forage oat are able to achieve optimum forage yields at relatively low seeding rates. Both spring and fall oat plantings are able to supply optimum forage yield for their respective growing season at relatively lower seeding rates.

In 2021, the grazing treatments and plant data collection were completed for a long-term study evaluating the effects of grazing period length and stocking density This grazing study is being conducted on upland Sandhills rangeland at UNL’s Barta Brothers Ranch. A grant proposal to examine grazing treatment effects on several soil components is pending.

In Kansas, wheat yield following a summer where seventeen annual forages were planted and evaluated as a forage option whether grazed, hayed, or ensiled was determined. Plant species mixtures had no effect on wheat grain yield. Harvesting method did impact grain yield where during the summer if the annual forage was harvested as a silage, there was greater wheat yield in the subsequent crop.

* Objective 3: Develop management strategies for cows/calf systems that use limited or no perennial pasture

Previously our research has shown that limit feeding a mix of nutrient dense by-products such as distillers grains with low digestibility roughages such as wheat straw or corn residue is an effective and economical way to feed cows in confinement. However, it appears that this practice does appear to limit their rate of gain. Providing a separate ration to the calves can improve rate and cost of gains resulting in more profit potential when weaning 7 months of age.

* Objective 4: Assess economic performance, resiliency, and adaptability of the systems and management practices explored

Results from two studies of the economics of yearling grazing systems were published this year.

A Nebraska Beef Report article (Merical, Drewnoski, and Parsons) evaluated wintering practices combined with summer grazing practices and determined slow growth winter diets decreased economic incentives to graze past mid-summer due to market risk and historical weight/price slides. Fast growth winter diets combined with long summer grazing periods produced the most profitable results. These results were presented in a BeefWatch webinar and discussed in an associated podcast.

An Applied Animal Science article (Welchons, et al.) evaluated the performance of yearling steers on smooth bromegrass pastures and determined supplementation with distiller grains (SUPP) was $16-19 per head more profitable on average than fertilizing the pastures (FERT) or unfertilized pastures with no supplement (CONT). In the ten years analyzed, SUPP was most profitable in seven, FERT in two, and CONT in one, respectively.

* Objective 5: Improve stakeholder understanding of the systems and management practices evaluated

Results from studies associated with Objectives 2 and 3 have been presented at multiple on-line producer workshops.

Andrea Basche is a co-instructor on a new course being offered at UNL with 50 enrolled students (resident and online sections) titled “Cover crops in Agroecosystems.” The course is the first of its kind in the U.S. to focus specifically on cover crop management. The course is being taught in collaboration with eight other instructors at six institutions.

Kansas data has been shared in experiment station reports, in podcast, in popular press articles and on Ag Today (radio program from Kansas State).

Activities

* Objective 1: Enhance productivity and efficient use of pasture, rangeland, and other forage resources
	+ A multi-location study was conducted in collaboration with extension educators and producers to evaluate the effect of forage allocation when grazing late summer planted cover crops/annual forage in the fall/winter.
	+ The grazing time and intensity study on Sandhills subirrigated meadows was finalized. Preliminary results suggest that fall grazing is more detrimental on subsequent year biomass production than grazing later in the winter. However, more biomass availability and higher quality forage in the fall outweighs the potential negative effects on slightly reduced hay production during the following growing season. Results are currently being prepared for publication.
	+ Results from Sandhills studies associated with Objective 1 have been presented at multiple on-line producer workshops. Results from the meadow grazing studies were presented at multiple extension events including the Nebraska Section of the Society for Range Management (80 participants), UNL Drought and Monitoring online workshops ( over 100 participants) and the Gudmundsen Sandhills Lab open house (100 participants) by Stephenson and Volesky.
	+ Completed 2nd year of interseeding warm season annual into cool-season perennial and grazing with replacement heifers
* Objective 2: Create and evaluate opportunities to incorporate forage production within cropping systems
* The second year of a three year project to investigate the grazing potential of cereal rye, triticale and winter wheat for early spring use in the NCR, including the timing of the start of grazing and nutritive value of forage as measured by cattle gain was completed.
* The second year of a study to compare cereal rye, triticale and winter wheat for spring silage production in the NCR was completed. To better understand how each species may fit into a crop rotation the relative timing of maturation of each species coupled with the yield and nutritive value at various stages was evaluated.
* Preliminary results of multi-university studies evaluating effects of seeding rate and fertilizer on oat production were shared at multiple events with the UNL Crop Production Clinics (900 participants at multiple locations in Nebraska).
* Collected wheat yield following a summer annual forage to determine feasibility of an grain crop and forage crop rotation on crop ground.
* Objective 3: Develop management strategies for cows/calf systems that use limited or no perennial pasture
* The third year of replicated study in which late summer calving cows are managed using cropland grazing and summer confinement compared to a perennial forage based system was completed.
* The second year of a study to evaluate the nutritional management of the young calf when cow/calf pairs are managed in drylot was completed.
* Objective 4: Assess economic performance, resiliency, and adaptability of the systems and management practices explored
* An M.S. thesis was completed examining market risk management practices of Nebraska cattle producers including utilization of marketing tools and animal sales diversification strategies (Kalkowski, 2021, MS Department of Agricultural Economics). Results will be used as background information and provide a baseline for evaluation of alternative production systems.
* The first year of a study to quantify the impact of flexibility on cattle production systems was completed. The basic framework and methodology will be used to evaluate two case study examples applicable to this project.

* Objective 5: Improve stakeholder understanding of the systems and management practices evaluated
* Research results were translated for use by producers and disseminated through electronic newsletters, podcasts, extension publications, and distributed through social media.
* Presentations were given both virtually (webinars) and in person reaching 879 producers and consultants.
* Research results were translated for use by producers and disseminated through electronic newsletters, podcasts, extension publications, and distributed through social media.
* In Kansas, 3 extension presentations were given to ~150 participants

**Impacts**

From Oct 1, 2020 to Sept 30, 2021, progress was made to develop and continue proposed research projects evaluating rangeland and pasture management strategies, opportunities for forage production on croplands, and cow-calf management strategies with limited pasture.

Additionally, as many of these projects were completed, they were published, resulting in 10 refereed journal publications, one of which was a collaborative effort between two universities within the NC-1181 group. Getting research results out to a producer audience is equally important. This NC-1181 group of researchers was able to develop webinars resulting in over 4800 views. Information was also shared through electronic newsletters and podcasts with over 5000 subscribers and additional downloads from search engines. Although Covid-19 has had a negative impact on in-person meetings in 2020, there are meetings planned for late 2021 and into 2022 so results of these projects can be shared with producers in person, which can increase production and efficiency for them as research practices are incorporated.

**Outputs**

***Abstracts/Posters/Professional Presentations (Bold = authors from multiple states)***

1. Grabau, M.T., K.H. Wilke, and M. E. Drewnoski. 2021. Management of the Young Calf when Dams are Limit-Fed in Confinement. [ASAS Midwest Meetings.](https://academic.oup.com/jas/article-abstract/99/Supplement_1/116/6271749)
2. Calus, K.J., M. E. Drewnoski, D. D. Redfearn, M. T. Grabau, R. B. Mitchell. 2021. Winter Hardy Small Cereal Cover Crops for Grazing in Nebraska. [ASAS Midwest Meeting](https://academic.oup.com/jas/article-abstract/99/Supplement_1/117/6271747?redirectedFrom=fulltext)
3. Calus, K., D.D. Redfearn, R. Mitchell, J. Parsons and M.E. Drewnoski. 2020. Economics of Grazing Calves on Oats Planted after Corn Silage in Eastern Nebraska. [ASA-CSSA-SSSA annual meeting](https://scisoc.confex.com/scisoc/2020am/prelim.cgi/Paper/126827).
4. Anderson, L., H. Blanco-Canqui1, M. E. Drewnoski, J. MacDonald, K. Calus, M. Brinton, B. H. Hansen, K. M. Ulmer, Z. Carlson and F. H. Hilscher. 2020. Impacts of Grazing Corn Stover and Cover Crops on Soil Physical Properties Under Corn Silage and High Moisture Corn. [ASA-CSSA-SSSA](https://scisoc.confex.com/scisoc/2020am/prelim.cgi/Paper/131612) annual meeting.
5. Grabau, M., J. C. MacDonald, Z. Carlson and M. E. Drewnoski. 2020. Impacts of Stocking Density on Soil Physical Properties and Subsequent Soybean Yield When Cattle Are Grazing Corn Residue in the Spring. [ASA-CSSA-SSSA annual meeting](https://scisoc.confex.com/scisoc/2020am/prelim.cgi/Paper/126552).
6. Rosa, A.T., S. Stepanovic, S. Koeshall, C. Creech, K.L. Glewen, D.D. Redfearn, M. Drewnoski, R. Werle. 2020. Double cropping field pea with shorts season grain crops, forages, and cover crops in eastern Nebraska. In 2020 Annual Meetings Abstracts ASA, CSSA, SSSA, Madison, WI.
7. Kuhn, A., D**.** Redfearn, L. Anderson, and H. Blanco. 2020. Crop response following grazed corn residue and cover crops. In 2020 Annual Meetings Abstracts ASA, CSSA, SSSA, Madison, WI.
8. Redfearn**,** D**.**D**.**, R. Mitchell, M. Stephenson, and J. Volesky. 2020. Opportunities and implications for moving native species beyond their adapted range. In 2020 Annual Meetings Abstracts ASA, CSSA, SSSA, Madison, WI.
9. Stephenson, M.B., J. Brennan, T. Mulliniks, S. Boerman. Use of GPS and accelerometers to detect nursing behavior in range beef calves. 2021 Society for Range Management Annual Meetings
10. Mollet, K., T. Millikan, B. Maharjan, S. Das, A. Orozco-Lopez, M. B. Stephenson. Monitoring Sandhills rangelands: Evaluating differences in plant community dynamics across ranch management strategies. 2021 Society for Range Management Annual Meetings
11. Andrade, Bianca O, Jerry D. Volesky, Martha Mamo, and Walter H. Schacht. 2021. Soil carbon response to grazing intensity on Nebraska Sandhills meadows. P. 180. Proc.: 74th Annual Meeting, Society for Range Management, Denver, CO.
12. PSI-7 Evaluation of Form of Supplement with or Without Ionophore on Stocker Steer Performance While on Bromegrass Katie Malone, Jaymelynn K Farney Journal of Animal Science, Volume 99, Issue Supplement\_1, May 2021, Page 224, https://doi.org/10.1093/jas/skab054.367
13. Tamegrass Forage Options for Growing Heifers During the Summer Jaymelynn K Farney, Macie E Reeb, Zachary T Buessing, Katie Malone Journal of Animal Science, Volume 99, Issue Supplement\_2, May 2021, Page 34, https://doi.org/10.1093/jas/skab096.061
14. PSI-2 Spices in Free-choice Mineral Offer Gain Advantages to Cattle on Tallgrass Native Range and Promise as Fly Control Macie E Reeb, Jaymelynn K Farney Journal of Animal Science, Volume 99, Issue Supplement\_1, May 2021, Pages 224–225, https://doi.org/10.1093/jas/skab054.368
15. 46 Effects of Implants, Clover, and Fescue Variety on Stocker Steers Zachary T Buessing, Jaymelynn K Farney Journal of Animal Science, Volume 99, Issue Supplement\_1, May 2021, Page 146, <https://doi.org/10.1093/jas/skab054.249>
16. Parsons, J. Recent and Emerging Multi-criteria Decision Making Applications in Agriculture. Accepted presentation in a sponsored session of Multiple Criteria Decision Making at the 2020 INFORMS Annual Meeting. November 13, 2020.

***Journal Articles (Bold = authors from multiple states)***

1. Blanco-Canqui, H., M. E. Drewnoski, D. G. Rice. 2020. Does harvesting cover crops eliminate the benefits of cover crops? Insights after three years. SSSAJ. 85:146-157. [10.1002/saj2.20175](https://acsess.onlinelibrary.wiley.com/doi/10.1002/saj2.20175)
2. Blanco-Canqui, H., S.J. Ruis, C.A. Proctor, C.F. Creech, M.E. Drewnoski, and D**.**D**.** Redfearn. 2020. Harvesting cover crops for biofuel and livestock production: Another ecosystem service? Agronomy Journal <https://doi.org/10.1002/agj2.20165>
3. Koehler-Cole, K., S.E. Everhart, Y. Gu, C.A. Proctor, M. Marroquin-Guzman, D**.**D**.** Redfearn, and R.E. Elmore. 2020. Is allelopathy from winter cover crops impacting row crops? Agriculture and Environmental Letters 2020; 5:e20015. https://doi.org/10.1002/ael2.20015
4. Christenson, E, Jin, VL, Schmer, MR, Mitchell, RB, and Redfearn, DD. Soil greenhouse gas responses to removal in the annual and perennial cropping phases of an integrated crop livestock system *Agronomy,* 2021, *11*(7), 1416; <https://doi.org/10.3390/agronomy11071416>
5. Smart, AJ, Redfern, D, Mitchell, R, Wang, T, Zilverberg, C, Bauman, PJ, Derner, JD, Walker, J, Wright, C. Integration of crop-livestock systems: An opportunity to protect grasslands from conversion to cropland in the US Great Plains *Rangeland Ecology & Management,* September 2021, 78, 250-256, <https://doi.org/10.1016/j.rama.2019.12.007>
6. Guretzky, J.A, J.D. Volesky, M.B. Stephenson, K.R. Harmoney, and J.L. Moyer. 2021. Interseeding Annual Warm-Season Grasses into Temperate Pasturelands – Forage Nutritive Value and Yields. Agronomy Journal. 113:2544-2556. <https://doi.org/10.1002/agj2.20653>
7. Liebman, M., Basche, A., Huong, T.X., Weisberger, D.A. 2021. How can cover crops contribute to weed management? A modelling approach illustrated with rye (Secale cereale) and Amaranthus tuberculatus. Weed Research. https://doi.org/10.1111/wre.12508
8. Chatterjee, N., Archontoulis, S., Bastidas, A., Elmore, R., Proctor, C., Basche, A. 2020. Simulating alternative corn management for earlier cover crop introduction in corn-soybean rotation system. Agronomy Journal. <https://doi.org/10.1002/agj2.20377>
9. Wilke, K.H., P. L. Loza, A.K. Watson. 2021. Sugar beets as an energy source in gestating, growing, and finishing diets for beef cattle. Appl. Anim. Sci. 37:115–121 <https://doi.org/10.15232/aas.2020-02111>
10. Welchons, C. A., R. G. Bondurant, T. J. Klopfenstein, A. K. Watson, J. Parsons, and J. C. MacDonald. 2021. Performance and economics of backgrounding yearling beef steers on smooth bromegrass pastures. Appl. Anim. Sci 37:68-76. <https://doi.org/10.15232/aas.2020-02064>.

***Extension Research Reports/Publications***

1. Carlson, Z. E., L. J. McPhillips, Galen Erickson, M. E. Drewnoski and J. C. MacDonald. 2022. Comparison of partially Confined and Traditional Cow-calf Systems. Nebraska Beef Report. MP 115:10-14.
2. Calus, K. J., M.M. Briton, B. H. Hansen, K. M. Ulmer, Z. E. Carlson, F. H. Hilscher, M. E. Drewnoski, J. Parsons and J. C. MacDonald. 2022. Economics of Grazing Calves on Oats Planted after Corn Silage in Eastern Nebraska. Nebraska Beef Report. MP 115:34-36.
3. Jakub, D. A, H. E. Riley, K. E. Hales, S. D. Shackelford, H. C. Freetly and M. E. Drewnoski. 2022. Effect of Rapeseed Inclusion in Late-Summer Planted Oats Pasture on Growing Performance of Beef Steers. Nebraska Beef Report. MP 115:32-33.
4. Grabau, M.T., J. C. MacDonald, Z. E. Carlson, and M. E. Drewnoski. 2022. Impact of Spring Corn Residue Grazing on Soil Physical Properties and Crop Yield. Nebraska Beef Report. MP115: 83-85.
5. Merical, M., M. Drewnoski, and J. Parsons. 2021. Winter Growth Rate and Timing of Marketing on Economics of Yearling Systems. Nebraska Beef Report. MP110: 24-27.
6. Grazing Nebraska’s rangelands, How does topography influence grazing intensity. Nebraska Cattlemen’s magazine, March 2021 Issue
7. Managing for Heterogeneity on rangelands in the Nebraska Sandhills. Beef Watch February 2021 Issue
8. Monitoring Sandhills Rangelands: A key step in understanding plant community dynamics. Center for Grassland Studies Spring Newsletter
9. Buessing, Z. T. and J. K. Farney. 2021. Evaluation of implants, clover, and fescue variety on stocker steers. Kansas Agricultural Experiment Station Research Report. Vol. 7. Iss. 2. https://doi.org/10.4148/2378-5977.8040.
10. Farney, J. K. and K. Malone 2021. Form of supplement and addition of ionophore effects on steer performance while grazing bromegrass and subsequent effects in feedlot and carcass measures. Kansas Agricultural Experiment Station Research Reports. Vol. 7: Iss. 2. https://doi.org/10.4148/2378-5977.8041.
11. Farney, J. K. 2021. Evaluation of grazing options during summer for growing heifers. Kansas Agricultural Experiment Station Research Reports. Vol. 7: Iss. 2. https://doi.org/10.4148/2378-5977.8042.
12. Farney, J. K. and M. E. Reeb 2021. Stocker steer gains and fly numbers as impacted by burn date and type of mineral on tallgrass native range. Kansas Agricultural Experiment Station Research Reports. Vol. 7: Iss. 2. https://doi.org/10.4148/2378-5977.8043.
13. Farney, J. K., M. E. Reeb Z. T. Buessing, K. Malone, and G. F Sassenrath. 2021. Evaluation of warm season annual forages for livestock: Biomass and cost of production. Kansas Agricultural Experiment Station Research Reports. Vol. 7: Iss. 2. https://doi.org/10.4148/2378-5977.8044.
14. Helwig, D., M. Haywood, J. K. Farney, B. C. Pedreira, and G. F. Sassenrath, G. F. 2021. Bermudagrass fertility trial in Southeast Kansas, 2020. Kansas Agricultural Experiment Station Research Reports. Vol. 7: Iss. 2. https://doi.org/10.4148/2378-5977.8045.
15. Helwig, D., M. Haywood, J. K. Farney, B.C. Pedreira, and G. F. Sassenrath. 2021. Impact of fertility and mowing on crabgrass quantity and quality for hay production in Southeast Kansas. Kansas Agricultural Experiment Station Research Reports. Vol. 7: Iss. 2. https://doi.org/10.4148/2378-5977.8046.
16. Sweeney, D. W., J. K. Farney, J. L. Moyer, and D. A. Ruiz Diaz. 2021. Nitrogen fertilizer timing and phosphorus and potassium fertilization rates for established endophyte-free tall fescue. Kansas Agricultural Experiment Station Research Reports. Vol. 7: Iss. 2. https://doi.org/10.4148/2378-5977.8047.

 ***Extension publications (peer-reviewed)***

1. Drewnoski, M. E. 2021. What to do with High Nitrate Forage. BeefWatch Electronic Newsletter. [September](https://beef.unl.edu/beefwatch/2021/what-do-high-nitrate-forage).
2. Drewnoski, M.E. and K.H. Wilke. 2021. Mineral and Vitamin Considerations when Drylotting Cows. BeefWatch Electronic Newsletter. [April](https://beef.unl.edu/beefwatch/2021/mineral-and-vitamin-considerations-when-drylotting-cows).
3. Parsons, J. and E. Dennis. 2021. Improvements to Livestock Risk Protection Insurance Implemented in January 2021. BeefWatch Electronic Newsletter, [February](https://beef.unl.edu/beefwatch/2021/improvements-livestock-risk-protection-insurance-implemented-january-2021).
4. Parsons, J. 2021. The Livestock Indemnity Program Year-end Updates. BeefWatch Electronic Newsletter, [January](https://beef.unl.edu/beefwatch/2021/livestock-indemnity-program-year-end-updates).
5. Redfearn, D., M. Drewnoski, and J. Parsons. 2021. Cattle compaction in cropland: Fact or fiction? Nebraska Extension, CropWatch Electronic Newsletter, CropWatch Electronic Newsletter, August 23, 2021. <https://cropwatch.unl.edu/2021/cattle-compaction-cropland-fact-or-fiction>
6. Redfearn, D., J. Parsons, and M. Drewnoski. 2021. Crop Residue Exchange links growers and grazers. Nebraska Extension, CropWatch Electronic Newsletter, CropWatch Electronic Newsletter, August 23, 2021. <https://cropwatch.unl.edu/2021/crop-residue-exchange-links-growers-and-grazers>
7. Parsons, J., M. Drewnoski, and D. Redfearn. 2021. Crop Residue Exchange links cattle producers to available feed resources. Center for Agricultural Profitability Electronic Newsletter, September 20, 2021. <https://cap.unl.edu/livestock/crop-residue-exchange-links-cattle-producers-available-feed-resources>
8. Parsons, J. 2021. Managing Risk with Annual Forages. Farm and Ranch Management Series 21-0607, Department of Agricultural Economics, University of Nebraska-Lincoln, June 17, 2021. <https://cap.unl.edu/forage/managing-risk-annual-forages>.
9. Evaluating the performance of Kernza® perennial grain in Eastern Nebraska. April 20, 2021. <https://cropwatch.unl.edu/2021/evaluating-performance-kernza-perennial-grain-eastern-nebraska>
10. Nebraska Extension Almanac, November 2020, “Aerial Imagery and Cover Crops” https://cropwatch.unl.edu/soilhealth
11. Midlands Business Journal, October 2020, “Interest in regenerative agriculture growing” https://issuu.com/mbj1/docs/mbj\_october-30-2020-vol-46-no-44
12. Nebraska Farmer, November 2020, “Aerial imagery brought to cover crop management” https://www.farmprogress.com/cover-crops/aerial-imagery-brought-cover-crop-management
13. Market Journal, December 2020, “Aerial Imagery” <https://marketjournal.unl.edu/december042020>
14. Parsons, J. 2020. “The Livestock Indemnity Program: A Case for Managing Risk with Good Recordkeeping.” University of Nebraska-Lincoln, *Cornhusker Economics*, Dec. 10, 2020.
15. Parsons, J. 2021. “LRP-Feeder Cattle Insurance Usage Up with Recent Changes.” University of Nebraska-Lincoln, *Cornhusker Economics*, July 21, 2021.
16. Parsons, J. 2020. “LRP insurance continues to evolve.” *Nebraska Farmer*, 162(10):42.
17. Parsons, J. 2021. “Good record keeping pays with LIP.” *Nebraska Farmer*, 163(2):52-53.
18. Parsons, J. 2020. “Managing Pasture Production Risk.” *Center for Grassland Studies Newsletter*, Vol. 26, Issue 3. University of Nebraska-Lincoln.
19. Parsons, J. 2021. “Workshop Focused on Improving Beef Production Systems.” *Center for Grassland Studies Newsletter*, Vol. 26, Issue 4. University of Nebraska-Lincoln.

***Workshops***

1. Parsons, J., E. Dennis, J. Jansen, R. Saner, T.L. Meyer, J. Groskopf, B. Beckman, B. Schick, and H. Greenwell. “Managing Cattle for Profit in 2021.” A series of 3.5-hour in-person workshops held in five locations across Nebraska. June-July, 2021. Attendance: 81.

***Multi-State Outreach Presentations***

* + - 1. Forage Field Days. Southeast Research Farm. Beresford, SD. August 4, 2021. Haskell Research Lab, Concord. NE. August 5, 2021. Attendance: 36.
			2. Johnson, A. and M. Drewnoski. Meeting Your Operation’s Goals with Small Cereals Silage.
			3. Parsons, J. Forage Insurance Options.

***Webinars/Videos and URL for online access***

1. Drewnoski, M. E. 2020. Grazing corn residue. [BeefWatch Webinar](https://youtu.be/bYov7kZIHZI). (30 live; 401 recording)
2. Drewnoski, M. E. 2020. [Using cover crops for growing calves](https://youtu.be/t1xmUIlGpgE). Livestock Lessons 2.0. Practical Farmers of Iowa. (200 live; 1233 recording).
3. Drewnoski, M. E. 2020. [Understanding protein needs of growing calves](https://youtu.be/H1_o1lDU6Qg). BeefWatch Webinar. (40 live; 1748 recording).
4. Drewnoski M.E. 2020. [Winter hardy cover crops for spring grazing and silage](https://youtu.be/2j_w4ATfWqk). Cover crops in corn systems opportunities for dual use webinar. (223 recording)
5. Wilke, K.H. [Drylotting Cows - How to Feed them](https://www.youtube.com/watch?v=PBFA-F6sc7k). (986 views)
6. Wilke, K., R. Saner, M. Stockton, and J. Parsons. [Early Weaning Calves: Management, Nutrition, and Profitability](https://cap.unl.edu/livestock/early-weaning-calves-management-nutrition-and-profitability-aug5-2021-webinar). One-hour webinar presentation for the Center for Agricultural Profitability, University of Nebraska-Lincoln. August 5, 2021. (Live: 12)
7. Drewnoski, M. and J. Parsons. [Winter Rate of Gain and Market Timing in Yearling Systems](https://youtu.be/2DGPEY3PNp0). University of Nebraska-Lincoln Beef Watch Webinar. February 9, 2021. (Live: 37)

**Funding (include grants and contracts)**

1. Parsons, J., D.D. Redfearn, and M.E. Drewnoski. 2021-2023. Economic Barriers and Opportunities Associated with Integrating Livestock and Cover Crop Systems in the United States. USDA-ERS. $100,000.

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3. USDA Natural Resources Conservation Service. “Cover Crop Initiative: A collaborative project to advance knowledge and utilization of cover crops for conservation measures in Nebraska.” $1,049,500. Lead PI, Co-PI Daren Redfearn. 2021-2025.

4. USDA National Institute of Food and Agriculture. "Developing and deploying a perennial grain crop enterprise to improve environmental quality and rural prosperity.” $10,000,000. Project Director: Jake Jungers. 2020-2025.