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Fall-grown oat to extend the fall grazing season for replacement dairy heifers[1]

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ABSTRACT

Our objective was to assess the pasture productivity and forage characteristics of 2 fall-grown oat (*Avena sativa* L.) cultivars, specifically for extending the grazing season and reducing reliance on harvested forages by replacement dairy heifers. A total of 160 gravid Holstein heifers (80 heifers/yr) were stratified by weight, and assigned to 1 of 10 identical research pens (8 heifers/pen). Initial body weights were 480 ± 43.5 kg in 2011 and 509 ± 39.4 kg in 2012. During both years of the trial, four 1.0-ha pasture replicates were seeded in August with Ogle oat (Schumitsch Seed Inc., Antigo, WI), and 4 separate, but similarly configured, pasture replicates were seeded with Forage Plus oat (Kratz Farms, Slinger, WI). Heifer groups were maintained as units, assigned to specific pastures, and then allowed to graze fall-oat pastures for 6 h daily before returning to the barn, where they were offered a forage-based basal total mixed ration. Two heifer groups were retained in confinement (without grazing) as controls and offered the identical total mixed ration as pasture groups. During 2011, available forage mass increased with strong linear and quadratic effects for both cultivars, peaking at almost 9 Mg/ha on October 31. In contrast, forage mass was not affected by evaluation date in 2012, remaining ≤2,639 kg/ha across all dates because of droughty climatic conditions. During 2012, Ogle exhibited greater forage mass than Forage Plus across all sampling dates (2,678 vs. 1,856 kg/ha), largely because of its more rapid maturation rate and greater canopy height. Estimates of energy density for oat forage ranged from 59.6 to 69.1% during 2011, and ranged narrowly from 68.4 to 70.4% during 2012. For 2011, responses for both cultivars had strong quadratic character, in which the most energy-dense forages occurred in mid November, largely due to accumulation of water-soluble carbohydrates that reached maximum concentrations of 18.2 and 15.1% for Forage Plus and Ogle, respectively. Across the 2-yr trial, average daily gain for grazing heifer groups tended to be greater than heifers remaining in confinement (0.85 vs. 0.74 kg/d), but both management strategies produced weight gains within reasonable proximity to normal targets for heifers in this weight range. Fall-grown oat should be managed as stockpiled forage for deferred grazing, and good utilization of fall-oat forage can be accomplished by a one-time removal of standing forage, facilitated by a single lead wire advanced daily to prevent waste.
Key words: dairy heifer, fall-grown oat, stockpiled forage, water-soluble carbohydrates

INTRODUCTION

Recently, several plot-scale research projects have evaluated the potential of fall-grown oat (*Avena sativa* L.) for use as an emergency fall forage option and to extend the grazing season throughout central Wisconsin (Contreras-Govea and Albrecht, 2006; Coblentz and Walgenbach, 2010a; Coblentz et al., 2011). Specifically, this forage option targets a grazing interval extending from late September through mid November, when perennial cool-season grasses often become less productive, thereby leaving only limited options for dairy producers seeking to meet intake requirements for lactating cows or heifers via grazed forages. As such, management options that provide forage for grazing dairy animals throughout October and early November are highly valued. Some growth characteristics of fall-grown oat make it especially well suited for fall grazing. Among these, the long-day photoperiod requirement for flowering (Dennis, 1984) is disrupted, thereby resulting in a slower maturation rate than observed for spring-established oat forages (Contreras-Govea and Albrecht, 2006). In addition, several unique quality traits have been associated with fall-grown oat that include (1) reduced concentrations of fiber components, (2) less ex-

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tensive lignification, (3) improved fiber digestibility, (4) a tendency to accumulate water-soluble carbohydrates (**WSC**) as a result of winter hardening, and (5) relative stability with respect to energy density across a broad window of opportunity for utilization (Contreras-Govea and Albrecht, 2006; Coblentz and Walgenbach, 2010a; Coblentz et al., 2012). Although most of these traits are desirable from a grazing management standpoint, many unresolved logistical questions are associated with the use of these forages and warrant investigation. Our objective was to assess the pasture productivity and forage characteristics of 2 fall-grown oat cultivars, specifically for extending the grazing season and reducing reliance on harvested forages for gravid dairy heifers.

MATERIALS AND METHODS

Establishment of Pastures

The experiment was conducted on a Withee silt loam (fine-loamy, mixed, frigid, Aeric Glossaqualfs) soil type at the University of Wisconsin Marshfield Agricultural Research Station, located near Stratford (44°7′N, 90°1′W). The 10-ha pasture unit was subdivided into ten 1.0-ha pastures, 8 of which served as the experimental units for all pasture measurements, whereas the remaining 2 pastures were used as training pastures to adapt dairy replacement heifers to both grazing and the electric-fencing system. No data were collected from the training pastures. During early August of 2011 and 2012, the entire pasture system was clean-tilled, and tested for soil fertility (University of Wisconsin Soil and Forage Laboratory, Marshfield). Soil tests for P and K indicated no requirement for these soil amendments; therefore, pastures were fertilized only with urea (46–0-0) at a rate of 67 kg of N/ha. Four pastures were seeded with Ogle oat (Schumitsch Seed Inc., Antigo, WI) at a seeding rate of 108 kg/ha with a Case IH model 5300 grain drill (Case IH, Racine, WI), configured with 18-cm-wide row spacings. Likewise, 4 pastures also were seeded with Forage Plus oat (Kratz Farms, Slinger, WI) by the same methods and seeding rate, thereby yielding 8 total pastures from which data was collected. Ogle oat is considered a mid-maturity, grain-type oat cultivar, whereas Forage Plus has been selected specifically for forage-related traits, and consistently exhibits a slower rate of maturation. In University of Wisconsin performance tests (2007 through 2009), mean harvest dates based on traditional spring establishment and a late boot/early heading growth stage were June 14 and 24 for Ogle and Forage Plus, respectively (Mochon et al., 2009). However, these maturity rate differences are known to be exacerbated for fall growth applications (Coblentz et al., 2011). Cultivars were assigned randomly to pastures each year and pastures were fertilized with a single application of N on August 11, 2011, and August 8, 2012, and then seeded on August 11, 2011, and August 13, 2012. The pasture layout contained a centrally located drover's alley, positioned with an east-west orientation; rectangular pasture replicates of similar dimensions (~55.3 × 181.0 m) were located on both the north and south sides of the drover's alley.

Management of Confined Heifer Groups

All animal handling procedures for this experiment were approved by the Research Animal Resources Committee (RARC) of the University of Wisconsin-Madison (protocol no. A01479). A total of 160 gravid Holstein heifers (80 heifers/yr) were stratified by weight and assigned in groups of 8 heifers to 1 of 10 identical research pens located within a pole-type barn with natural cross-ventilation. Initial BW were 480 ± 43.5 kg and 509 ± 39.4 kg during 2011 and 2012, respectively, and the mean age of heifers was 17.5 ± 1.48 mo for 2011 and 17.3 ± 1.77 mo for 2012. All heifers were confirmed pregnant (97 ± 31.3 and 89 ± 39.2 d for 2011 and 2012, respectively) by the attending veterinarian before initiating the trial to avoid the inconveniences associated with breeding grazing heifers by AI. Within the barn, each research pen was equipped with continuous access to fresh water, 8 freestalls with foam-core mattresses, an automatically controlled mechanical alley-scraping system, and adequate bunk space adjacent to a drive-by feed alley that allowed all heifers to eat simultaneously.

Each year, the 10 research pens were assigned to 1 of 3 treatments that included (1) Forage Plus oat pasture, (2) Ogle oat pasture, or (3) no grazing (control). Four replications (pens) were assigned to each oat cultivar and 2 pens of heifers were assigned as control (confinement; no pasture) groups. A basal TMR diet composed of cereal-grain silage (ryelage or oatlage) and alfalfa haylage (Table 1) was dispensed to the control groups at 0900 and 1530 h in proportions accounting for 60 and 40% of the total daily allotment, respectively. After delivery of the TMR at 1530 h, the blended silage diet was top-dressed with ground corn at rates of 0.50 and 0.11 kg/heifer per day during 2011 and 2012, respectively. The ground corn also was used as a carrier for a low-phosphorus mineral package (Table 1) offered at a rate of 82 g/heifer per day. The TMR diet was offered for ad libitum intake by managing daily offerings of TMR to a defined bunk score of 2, where 0 = no feed particles remaining; 1 = only scattered feed particles remaining; 2 = numerous particles remaining, but the concrete floor still easily visible; or 3 = feed particles completely covering the concrete bunk floor (Hoffman et al., 2008). Bunks were scored each morning, and the