

Increasing Sustainability of Livestock Production of the Northern Great Plains

Sustainable Agriculture Research and Education (SARE) Project #LNC11-335

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Increasing sustainability of livestock production in the Northern Great Plains has significant implications for the agricultural sector in the focus region. Crop and beef cattle producers are experiencing historically high commodity prices for cattle, calves, and fed cattle, while grain and oilseed prices have fluctuated widely. The research in this project is evaluating interrelationships between crops, livestock and soils to identify the complementing holistic potential that may exist. Paralleling the actual research is a focus on education for existing producers through farmer-cooperator projects, educational events for high school and undergraduate students, and an international Turkish research scientist connection.

The report encompassed activities and events for the first two years of the project. Public awareness of alternative production methodologies is increasing as evidenced by agricultural programming awareness across the entire agricultural sector and attendance at the 2012 and 2013 Beef Cattle and Forage Field Days held at the Dickinson Research Extension Center Ranch Headquarters. The field days are designed as workshops for a cross section of stakeholders including farmers and ranchers, research personnel, local, state and federal agency representatives who may or may not be actively raising cattle and crops, but have a focused interest in non-traditional production methods. Program topics include project data summary presentations and tours of the integrated diverse cropping and beef cattle systems being studied, and presentations and tours of producer-cooperator projects that are grazing cover crops and utilizing unharvested corn for extensive backgrounding newly weaned calves. The field day/workshops are practical sessions focusing on soil health, and the mechanics of upgrading and attaining soil health benchmarks using the pillars of soil health that include minimal soil disturbance with no-till seeding and planting, crop diversity using cool and warm season broadleaf and grass crops, including cover crops in the crop rotation, maintaining a living root in the soil as long as possible, maintaining soil surface residue, and including livestock grazing whenever possible.

Youth education is focusing on high school and undergraduate college students. At the high school

level, there has been active participation by southwestern North Dakota Vocational Agriculture students through their annual participation in the Vo-Ag High School Student Field Day hosted by the Dickinson Research Extension Center. Fifty to sixty enthusiastic students have attended each year to learn about a variety of agricultural topics as well as the connectivity between the microbial world and agriculture, and how the living components of soil and sun are the foundation of food production. At the undergraduate college student level, Dickinson State University (DSU), Agriculture and Technical Studies undergraduate students are encouraged to participate in the SARE research by completing the student requirement for an undergraduate research project through research in some aspect of the SARE project. Lauren Pfenning, DSU Senior has been actively participating in the SARE research. After a period of four years of the diverse crop rotation that includes beef cattle grazing, soil bulk density (BD) difference between spring wheat control, rotation crops, and native range was evaluated by Ms. Pfenning. Results from the project were presented by Ms. Pfenning at the DSU undergraduate student scientific research review on May 11, 2014 (See Pfenning and Landblom, *Bulk Density Comparison within a Crop Rotation in Western North Dakota*, under Abstracts, Dickinson State University Undergraduate Student Research Projects). Briefly, when BD values for native range were compared to all of the crops, BD was less except for corn and tended to be less for the pea-barley crop ($P > 0.05$).

Traditional soil testing and fertilizer recommendations from the NDSU Soil Testing Laboratory are used to determine the amount of N-P-K-Cl to apply. Fertilizer recommendations are declining due to the interactive and collective effect of the soil health principles employed, and crop yields have increased steadily as years of crop yield history accumulate.

Non-confinement grazing of crops and residues by beef cattle is showing that less intensive procedures can have a positive effect on profitability. These data suggest that high breeding efficiency can be attained among small (SF) and large (LF) March-April born virgin heifers when transitioned to May-June calving

through the strategic use of grazed and harvested forages resulting in a lower net cost per pregnant SF heifer (Published in the Asian-Australasian Journal of Animal Science, *Effect of Heifer Frame Score on Growth, Fertility, and Economics*, Vol. xx:xx-xx.).

Compared to traditional feedlot growing and finishing of yearling steers, 141 steers grown for modest winter growth of approximately 1.0 pound/day that grazed perennial and annual forages (crested wheatgrass, native range pasture, pea-barley intercrop, and unharvested corn) for 182 days before entering the feedlot required the least number of days on feed (66 days) compared to the feedlot control (142 days) and an all perennial treatment (91 days). Reducing feedlot residency from 142 days to 66 days was profitable even during a period when corn was priced over \$7/bushel. Control feedlot steers lost \$298/steer whereas the perennial/annual forage steers brought \$9 profit/steer; a margin difference of \$307/steer. The data clearly shows that long-term extended grazing has the greatest potential for profitability (*Consequence of Perennial and Annual Forage Grazing Systems Before Feedlot Entry on Yearling Steer Grazing and Feedlot Performance, Carcass Measurements, Meat Evaluation, and System Net Return*, Proceedings, Western Section, Am. Soc. Anim. Sci., Vol. 65:xx).

A second and ongoing similar study is evaluating the performance and economic difference between small (3.4 frame score units) and large frame (5.31 frame score units) steers using a similar research protocol. Small and large frame steers were sent directly to the feedlot (FLOT) and a comparable randomly assigned group grazed perennial and annual forages (GRAZ - crested wheatgrass, native range pasture, pea-barley intercrop, and unharvested corn). To determine system net return, expenses (e.g. steer placement cost, grazing and feedlot finishing expenses, transportation and brand expenses) were deducted from the gross carcass value. Net return for the FLOT treatment was considerably smaller than the

GRAZ treatment and within the individual treatments net return for SF steers was much lower. Lower expenses were one reason that system net return for GRAZ steers was higher than FLOT steers, but also sales price increased 13.3% from the December sales date to the March sales date. In this first year of a 2-year study, LF steers were more profitable than SF steers (*The Combined Effect of beef cattle frame score and forage grazing sequence on yearling steer grazing and feedlot performance, carcass trait measurements, and system economics*).

Producer educational schools have been reserved until the last year of the project to allow for accumulation of data upon which to base the educational format and knowledge transfer. Public awareness of this SARE project is increasing and with increasing awareness project PI, Doug Landblom, has been an invited program speaker to 12 winter series meetings in southeastern Montana and western North Dakota presenting the topic, "Crop Diversity, Cover Crops, and Beef Production", and he was also invited to speak at the Multi-State Waste Management Annual conference on the subject titled, "Effect of Extended Grazing Management on Economics and Manure Distribution". Free-lance writers have also published articles on different aspects of the SARE project in the regional bi-monthly publication, Farm and Ranch Guide, and the national magazine, Feed-Lot. Research reports have been published in non-peer reviewed publications to include the Dickinson Research Extension Center Annual Report, 2013 North Dakota Beef Report, and an abstract has been submitted to the Western Section, American Society of Animal Science proceedings. The extensive heifer development research project has been accepted for peer-reviewed publication in the Asian-Australasian Journal of Animal Science and additional peer-reviewed publications are expected to be generated from the SARE research. Summarized data to date suggests that grazing and situations in which the animal does its own foraging and harvesting reduces input cost and supports improved profit margins.