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Effect of perennial forage system on forage characteristics, soil nutrients, cow performance, and system economics

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ABSTRACT

Two perennial forage systems were evaluated in a 3-yr study for their effect on forage biomass and nutritive value, botanical composition, soil nutrients, forage disappearance, beef cow performance, and economic analysis. Spring-calving, dry, pregnant Bos taurus beef cows [yr 1 (n = 60), 632 ± 8 kg; yr 2 (n = 60), 638 ± 5 kg; yr 3 (n = 48), 653 ± 5 kg] were managed in 1 of 2 replicated (n = 3) forage systems: (1) grazing stockpiled perennial forage [TDN = 52.5, CP = 10.7 (%DM); SPF] in field paddocks or (2) drylot pen feeding round bale hay [TDN = 52.7, CP = 10.0 (%DM); HY]. Forage utilization was greater (P = 0.01) for HY cows in all years (94%) compared with yr-1 and yr-2 SPF cows (58 and 78%, respectively). Forage disappearance was greater (P = 0.01) for yr-3 SPF cows than HY system cows; however, supplement was greater (P = 0.01) for SPF cows compared with HY cows during the study period. Soil NO_3*-N (P = 0.02) and organic carbon (P = 0.01) amounts at the 0- to 30-cm soil depth were greater in SPF paddocks than HY paddocks. Body weight and BCS did not differ (P > 0.05) for cows in either SPF or HY systems. Averaged over 3-yr, SPF total system costs were 14% less (P = 0.01) compared with the HY system. Results suggest field grazing stockpiled perennial forages in western Canada can be a viable strategy without any negative effect to beef cow performance.*

Key words: beef cow, economics, stockpiled forage

INTRODUCTION

Winter feeding costs are 60 to 68% of the total production cost of a cow-calf operation system in western Canada (Kaliel and Kotowich, 2002; Larson, 2010) and the United States (Karn et al., 2005). Winter environmental conditions create challenges because conserved feed and supplements are required, even with traditional drylot wintering programs (McCartney et al., 2004; Kelln et al., 2011). Extensive winter grazing systems, where cows are managed in field paddocks, can increase grazing days, thereby reducing feed costs, and also manage manure nutrients more efficiently (Jungnitsch et al., 2011; Kelln et al., 2011). Extensive grazing systems can decrease costs for harvesting, transportation, labor, and manure removal relative to the conventional drylot system (Hitz and Russell, 1998; Johnson and Wand, 1999; Volesky et al., 2002; Nayigihugu et al., 2007). Volesky et al. (2002) stated feed costs in an extensive swath grazing system were US$0.16/cow per d compared with $0.30/cow per d for baled hay fed in drylot pens. Jungnitsch et al. (2011) reported improved soil fertility and greater pasture growth where manure and urine were deposited during winter in-field bale grazing.

Stockpiling forage is the practice of accumulating forage biomass during summer and fall and grazing it after the growing season (Hitz and Russell, 1998; Riesterer et al., 2000). Grazing stockpiled perennial forages can be an excellent alternative to more expensive hay or silage feeding in drylot pens (Johnson and Wand, 1999; Cherney and Kalenback, 2003). However, stockpiled forages are usually mature

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and due to leaf senescence, can be moderate to poor in nutritive value (Matches and Burns, 1995). Yet, stockpiled forage can meet dry cow nutrient requirements in early to mid-gestation when requirements are less compared with lactating cows (Poore and Drewnoski, 2010). Stockpiled forage can be grazed from October to early December, or until weather and snow conditions prevent grazing, or can be used in early spring, before new pasture growth (Baron et al., 2005). The objectives of this study were to compare the effects of stockpiled forage grazing or feeding round bale hay in drylot on forage biomass and nutritive value, botanical composition, forage utilization and estimated disappearance, beef cow performance, and system economic analysis.

MATERIALS AND METHODS

The University of Saskatchewan Committee on Animal Care and Supply approved the procedures and facilities used in this study, and all animals were managed according to the Canadian Council for Animal Care (CCAC, 2009).

Forage Systems and Pasture Management

A 3-yr study evaluating 2 perennial forage systems was initiated in the spring of 2010 on a 12-yr-old pasture. A 24-ha pasture of meadow bromegrass (*Bromus riparius* Rehm., 'Paddock') and alfalfa (*Medicago sativa* L., 'Algonquin') (90:10 blend) was established (seeding rate of 9 kg/ha) in 1998 at the Western Beef Development Center's Termuende Research Ranch located 8 km east of Lanigan, Saskatchewan, Canada (51°51′N, 105°02′W, elevation 533 m). This location had an annual fertility history of 55 kg/ha actual N applied up to 6 yr preceding the current study. Historical pasture management included early summer to late fall grazing annually up to the year before the current study. The study site is located in the Black soil zone of Saskatchewan, and the soil is classified as Chernozemic Black Oxbow soil (Saskatchewan Soil Survey, 1992; Canadian system) or Udic Boroll (Kimble et al., 1993; United States system). The 24-ha pasture was further subdivided into six 4-ha paddocks using permanent wire fencing. Each 4-ha paddock was then randomly assigned to 1 of 2 replicated (n = 3) systems (treatments), either (1) stockpiled perennial forage grazing (**SPF**), where forage was stockpiled until early fall and then swathed and windrowed using a 6-m New Holland 2550SP Windrower (New Holland, PA), with field grazing commencing mid-October; or (2) stockpiled forage harvested early fall as large round bales (**HY**; 598 ± 48 kg) using a New Holland BR780 round baler, transported to the yard site, and fed in drylot pens located at Termuende Research Ranch site facilities, 1.0 km away from the field grazing site. Each paddock was assigned to the same respective system over the 3-yr study, and forages were swathed (meadow bromegrass in late anthesis; alfalfa in full bloom) on September 17, 2010, September 15, 2011, and September 14, 2012, in yr 1, 2, and 3, respectively. Following swathing, HY forage was baled as twine-wrapped round bales on September 20, 2010, September 17, 2011, and September 16, 2012, in yr 1, 2, and 3, respectively. Forages were not managed either in swathed or bale form until the growing season had ended, with the intent to evaluate forage managed in either system as perennial senesced material.

Cows managed in the SPF system had controlled access to swathed stockpiled forage within each 4-ha paddock using temporary electric fence with access to new forage provided every 3 d. Back-grazing was allowed, but cows were observed to graze swathed forage in the area where they had most recently been given access. Well water (also provided to HY cows) was supplied in stock troughs to all SPF cow groups and monitored on a daily basis, and 3 portable windbreaks (10 × 16 m each) were supplied in each replicate SPF paddock for wind protection. Cows in the HY drylot system were housed in outdoor pens (60 × 120 m) with 720 (yr 1 and 2) and 900 m^2 (yr 3) per cow and fed stockpiled forage round bale hay in bale feeders (#3005, Stampede Steel Manufacturing, Linden, AB, Canada). All pens were surrounded by slatted wooden fences and contained an open-faced shed, heated watering bowl, and a round bale feeder. Cows were allocated stockpiled forage or hay based on BW, cow nutrient requirements, and feed nutrient density in accordance with the NRC (2000) beef model as predicted by CowBytes Beef Ration Balancing Program (Version 5.3.1, 2011, Alberta Agriculture Food and Rural Development). The goal was to have cows maintain body condition and have no BW gain or loss above that required for pregnancy. However, the amount of stockpiled forage and hay offered varied depending on forage utilization and environmental conditions and was adjusted every 14 d for temperature fluctuations as follows: ≥−12°C, no adjustment; −12 to −15.0°C, DMI was increased 7%; −15.0 to −18°C, DMI was increased 10%; and when temperatures declined to a range between −18 and −23°C, DMI was increased 16% (NRC, 2000). During the 3-yr study, SPF and HY cows received an average of 1.1 and 0.1 kg/d (0.2 and 0.01% of BW) of supplemental rolled barley (12.4% CP, 86% TDN), respectively, or 0.3, 1.0, and 2.3 kg/d (SPF) and 0.0, 0.1, and 0.2 kg/d (HY) during October, November, and December, respectively. Supplement levels differed between SPF and HY systems, because SPF cows in field paddocks were more exposed to windchill factor and energy loss due to cold temperature (NRC, 2000). The supplement barley was provided each morning in portable feeders (0.5 × 4 m), with the amount of barley offered recalculated every 14 d based on average BW change and previous 2-wk change in environmental (temperature, precipitation) conditions. The amount of stockpiled forage, hay, and supplement associated with each treatment group of