Effects of Supplemental Feeding Using Different Nitrogen Sources on Body Weight Gain and Physiological Conditions on Grazing Castrated Lambs in the Steppe Zone of Mongolia

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The 23rd International Grassland Congress (Sustainable use of Grassland Resources for Forage Production, Biodiversity and Environmental Protection) took place in New Delhi, India from November 20 through November 24, 2015.

Proceedings Editors: M. M. Roy, D. R. Malaviya, V. K. Yadav, Tejveer Singh, R. P. Sah, D. Vijay, and A. Radhakrishna

Published by Range Management Society of India

Paper ID: 1444
Theme 2. Grassland production and utilization
Sub-theme: 2.1. Quality, production, conservation and utilisation

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Keywords: Brewers' grain, Carrying capacity, Pasture degradation, Risk management, Wheat bran

Introduction

The pastoral livestock production system in Mongolia has traditionally been operated in natural open pastures, which occupies approximately 80% area of the country. The productivity of the system is extremely seasonal, and the nutritional values of pasture plants such as crude protein (CP) and total digestible nutrients (TDN) decrease until spring (Yamasaki *et al*., 2013), resulting in animals losing their live weight by spring. In recent years, the damage caused by disastrously snowy and cold conditions, termed dzud in Mongolian, has evidently worsened, thereby affecting farm management in the region. To overcome the dzud and establish a sustainable livestock production system, supplemental feeding during the cold seasons is required. Wheat bran is the most prevalent feed among the country's herders. Brewers' grain (BG) is one of the most important livestock feed resources because it is rich in energy, protein, fiber, and fat content (MAFF, 1995). The production of BG has been steadily increasing year by year (National Statistical Office of Mongolia, 2014), but the usage of BG in the country is restricted, particularly during summer. Then, ensilaging would be one of the key techniques to store and conserve the nutritional value of BG,, as it is possible for even small-to-medium sized farmers and/or herders. In addition, the importation of urea into the country is beginning to accelerate and is expected to be a source of nitrogen (N) for ruminants. We then determined and compared the effects of the different N sources and the amounts on body weight gain and physiological conditions for animals, so as to contribute to the establishment of supplemental feeding technologies during the cold seasons in this region.

Materials and Methods

The current study was conducted in the Argalant rural district (sum), Tuv prefecture (aimag), where the vegetation type is classified as steppe. The vegetation survey was conducted at pastures that had been used frequently for grazing within 2–5 km distance from a tent, termed as ger in Mongolian, of a herder who managed the study animals. The pasture statuses for aboveground biomass were determined, and the dominant plant species were noted. Eight to nine months old 36 castrated sheep (B.W. 30.0 ± 2.0 kg) at the start of the experiment in early December, 2014, were selected at the herders' household and the neighbors'. The animals were divided into seven groups. All sheep were grazed and fed each type of supplemental feed individually in the fence besides the ger every day, except the six control (C) sheep which were just grazed. Wheat bran, silage, and urea were used for supplementation. Silage was prepared by mixing BG and wheat bran at the ratio of 9: 1, respectively, on a fresh matter basis during early September, 2014. The feed samples were analyzed for the N contents (%) on a dry matter (DM) basis before the start of the experiment. At the initiation of the experiment, the sheep were adapted for each feed for ten days to determine the amount the sheep could consume with no constraint and stress, particularly on the silage. Furthermore, from the maximum amount of the silage, the maximum amount of wheat bran, which was equivalent to the maximum amount of the silage on an N basis, was determined. Further, 30 sheep, five sheep in a group, were allocated by the quantities of the feeds on the basis of DM as follows: 1) half of the maximum intake of the silage, or 1.5% B.W. (S1); 2) maximum intake of the silage, or 3.0% B.W. (S2); 3) half of the maximum intake of the silage, or 1.5% B.W. mixed with urea to total the same N intake as S2 (S1U); 4) half of the maximum intake of the wheat bran or 0.7% B.W. (W1); 5) maximum intake of the wheat bran, or 1.4% BW (W2); and 6) half of the maximum intake of the wheat bran, or 0.7% B.W. mixed with urea to be the same N intake as W2 (S1U). The daily quantities of the feeds were accurately weighed for individual animals, and the feed refused by animals was collected to determine the intake. The feeding was done until a day before the end of the experiment, i.e., until May, 2015, a duration of 155 days. Minimum and maximum daily temperatures and time of starting and finishing of grazing were noted daily. The numbers of surviving animals were enumerated, and in principle, body weights were measured monthly until the end of the experiment. The digestibility was determined by the lignin method (acid detergent lignin, ADL) and the indicator method (titanic oxide, TiO2) for each animal in duplicate, *i.e*., during late January and early February, and in April, 2015, to estimate the forage intake. During each period, harnesses were attached to all animals, and all feces were collected twice a

day, before and after grazing. During the period, the TiO2 was placed in capsules and administered at a rate of 2 mg/day/sheep. Samples of pasture plants consumed by animals were collected during each period by following the herd and observing the feeding behavior of the sheep. Blood tests were performed three times, *i.e*., early December, 2014, the end of February, and the end of May, 2015, to determine the physiological condition of the animals. In addition, before the end of the experiment, the biological and physiological conditions of the animals were determined on the basis of the types and number of ciliates and lactic acid bacteria, and the pH of the rumen fluid. The blood was also sampled to measure the concentration of urea, lactic acid, and ammonia. The contents of DM, CP, ether extracts, acid detergent fiber, neutral detergent fiber, ash, calories, and ADL in all feed samples and pasture plants were analyzed according to AOAC (2000). In addition, the concentration of TiO2 in feces was measured. The concentrations of lactic acid and volatile fatty acids were additionally determined. The data were analyzed using General Linear Models of ANOVA using the statistical software MINITAB ver. 16.

Results and Discussion

The daily intakes of the supplemental feeds by the animals on a DM matter basis during the study period are shown in Fig. 1. There were significant differences in the amount ($p < 0.001$), which was highest in W2, second highest in S2, third highest in W1 and W1U, and lowest in S1 and S1U. This indicates that the sheep fed on almost all feeds which were supplied. Fig. 2 shows BW of the sheep at the end of the experiment. The BW of S2 and W2 were significantly higher than C and S1U ($p < 0.001$). The magnitude of S2 appeared to be higher than that of W2, although there was no significant difference ($p > 0.05$). BW of S1, W1, and W1U were medium, and no difference was found between BW of the other groups ($p < 0.05$). The above results can be summarized as follows: 1) the effect on BW of silage supplementation was comparable with that of wheat bran, although the quantity on DM basis was lower in the silage; and 2) The addition of urea to increase the N proportion in the feeds showed no effect on BW. After the progression and completion of the analysis of the remaining parameters, additions will be made to the results and discussion, and the conclusion will be finalized.

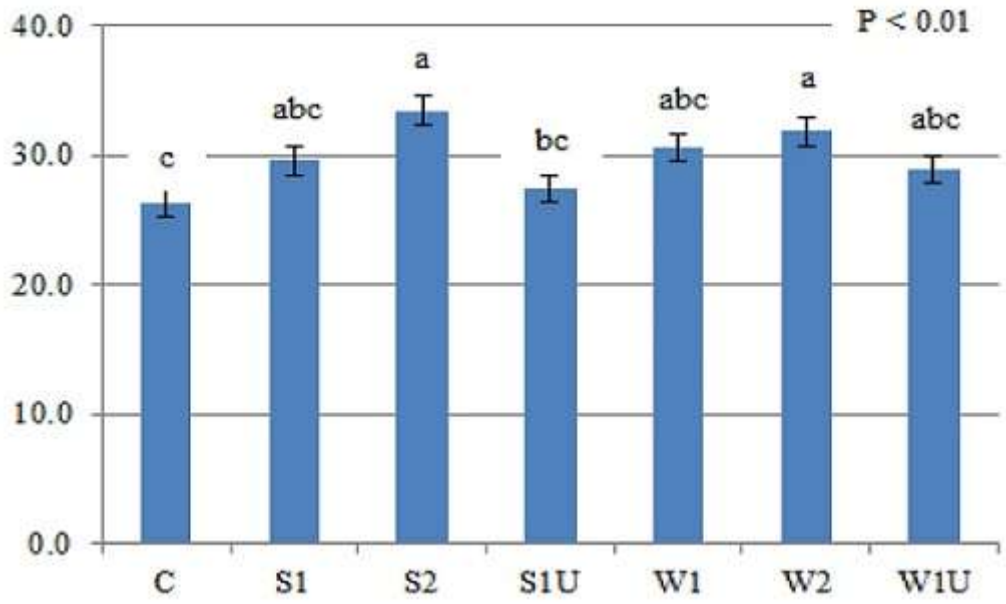

Fig. 1: Body weight of the sheep as per treatment groups at the end of the experiment, kg (error bar: SEM)

Conclusion

The BG silage supplementation with maximum intake or 3.0% of body weight would be recommended to increase the body weight gain, and to reduce / replace the wheat bran. The urea was not recommended to increase the N intake.

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Acknowledgement
The study was conducted under the research project "Development of resilient agro-pastoral systems against the risks of extreme weather events in arid grasslands in Northeast Asia" founded by Japan International Research Center for Agricultural Sciences.