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THE INFLUENCE OF ENERGY SUPPLEMENTATION ON PERFORMANCE, DIGESTIVE KINETICS, AND INTAKE OF CATTLE GRAZING NATIVE FLOOD MEADOWS IN EASTERN OREGON

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ABSTRACT: Two experiments were simultaneously conducted to evaluate the effects of energy supplementation on forage intake, digestibility, digestive kinetics, and performance of cattle grazing native flood meadows. In experiment 1, eighty-four heifers (avg beginning wt 272 kg) were blocked by weight and randomly allotted to the following supplementation treatments (21 heifers/trt): 1) control (no supplement, CON); 2) .5 kg corn/h/d (LOW), 3) .75 kg corn/h/d (MED), 4) 1.0 kg corn/h/d (HI). In experiment 2, 10 ruminally cannulated steers were blocked by weight and randomly allotted to CON and MED treatments of experiment 1 (5 steers/trt). Heifers and steers were allowed to graze together in a 22.4 hectare pasture. Digestive kinetics and intake were determined by use of a pulse dose particulate phase marker. In experiment 1, heifers showed no treatment effect and gained approximately 1 kg/d during the 72 d trial. In experiment 2, supplementation had no effect (P>.10) on forage intake of steers (CON 21.2, MED = 20.1; g OM/kg BW) or in vitro digestibility (%; CON = 72.2, MED = 73.2). Rate of forage DM or NDF disappearance (%/h) was not altered by supplementation (CON = 5.9, MED = 6.8; CON = 5.8, MED = 6.5; P>.10). Likewise, extent of DM or NDF disappearance (72 h in situ incubation) exhibited no supplementation effect (P>.10). Particulate passage rate, ruminal retention time, and gastrointestinal fill were altered by supplementation (P<.05). Supplementation increased particulate passage rate (CON = 2.70, MED = 3.33; %/h), decreased ruminal retention time (CON = 45.1, MED = 35.9; h) and reduced gastrointestinal fill (CON = 2388, MED =1921; g OM). These results suggest that although some changes in digestive kinetics were noted, low levels of energy supplementation are not likely to increase performance of animals grazing high quality meadow pasture.

Key Words: Energy Supplementation, Performance, Meadow

Introduction

Native flood meadows (NFM) in the northwestern U.S. are classified as seasonally wet and are typically managed for hay production. In southeastern Oregon, surface irrigation is achieved by a series of ditches and headgates which force water across the meadow. Meadows are generally wet from April through June and control of flooding is minimal. This lack of control often prevents harvesting at a point when quality is optimal (Rumburg, 1963). In the last 20 years meadow foxtail (*Alopecurus pratensis*) has become a dominant species in many areas, but sedges (*Carex spp.*), rushes (*Juncus spp.*) and reed canarygrass (*Phalaris arundinacea*) are also important species. Meadow foxtail recovers quickly from grazing if soil moisture is adequate (Seamands, 1973). Therefore, early spring grazing has potential for improving management of NFM (Blount et al., 1991), although several researchers have reported depressed animal performance while grazing meadow foxtail (Rode, 1986; Rode and Pringle 1986; Blount et al., 1991). Additionally, other researchers have suggested that low levels of energy supplementation may enhance gains of animals grazing forage in an early vegetative state (Horn and McCollum, 1987; Vanzant et al., 1990). Thus, the objective of this study was to evaluate the effects of energy supplementation on intake, digestibility, digestive kinetics, and performance of heifers grazing NFM.

Materials and Methods

Research Site. This study was conducted at the Eastern Oregon Agricultural Center (EOARC) located approximately 6 km south of Burns, OR. The 22.4-ha pasture selected for the study was dominated by meadow foxtail, along with saltgrass (*Distichlis stricta*), reed canarygrass, quackgrass (*Agropyron repens*), Nevada bluegrass (*Poa nevadensis*), sedges and rushes. Dominant forbs include hesperochiron (*Hesperochiron pumulus*), common dandelion (*Taraxacum officinale*) and small quantities of arrowgrass (*Triglochin maritima*). Two concurrent experiments were conducted. Animals for both experiments grazed the pasture in common from May 3 to July 14, 1993.

Experiment 1. Eighty-four Hereford x Angus heifers (avg beginning wt 272 kg) were blocked by wt and randomly assigned to one of the following

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treatments (TRT; 21 heifers/TRT): 1) Control (CON, grazing only); 2) Low (LOW, grazing plus .5 kg cracked corn/h/d); 3) Medium (MED, grazing plus .75 kg cracked corn/h/d); 4) High (HI, grazing plus 1.0 kg cracked corn/h/d). Supplement was fed daily on an as-fed basis. Heifers were gathered daily at 0600, sorted into pens according to TRT (9 heifers/pen) and bunk fed supplement. Control heifers were immediately returned to pasture to continue grazing. After a 14 d adaptation period, heifers were weighed every 14 d following a 16 h shrink throughout the 72 d trial.

Experiment 2. Ten ruminal cannulated Hereford x Angus steers (avg beginning wt 277 kg) were weighed and randomly assigned to either CON or MED TRT groups (5 steers/TRT). Steers were also gathered daily and supplemented via the rumen cannula.

Two collection periods (early June and late June/July) were conducted to determine intake, digestibility and digestive kinetics. Only the results from the late June/July period will be reported. Beginning at 0500 on d 1 of the collection period all steers were gathered and a rumen evacuation was performed according to Lesperance et al. (1960). Collected masticate was split into 3 subsamples. The first subsample was composited across steer and TRT, and labled with Yb (Teeter et al., 1984) for use as a particulate phase marker. The second subsample was composited according to TRT, freeze dried and used as a substrate for in situ digestibility estimates. The third subsample, which remained specific to steer, was freeze dried, and used for in vitro digestibility estimates and diet quality determination.

On d 5, steers were dosed with Yb (94 g DM) and subsequent fecal grab samples followed 12, 18, 24, 30, 33, 36, 39, 42, 48, 60, 72, 84, 96, 108 and 120 h post dosing. Collected fecal samples were dried in a 60° C oven and ground to pass a 1 mm Wiley Mill screen. Fecal Yb was extracted using the DTPA extraction procedure described by Karimi et al. (1986) and measured by atomic absorption spectrometry using a nitrous oxide/acetylene flame. Ytterbium concentrations were fitted to a one-compartment model as described by Pond et al. (1982). Particulate passage rate, OM fill and retention times were estimated using the one-compartment model described by Krysl et al. (1988).

On d 9, duplicate nylon bags (20.0 x 10.0 cm; pore size 53 $\pm$ 10 µm) containing 4 g masticate samples plus one blank bag were suspended in the rumen for 72 h. Subsequent samples were suspended in the rumen for 48, 36, 24, 12 and 6 h. All bags were removed at 0 h. Bags were rinsed until water was clear, and dried 60°C. Residue remaining in the bags were analyzed for DM and NDF disappearance. In situ rate of DM and NDF disappearance was calculated using log transformation methodology described by Mertens and Loften (1980).

Beginning at 0600 on d 13, rumen fluid was collected from each steer and used as inoculum to determine in vitro OM digestibility of masticate (Tilley and Terry, 1963). Masticate samples were also analyzed for DM, ash and Kjeldahl N (AOAC, 1984). Fiber constituents, NDF and ADF, were analyzed non-sequentially according Goering and Van Soest (1970). Intake was estimated using IVOMD and fecal output estimates.

Statistical Analysis. Diet quality, digestibility, intake, in situ rate and extent, digestive kinetics and performance variables were analyzed as a completely randomized design, using the ANOVA procedures of SAS (1987). Means were separated by the least significant difference procedure following a significant F-test (Steel and Torrie, 1980).

Results and Discussion

Final heifer weights for the 72 d trial were similar across all TRT, with a final avg wt of 355 kg (Table 1; P>.10). Likewise, ADG was also similar (P>.10) among TRT, and heifers gained approximately 1.0 kg/d (Table 1). Similar gains were reported by Blount et al. (1991) and Rode and Pringle (1986) for steers grazing meadow foxtail without supplementation.

Nutrient composition of diets (Table 2) indicates that supplementation had no effect (P>.10) on quality of diet selected by steers grazing NFM. Diet CP was 19.4 and 20.6 percent for supplemented and nonsupplemented animals, respectively. Likewise, supplementation failed to influence in vitro organic matter digestibility (IVOMD; P>.10; Table 2) and averaged 73 percent.

Additionally, supplementation failed to influence total OM intake (TOMI; P>.05; Table 3). Control steers consumed 2.1% of BW, while MED steers consumed 2.0% of BW. These intake estimates are consistent with data reported by Blount et al. (1991) and Sharrow (1983) for steers grazing meadows.

Although supplementation had no effect on TOMI, digestive kinetics were influenced. Particulate passage rate (%/hour) was increased (Table 3; P<.05) from 2.7 percent for CON to 3.3 percent for MED. Rumen retention time (h) was decreased with supplementation (CON = 45.1, MED = 35.9; P<.05). Likewise, supplementation also decreased gastrointestinal mean retention time from 56.5 to 45.7 hours (P<.01). Gastrointestinal fill was also depressed with supplementation (P<.05).

Extent of forage DM and NDF disappearance, was not affected by supplementation (Table 4; P>.10). Likewise, supplementation failed to affect rate of forage DM and NDF disappearance (Table 4; P>.10).

Although some differences were noted in digestive kinetics; diet quality, rate of digestion, and intake estimates were all similar. Moreover, at the end of 72 d, no differences in weight or rate of gain were

noted between supplemented and nonsupplemented heifers.

Implications

Rode (1986) reported a decreased ADG for steers grazing meadow foxtail compared to steers grazing timothy. He concluded that while meadow foxtail could be used in the growing season, ADG's may be lower than expected based on forage quality. Furthermore, Rode (1986) theorized that anti-quality factors may exist in meadow foxtail. In contrast, Vanzant et al. (1990) concluded that small amounts (.35% BW) of grain may enhance gains of cattle grazing early season tallgrass prairie. In the present study, ADG was not enhanced when supplementation levels were at .18% BW, .27% BW and .37% BW.

According to the results of this study, low levels of energy supplementation of young growing animals grazing early season NFM did not enhance ADG enough to warrant the labor and expense involved in such management practices. Furthermore, the possibility that anti-quality factors may exist in meadow foxtail warrants further investigation.

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Table 1. Average final weight and ADG of heifers grazing native flood meadow during late spring and supplemented with 0, .5, .75 or 1.0 kg cracked corn during a 72 d trial.

	Treatment			
Item	0	.5	.75	1.0
Avg wt, kg	352 ± 34	352 ± 30	359 ± 31	357 ± 29
ADG, kg	1.0 ± .1	1.0 ± .1	1.1 ± .1	1.1 ± .1

Table 2. Nutrient composition of diets consumed by steers grazing native flood meadow during late spring, and receiving 0, or .75 kg cracked corn.

	Treatment	
Item[a]	0	.75
OM, %	82.8	83.7
NDF, %	55.5	55.7
ADF,%	30.3	31.1
CP, %	20.6	19.4
IVOMD, %	72.2	73.2

[a]OM = organic matter, NDF = neutral detergent fiber, ADF = acid detergent fiber, N = nitrogen, IVOMD = in vitro organic matter digestibility.

Table 3. Organic matter intake, and digestive kinetic variables for steers grazing native flood meadow during late spring and supplemented with 0 or .75 kg cracked corn.

	Treatment	
Item	0	.75
Total OM Intake, g/kg BW	21.2	20.1
Particulate passage rate, %/h[a]	2.7	3.3
Rumen retention time, h[a]	45.1	35.9
Gastrointestinal mean retention time, h[b]	56.5	45.7
Gastrointestinal fill, g[a]	2388	1921

[a]Row means differ (P<.05).
[b]Row means differ (P<.01).

Table 4. Extent and rate of forage dry matter disappearance for steers grazing native flood meadow during late spring and supplemented with 0, or .75 kg cracked corn.

	Treatment	
Item	0	.75
Forage DM Disappearance		
72 h, %	88.0	86.3
Rate, %/h	5.9	6.8
Forage NDF Disappearance		
72 h, %	81.0	78.3
Rate, %/h	5.8	6.5