BEEF CATTLE

PRACTICES TO IMPROVE SUSTAINABILTY

Ruminant livestock species, such as cows and sheep, play a valuable role in sustainable agricultural systems by converting renewable resources not suitable for human consumption into high-quality meat, dairy, and fiber products. More than 40 percent of Earth's land area is covered by grasslands. In addition to a renewable supply of food, forage, and energy, these ecosystems provide wildlife habitat, carbon and water storage, and watershed protection. Proper grasslands management enhances the sustainability of natural resources as well as livestock production.

SYSTEM WASTES

Although ruminants are naturally efficient users of grasslands, some nutrient loss is inherent in digesting these high-fiber grasses. The ruminant animal does not initiate forage digestion. Breakdown begins with microbes in the animal's rumen, which trigger a fermentation process to digest the forage and make nutrients available for absorption. These microbes enable ruminants to use fibrous forages efficiently but are not 100% successful. Undigested nutrients are expelled from the animal as carbon dioxide (CO_2) and methane (CH_4), both of which are greenhouse gases (GHG).

Nutrient losses also occur through excretion of urine and feces, particularly when supplements are provided in excess of the amounts animals need. With improper fertilizer applications, pasture can contribute to emissions of nitrous oxide (N_2O) and ammonia by grazing animals and to the elimination of excess nitrogen (N), phosphorus (P), and other nutrients in manure and water runoff. Management practices to mitigate negative effects of GHG emissions (CO_2, CH_4, N_2O, ammonia, and odors) and losses of excess nutrients should be considered.

FEEDING TO REDUCE WASTE

Taking steps to reduce greenhouse gas emissions is important in livestock management from a regulatory standpoint as well as a production standpoint. Any time waste can be reduced, efficiency improves, which correlates to greater gains, higher pregnancy rates, appropriate body condition, and decreased feed costs. Supplemental feeding practices have been shown to decrease CH_4 and CO_2 emissions while increasing animal production. Providing energy and protein in proportions to match cattle requirements optimizes animal performance, minimizes fecal wastes, and costs less than overfeeding the animals. The following information focuses on practices that allow producers to increase their profits while reducing the environmental impact of cattle production.

STOCKER CATTLE OPTIONS

Protein supplementation of cattle on low-quality forage improves feed efficiency, gain, and forage intake, while reducing methane (CH_4) and carbon dioxide (CO_2) as illustrated in figure 1. Cattle supplemented with a nutrient deficient in the diet usually are more productive than cattle that are not supplemented. Supplementing cows on a high-quality forage such as wheat with a corn supplement tends to lower CH_4 emissions (Figure 2). One study found that supplementing cattle on lower-quality forage with whole cottonseed increased average daily gain about 0.1 pounds for each pound of whole cottonseed fed, up to a 10 pounds per head per day rate. Daily CH_4 emissions were also reduced with whole cottonseed supplementation, with the lowest amount of CH_4 produced when animals were fed about 4.5 pounds of whole cottonseed per head per day. This shows that supplementation can improve animal production while reducing GHG emissions, which in combination reduces the environmental impact per unit of food production.

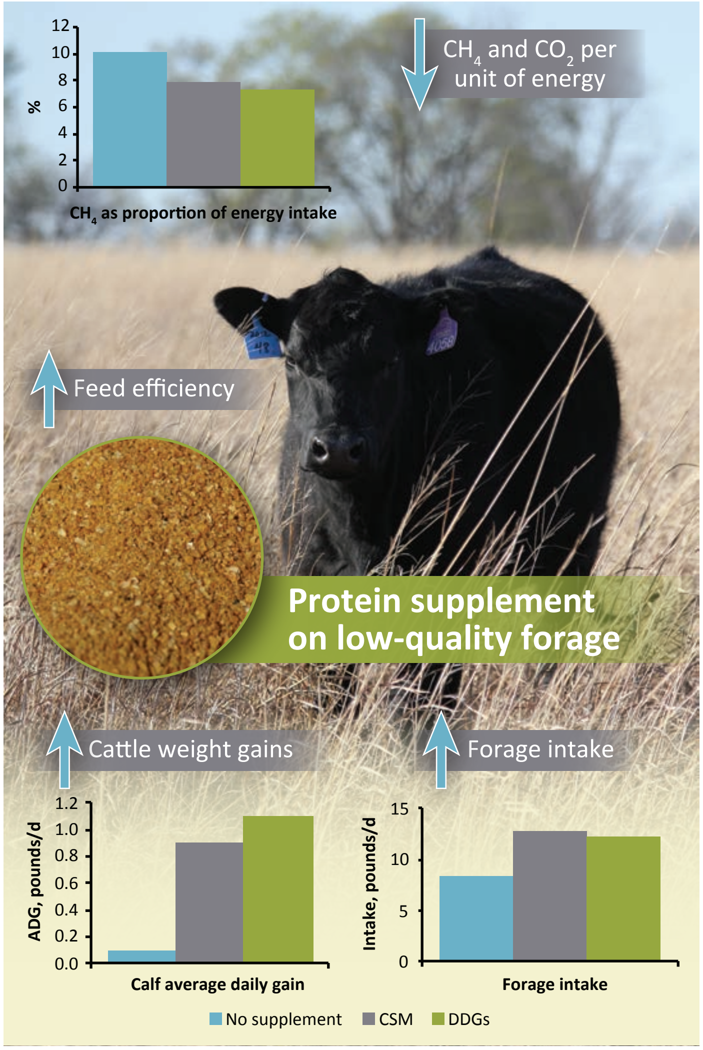

Figure 1. Protein supplementation with cottonseed meal (CSM) at 0.29% of body weight or dried distillers grains with solubles (DDGs) at 0.41% of body weight, increased the intake of cattle on low-quality forage (bluestem hay with a 3.9% crude protein). Total emissions of methane and CO_2 also increased; however, when evaluated based on energy intake, supplementation reduced CH_4 and CO_2 emissions by around 3%. (Source: Shreck et al., 2015)

Pasture management is important for stocker calves as well as cow-calf operations. Pastures can be a source of greenhouse gases, especially if fertilized. Optimal fertilization following the 4R principles of right source, right rate, right time, and right place (*www.nutrientstewardship.com/4rs/*) is important in mitigating GHG emissions. The amount of nutrients, or fertilizer, excreted from cattle is another key consideration. In Nebraska and Kansas studies, cattle supplemented with dried distillers grains (DDG) containing high concentrations of N and P cows were found to recycle excess N and P through urine and feces, providing nutrients (fertilizer) to the pasture. One limitation to utilizing cattle as a sole source of pasture fertility is the concentration of manure and urine around water sources, loafing areas, and mineral feeders or bunks. Producers can address this issue using practical measures such as spreading out feeding sites and moving mineral feeders to different locations in the pasture to improve waste distribution. Locating water, shade, and feeders at higher elevations and allowing the pasture to filter the runoff helps to alleviate water quality issues.

COW-CALF MANAGEMENT

Forage quality has a significant impact on cow body condition, gain, and methane (CH_4) emissions. For non-supplemented cows, methane emissions are highest during grass dormancy, moderate during late-season grazing, and lowest early in the growing season. In one study, the amount of methane produced by a cow on tall grass prairie ranged from about 0.75 pound per day per head early in the growing season to nearly 1 pound per day per head on dormant pasture. The use of good grazing management practices over an entire year minimized CH_4 emissions of individual animals.

A Louisiana study that evaluated CH_4 production by cows over an entire year, found a reduction in annual CH_4 emissions by cows with management intensive grazing (MIG) practices as compared to continuous grazing. Cows in the MIG system were supplemented during the dormant season and managed with rotational grazing during the growing season. Annual CH_4 production for the MIG cows was 22 percent lower than cows in the continuous grazing system. Additionally, cows on the MIG system bred a month earlier and had calves with heavier weaning weights. Although all cows naturally produce a certain amount of CH_4, managing toward optimal productivity in the cow-calf enterprise reduces overall emissions of CH_4 per unit of production.

Another method to reduce CH_4 production by cows is to incorporate legumes into grass pastures, which helps mainly by improving production efficiency. In pasture systems, most nitrous oxide (N_2O) originates from fertilizer applications. Adding legumes to pastures reduces the amount of synthetic fertilizer required for livestock production, which reduces N_2O emissions.

Supplementing protein to match cow dietary requirements and grazing high-protein forages strategically reduces CH_4 emissions per unit of production. This GHG reduction is realized because cow dietary requirements are being met and N is not being overfed. Placing cattle with the highest energy and protein demands on the highest quality forages maximizes land use while minimizing GHG emissions per unit of production. For example, growing calves and lactating cows require more energy and protein than dry, pregnant cows and should be grazed on high-quality forages. Low-quality forages should be grazed by dry, pregnant cows. This practice optimizes livestock production, minimizes greenhouse gas emissions, and reduces the amount of extra N and P excreted in manure and urine.

SUPPLEMENTS AND TECHNOLOGY

Processing of starchy feeds. In general, the more processed the grain the better the gains and feed efficiency. In feedlot studies, animals produced less CH_4 when fed more processed starchy feeds. For example, cattle fed steam-flaked and high-moisture corn-based diets produced less CH_4 than cattle fed dry-rolled corn-based diets.

Dietary fat. Fat has been shown to decrease CH_4 emissions in cattle. Supplementing with corn-distillers grains is a way of providing additional fat to grazing cattle. Avoid feeding more than 4 to 6% supplemental fat in the total diet, which can reduce feed intake and possibly gains.

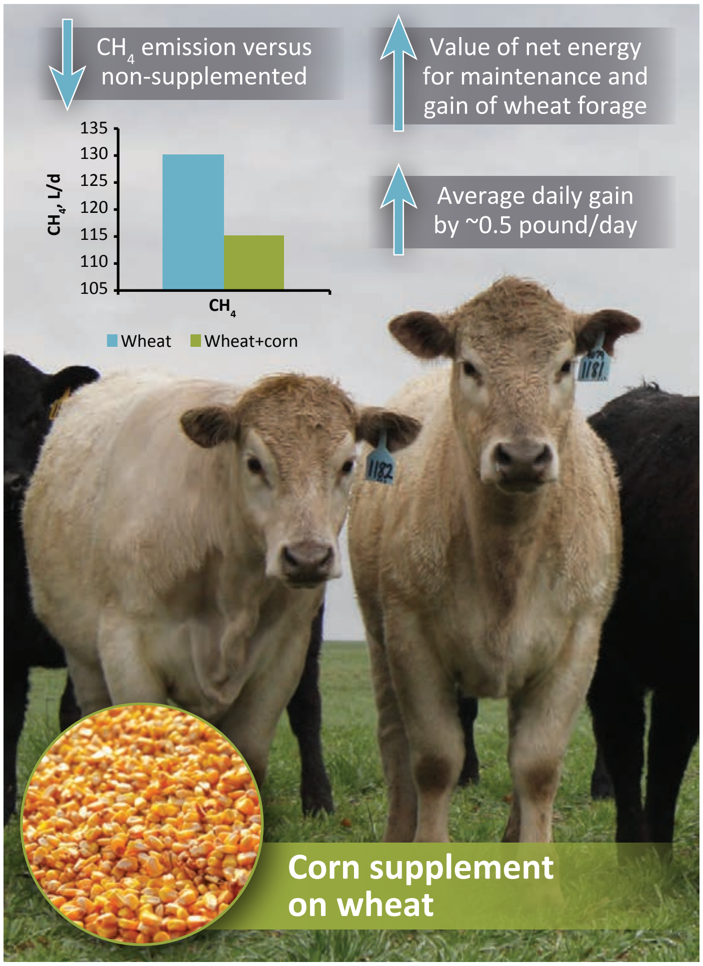

Figure 2. Energy utilization and CO_2 emissions were similar when a high-quality forage such as wheat was supplemented with corn; however, CH_4 emissions tended to be lower for supplemented versus non-supplemented animals. (Source: Shreck et al., 2017)

Ionophores. Ionophores are feed additives that alter the rumen microbial population. This shift in rumen microbes generates more useable energy and improves cattle efficiency. Some studies have reported a 9 to 10% reduction in CH_4 production by cows fed ionophores compared to cows not fed an ionophore. Ionophores also help control coccidiosis, a common health issue in cattle. Ionophores are a low-cost supplement when integrated into grazing cattle operations. Monensin is the only ionophore approved for lactating cows. In some studies, cows that received monensin maintained body weight and condition on 10% less forage.

Implants. Implants have been used for many years in cattle operations to stimulate growth of suckling calves, stockers, and feedlot animals. Implants are one of the few technologies consistently shown to produce a positive return on investment. Weight gains of implanted calves are reported to be 10 to 20% better than non-implanted calves. Steers respond to implants more positively than heifers. Cattle on highly nutritious diets respond with better gains than cattle on low-quality forage. A Canadian analysis found the carbon footprint of implanted calves to be 4.9 to 5.1% lower than that of non-implanted calves.

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