



Effects of annual and perennial forage systems on plant and soil parameters, grazing animal performance and system economics

GRAZING STRATEGIES TO OPTIMIZE FORAGE AND BEEF PRODUCTION

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Background: Soil, water, plant, animal, and economic components all play key roles in a successful grazing system and contribute positive environmental benefits if managed correctly. Many times, these components are examined on an individual basis, instead of as part of an entire ecosystem. While systems research is challenging, it can provide a more realistic interpretation of what is occurring on-farm.

While annual forages often provide higher yields than perennial forages, they also have higher establishment costs and may be less effective at sequestering carbon. Very few multi-year Canadian studies exist that compare animal performance on annual and perennial forage mixtures that also include soil, water use, carbon, and greenhouse gas measurements.

Objectives:

- Evaluate animal performance and kilograms of beef produced per hectare from grazing either perennial or annual forage mixtures that utilize newer forage varieties
- Evaluate grazing dry matter intake and forage persistence under grazing
- Determine soil water balance under perennial or annual pasture systems under western Canadian growing conditions

- Determine greenhouse gas emissions under grazing either annual or perennial forage mixtures
- Determine carbon and nitrogen cycling, along with soil characteristics for each system
- Determine system costs and net returns for the annual and perennial forage systems

What they did: At the Livestock and Forage Centre of Excellence near Clavet, SK, two binary perennial forage mixtures were established: AC Success hybrid brome/grass + PS30006 alfalfa and AC Armada meadow brome/grass + AAC Mountainview sainfoin in 2018. From 2019-2022 two annual forage mixtures were also seeded: AC Hazlet fall rye + Frosty berseem clover and CDC Austenson barley + 4010 forage pea + Winfred forage brassica + Gorilla forage brassica. Forages were seeded at rates and depths recommended for the dark brown soil zone and the annual treatments were fertilized with 13-33-0-15 at a rate of 112 kg/ha based on soil test results.

Each year, 120-156 crossbred beef steers grazed the different forage systems. Forage dry matter biomass, quality and botanical composition was assessed, along with steer performance, dry matter intake, enteric emissions, soil moisture/hydrology, soil characteristics, and the economics of each system.

What they found: Over the four years of the study, the highest feed quality was found in the annual mixtures followed by the perennial mixtures (fall rye/clover, barley/pea/forage brassica, hybrid brome/alfalfa, meadow brome/sainfoin). Only the fall rye/clover mixture met the protein requirements for growing yearlings or lactating beef cows, and the meadow

brome/sainfoin mixture protein level was not acceptable for heifers or cows during any portion of gestation.

The greatest steer weight gain per hectare was achieved by the hybrid brome/alfalfa mix (99.8 kg/ha), followed by fall rye/clover (79.2 kg/ha), meadow brome/sainfoin (66.9 kg/ha) and barley/pea/forage brassica (61.8 kg/ha). Fall rye/clover had the fewest available grazing days, while the other mixtures were similar. Steers grazing annual forage systems had lower methane emissions due to the higher nutritive value of those forages.

Few differences were observed between the mixtures with regards to soil measurements. The fall rye/clover mixture tended to be slightly better in terms of maintaining or slightly increasing soil carbon and nitrogen at the 0-30 cm depth.

Generally, the annual forages started the growing season with higher soil moisture levels, but the perennial forages were able to access deeper soil moisture and maintain yield, which was valuable in the dry years of this study. This was reflected in a 47% higher net return for the perennial systems over the annual systems.

What it Means: The reduced annual seeding costs and ability of perennial forages to access deeper soil moisture reserves were key in their improved economic performance over the study period. Although the perennial systems demonstrated a higher net return, the reduced forage quality as the season progresses means that they may not always be suitable for certain types of cattle. In those situations, utilizing an additional annual forage can provide a quick source of high-quality forage to avoid any drop off in animal performance.

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