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Innovations in Forages and Grazing in the High Plains

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Vast stretches of treeless grasslands are emblematic of the Great Plains. Before Euro-American settlement, indigenous tribes were supported by abundant herds of bison and antelope grazing on diverse grasses and forbs. Beef cattle were introduced with settlement and the plow opened the soil for rainfed cropping. Today beef cattle graze in every county of the Great Plains (Figure 1). Land allocation between grazing and cropping depends largely on soil productivity and availability of water for irrigation. Cow-calf ranches predominate on extensive stretches of non-tillable, non-irrigated grasslands, and concentrated feedlot operations for fattening beef cattle and dairy production are found near irrigated cropland. In both situations, beef and dairy production enhance the economic value of grasses and grain.

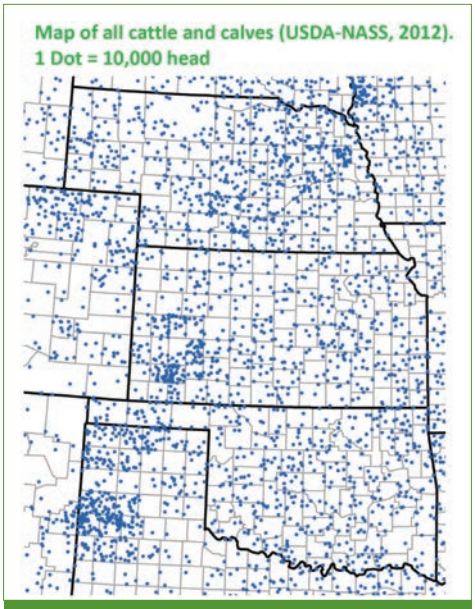

FIGURE 1: Map of all cattle and calves in the Ogallala aquifer region. (Source: USDA-NASS, 2012)

The vast agricultural area overlying the Ogallala aquifer provides around 30% of the nation's beef supply, thanks largely to irrigation use to support corn production. Grazed grasslands and cultivated forage crops provide important complementary feed sources in the beef and dairy industries, helping to sustain breeding herds and providing low-cost dietary protein and fiber. Besides the well-known role of corn as the main source of energy-concentrated grain for cattle, corn silage is also one of the most valuable forages with the combination of high productivity and nutrition in the form of digestible fiber and energy. Being high in water content (around 35%), it is an expensive crop to transport, therefore having production fields close to livestock facilities is ideal. However, corn silage requires significant inputs to produce a profitable harvest, requiring nitrogen fertilizer (typically 200 lbs/acre per year), and more than 30 inches of effective in-season rain plus irrigation. With Ogallala aquifer water supplies in decline, interest in finding alternatives to corn silage has increased.

One of the most promising alternatives are the many varieties of sorghum. The short-statured grain sorghum (milo) is a dryland-adapted, alternative source of high-energy feed grain. The tall-growing forage sorghums and sorghum-sudangrass hybrids are displacing corn silage in some areas where pumping capacity is too limited to support corn production. Maximum yields of forage sorghum require 25-30% less water compared to that required for maximum corn silage yields, with similar amounts of water consumed per ton of forage produced. However, the lower grain content of sorghum silage than of corn is a drawback. Breeders have incorporated a trait called brown midrib (BMR) into forage sorghum to unlock more digestible energy from the sorghum fiber and narrow the difference in energy nutrition relative to corn. This is an example of how improving the digestibility of a water-use efficient forage can boost its usefulness where irrigation conservation is critical.

Grazing winter wheat is another common forage alternative in Texas and northward to southern Kansas, thanks to relatively mild winters. This is a common alternative for young growing cattle, called stockers, before they reach finishing or the milking herd. Such wheat is managed as a dual-purpose crop, with grazing finished by early March and allowed to regrow to produce grain in late spring. One of the challenges for grazing wheat is that in much of the High Plains rainfall is too low or variable in late fall and winter, limiting availability of wheat forage for grazing, and where irrigation is available, the economics of irrigating wheat pasture are often unfavorable. Raising stocker cattle is another key sector on the High Plains.

Summer stocker programs can be carried out using annual forages such as sorghum-sudangrass and pearl millet, but also using perennial forages so that pasture establishment and maintenance costs are spread over many years. These can be an option in no or low irrigation areas, as summer-adapted forage crops are highly responsive to modest levels of available water.

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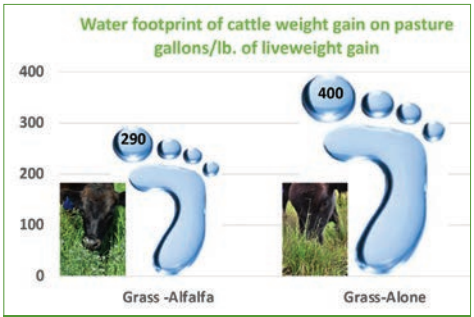

FIGURE 2: The water footprint of cattle weight gain (gallons/lb.) on pasture.

Dr. Daren Redfearn, University of Nebraska–Lincoln extension forage crop residue specialist.

In Nebraska, Daren Redfearn, extension forage crop residue specialist at the University of Nebraska–Lincoln, is conducting a four-year integrated crop-forage-livestock systems experiment to evaluate conversion of marginally productive cropland to perennial grassland and integrate grazing animals into the system. This project is part of a USDA-NIFA CAP collaboration with USDA-ARS and the University of Nebraska–Lincoln and led by South Dakota State University. An objective of the project is to evaluate system performance and sustainability of beef gains, hay and corn grain yields, greenhouse gas emissions, cover crop growth, and economic evaluation for yearling steers grazing smooth bromegrass in spring and fall and switchgrass during summer. Early results show variable beef gains, corn grain yields, and economic net returns. Look for discussion of the full results in future editions of the Water Current.

Growing winter cover crops as a forage source has also increased in the Great Plains. They can provide benefits beyond forage such as reducing wind erosion of soil and rebuilding soil organic matter content. While it is difficult to recover the cost of cover crop establishment through soil health alone, these spring grazing cover crop species can improve returns while enhancing the soil benefits. Grazing cover crop species include triticale, rye, vetch radishes, and turnips. Even crop farmers who do not own cattle can contract with cattle owners for 2-4 months of grazing as a means of diversifying their income streams.

A specific production system that we investigated was how to improve cattle gains by looking at combinations of traditional perennial grass, improved grass varieties, alfalfa interseeding, and irrigation. In the Lubbock area of Texas, young cattle typically gain around 2 lbs. per head per day on perennial grasses from mid-May to late July, before dropping to 1.5 lbs. through September using 9-12 inches of irrigation. A variety of Old World bluestem, WW-B.Dahl, has performed consistently well in terms of persistence, with stands established in 1997 still highly productive. In 2009, alfalfa was interseeded into some of these bluestem pastures. Other pastures were planted with a plot of alfalfa and tall wheatgrass, 20% of the total grazed area, called a "protein bank." All received 9 inches of irrigation. During 2014-2016, steers were grazed on these pastures so that cattle in the alfalfa-grass system rotated weekly between the alfalfa-bluestem (5 days on) and alfalfa-wheatgrass (2 days on). The grass-only system contained no alfalfa and received 60 lbs. per acre annually of nitrogen fertilizer, whereas the alfalfa-grass system received no nitrogen fertilizer.

Weight gains of cattle on the alfalfa-grass system averaged 2.1 lbs. per day, while gains on grass-alone were 1.7 lbs. per day. The amount of irrigation applied to the alfalfa-grass pastures was slightly more than the grass-only pastures, but cattle produced 60% more gain per acre on the alfalfa-grass system, resulting in 27% less groundwater use for each pound of weight gain than without alfalfa.

Alfalfa has been dismissed as a water-wasting crop. However, used in these systems, it can boost the economic productivity of High Plains cropland over grass-alone. Its superior nutritional value supported faster steer growth and its deep root system allowed access to soil water below the grass root system.

A possible scenario could be a center-pivot, formerly a corn field, whose well has experienced reduced pumping capacity to the point that only one-fifth of the area can be occasionally irrigated. That wedge could contain an alfalfa-dominant protein bank, which cattle would have limited access to as a protein and energy supplement, while most of the grazing would take place on the non-irrigated remainder of the field. After fall weaning of calves, the dry cows could also rotate grazing with an adjacent corn or sorghum field to scavenge the crop residue.

These are just a few of the options available for greater use of annual and perennial forages to enhance the sustainability of agriculture in the Ogallala aquifer region. Forages provide diversification of commodities to even out market volatilities, prevent soil erosion, inhibit weeds, build water-retaining soil organic matter, exploit the deep rootedness of perennial crops, and provide alternatives to corn where irrigation output is in decline.

More information is available at http://bit.ly/SARE_SHP_Bulletins.

Cattle graze on alfalfa in Texas's High Plains region near Lubbock. (Credit: Lisa L. Baxter)