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Research on influence of different non-protein nitrogen (NPN) compounds in beef cattle feeding

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Abstract

The aim of the study was to investigate the activity of slow-release non-protein nitrogen compound with the enzymatic activity (SENPN) and to compare it with the activity of slow-releasing non-protein nitrogen compound (SNPN) in beef cattle feeding. The following indicators were monitored: body weight (BW), average weight gain (AWG), feed conversion ratio (FCR), trunk weight at slaughter (TWS) and dressing percentage (DP). Beef cattle were divided into two groups of uniform body weights; control group (CG) and experimental group (EG). The feed ration of the CG contained SNPN, while the feed ration of the EG contained SENPN. During the trial, three weights were performed to measure BW. The trial consisted of two parts: (i) the first part of the trial refers to the period between the first and second weighing, in which the feed ration of the EG contained 4.81% less starch per kg of dry matter (DM) compared to the feed ration of the CG, and (ii) the second part of the trial was conducted in the period between the second and third weighing, in which the feed ration contained equal starch levels. After the third weighing, the beef cattle were transported to the slaughterhouse, where they were sacrificed, and subsequently the values of TWS and DP were measured. There were no statistically significant differences found for each of the measured parameters. In conclusion, the usage of SENPN positively affects the utilisation of nutrients in the mixture, e.g. feed ration.

Keywords: beef cattle, feed conversion, gain, slow-release urea

Introduction

The NPN compounds have been present for many years in cattle feeding, so that Hungate (1966) concluded that microorganisms in rumen can use ammonia for their growth and represent a source of microbiological protein for an animal. The most commonly used source of non-protein nitrogen in ruminants' feeding is urea. One of the greatest problems related to the usage of urea is the degradability that is much faster than the ability to utilise ammonia by the microorganisms, which is leading to the loss of nitrogen (N) (Bloomfield et al., 1960). For the sake of optimal microbiological protein synthesis, it is necessary to ensure enough energy needed for the utilization of nitrogen compounds by microorganisms (Firkins, 1996). Subsequent researches have been conducted in direction of studding various forms of slow-release urea, such as biuret, stearate, urea-formaldehyde, uromol, urea-lignocellulosic complex, calcium chloride linked urea, calcium sulphate linked urea, urea coated with a complex fat matrix, etc. (Huntington et al., 2006; Cherdthong et al., 2011). SNPN is an NPN compound in which the urea fraction is coated with a complex fat matrix, thanks to which ammonia is being slowly released and its activity on fattening performances and slaughtering characteristics of young cattle categories has already been the subject of Khan et al. (2015). SENPN is one of the NPN compounds of a recent date, it is also a slow-release NPN compound that, besides the properties of slow releasing of ammonia and meeting the energy needs of microorganisms in rumen, also contains nutritive substances with an enzymatic activity derived from enzyme complex obtained by fermentation of *Aspergillus niger* that should improve utilization of feed. The aim of this study was to investigate the activity of slow-release NPN compound with enzymatic activity and to compare it with the efficiency of slow-release NPN compound in beef cattle feeding.

Materials and methods

The 38 Limousin breed beef cattle were individually weighed and placed in the group pen by arrival at the farm, thus commencing the preparatory period of 15-day. The nutritional composition of feed rations both for CG and EG are presented in Table 1.

At first weighing the beef cattle were individually weighed and based on the measured BW, they were divided into two groups (19 animals each) of uniform body masses: control group (CG) and experimental group (EG). Group feeding was applied for the beef cattle. Consumption of feed rations was recorded daily by group and represent the difference between the distributed and the leftover amounts. The feed ration consisted of voluminous (high-humid maize grain, maize silage and hay) and concentrated portion, i.e. 1.3 kg of previously prepared fodder mixture. The mixture for the CG contained 4% SNPN, whilst the mixture for the EG contained 4.5% SENPN, so that the feed ratio for the CG contained 0.05 kg of SNPN, whilst the feed ration for the EG contained 0.06 kg SENPN. The second weighing was scheduled 53 days after the first weighing, for the purpose of calculating average weight gain (AWG) and feed conversion ratio (FCR). After the second weighing, the beef cattle crossed to the second feed ration shown in Table 1. The third weighing was scheduled 48 days after the second weighing, for the purpose of calculating AWG and FCR related to the second part of the trial and to the whole trial. The weights were carried out individually. After the third weighing, and based on the obtained BW values from 19 animals in each group, 15 animals were selected to be taken to the slaughterhouse. Based on the obtained trunk weight at slaughter (TWS) values, the dressing percentage (DP) values were calculated. Research results were then processed with one-way ANOVA. Differences between treatments were obtained using Tukey HSD test at significance level $P<0.01$ using the Statistics program.

Table 1. Nutritional composition of feed ration

Item (% DM)	CG[d]	EG[e]	CG	EG
	1st part of the trial		2nd part of the trial	
Dry matter	54.87	52.56	54.87	54.87
Crude proteins	11.69	11.64	11.69	11.71
PDIN[a]	7.55	7.41	7.54	7.55
PDIE[b]	10.41	9.95	10.13	10.41
PDIA[c]	3	2.82	3	3
Crude fibre	10.92	12.88	10.92	10.93
Starch	48.18	43.37	48.18	48.18
Fat	3.3	3.18	3.3	3.3
Net energy value (NEL, MJ)	7.61	6.87	7.61	7.68

[a]Protein digested in the small intestine when rumen fermentable N is limiting; [b]protein digested in the small intestine when rumen fermentable energy is limiting; [c]ruminally undegraded feed protein digested in the small intestine; [d]control group; [e]experimental group.

Results and discussion

The values of the obtained results for ABW, as well as AWG during the first and second part of the trial, and in duration of the whole trial, did not reveal any statistical significance among the groups (Table 2).

Baldi et al. (2014), who used NPN as a partial replacement for soybean meal in their experiment, obtained higher values both for ABW and AWG, confirmed with statistically significant differences ($P<0.001$). The conversion of feed was higher in the EG, but it is also apparent that in the first part of the trial this difference was higher (2.69 kg·kg), whilst in the second part of the trial this difference was reduced (1.04 kg·kg).

Sgoifo Rossi et al. (2015) obtained results that are in contrast to the results obtained in The conversion of feed in their experiment was statistically significantly higher ($P<0.001$) in the CG compared to the EG. Possible explanation of the results from this experiment can be given on the basis of the content of dry matter and starch content in the feed ration.

According to the obtained results for carcasses traits (Table 3), the usage of SENPN had positive consequences on the TWS value ($P=0.72$). Similar results were reported by Baldi et al. (2014), who replaced soybean with NPN obtained statistically significantly higher (P<0.001) TWS values in the EG compared to the CG, whilst the values of DP were without statistically significant differences.

Table 2. The obtained values of average body weight and average weight gain

Parameter	Weighing number	CG[e]	EG[f]	P-value
		$\bar{x}^{c}$ ± Sd[d]	$\bar{x}$ ± Sd	
Average body weight (kg) (n=38)	1	402.21 ± 56.2	401.74 ± 31.26	0.974
	2	463.7 ± 57.5	462.58 ± 33.18	0.939
	3	518.68 ± 56.82	516.32 ± 35.1	0.878
Average weight gain (kg) (n=38)	1-2	61.53 ± 10.02	60.84 ± 11.85	0.848
	2-3	54.95 ± 18.14	53.74 ± 14.82	0.823
	1-3	116.47 ± 22.04	114.58 ± 18.58	0.776

[c]Mean value; [d]standard deviation; [e]control group; [f]experimental group.

Table 3. Carcasses traits

Slaughtering indicators	CG[e]	EG[f]	P-value
	$\bar{x}^{c}$ ± Sd[d]	$\bar{x}$ ± Sd	
Trunk weight at slaughter (kg)	297.93 ±23	299.27 ±14.88	0.72
Dressing percentage (%)	56.68 ±0.51	56.52 ±0.31	0.322

[c]Mean value; [d]standard deviation; [e]control group; [f]experimental group.

Conclusions

Based on the results obtained through the first and second part of the trial, as well as throughout the whole trial period, it can be concluded that SENPN can be used in beef cattle feeding without adverse consequences on fattening and slaughtering indicators. Slightly poorer results were obtained only for feed conversion, for which possible explanation may be derived from the fact that in the first fattening period the feed ration for the EG contained less dry matter and less starch, whereas in the second fattening period, after equalizing the amount of dry matter in the feed ration and the amount of starch, the difference in feed conversion between the groups was significantly reduced. In order to investigate the influence of SENPN and to ascertain more precisely its influence in the feed rations for beef cattle, further research will be needed.

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