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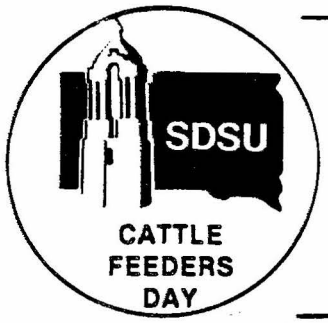

SOURCES AND HEAT TREATMENT OF PROTEIN INGREDIENTS FOR SUPPLEMENTING CORN SILAGE FOR GROWING CATTLE

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Summary

A study with one hundred sixty-eight Angus and Hereford-Angus steers was conducted to evaluate protein supplementation under various conditions with corn silage diets. Steers averaged 581 lb initially and were fed 103 days.

Diets consisted of 90% corn silage and 10% supplement on a dry basis. Corn silage (39% DM) was stored in two tower silos. Forage from one was treated with a microbial additive and silage from the other served as a control. Twenty-four pens with seven steers each were used for six dietary treatments (four replications). Corn silage treatments were balanced according to protein treatment groups. Dietary supplements were control, urea, Golden Pro, urea + soybean meal, urea + heat-treated protein (HTP) soy blend meal and Golden Pro + HTP soy blend meal, providing protein levels of 8.43, 11.03, 10.74, 10.96, 10.91 and 10.73%, respectively, on a dry basis. Golden Pro (about 60% protein) is a heat-treated product and consists of urea (20%), ground yellow corn and sodium bentonite. HTP soy blend meal (about 40% protein) consists of 40% whole soybeans and 60% solvent processed soybean meal. This product was extruded and heat-treated at 320 F under pressure.

Results showed that protein-supplemented steers gained at a faster rate than controls throughout the experiment. This resulted in total gain improvements for protein-supplemented steers over the control ranging from 38 to 55 lb per head. Feeding urea, Golden Pro and urea + soybean meal resulted in similar animal performance. Feeding HTP soy blend meal with either urea or Golden Pro showed an initial advantage over the other supplements with only small differences between these two supplements. After the second weight period, rates of gain were similar for all protein-supplemented steers.

Steers fed the control diet had lower levels of feed intake than steers fed protein-supplemented diets with only slight differences between the supplemented groups. Feed requirements for steers fed supplemental protein were lower than for the controls. Small differences in feed to gain ratios were observed between supplemental treatments. Faster rates of gain

and reduced feed consumption during the first month of the experiment resulted in lower feed requirements. However, these requirements increased with increasing time on feed and weight of cattle.

Introduction

Urea is the most common nonprotein nitrogen source used in cattle and sheep diets. With new concepts in protein supplementation and feedstuffs processing, it is important to reevaluate the role of urea in cattle feeding. Nutritional concepts such as protein solubility, protein "by-pass" and amino acid composition together with feed processing methods (chemical treatment, heat treatment) are bringing about changes in diet formulation. Consequently, it is useful to study these changes in association with urea in cattle diets. This experiment was conducted to evaluate protein supplementation under various conditions with corn silage fed to growing cattle with emphasis on factors affecting utilization of urea.

Procedures

This experiment used one hundred sixty-eight Angus and Angus-Hereford steers averaging about 581 lb which were previously adapted to a full feed of corn silage with no supplemental protein. All steers were ear tagged, implanted with zeranol, vaccinated against BVD (Bovine Virus Diarrhea), IBR (Bovine Rhinotrachaetis) and PI_3 (Parainfluenza), injected with a 4-way clostridium bacterin and treated with Warbex (pour-on) for parasite control prior to the experimental period.

Upon starting the experiment, steers were weighed in early morning before feeding and again the following morning after withholding feed and water for about 18 hr. After the shrunk weight was obtained, steers were allotted into 24 pens on the basis of weight and breed group with seven steers per pen. Treatments were replicated four times with a diet containing 90% corn silage (39% DM) and 10% supplement on a dry basis.

The supplements used were as follows:

1. Control supplement
2. Urea supplement
3. Golden Pro supplement
4. Urea + soybean meal supplement
5. Urea + heat-treated protein (HTP) soy blend meal
6. Golden Pro+HTP soy blend meal

Ingredient composition of the supplements which formed the dietary treatments used in this experiment are shown in table 1. The control supplement without a high-protein ingredient served as a measure of response to the various protein-supplemented diets. It contained ground corn grain, limestone, dicalcium

phosphate, trace mineral salt, vitamin A and lasalocid so cattle fed the control diet would receive similar dietary levels of calcium, phosphorus, salt, trace minerals, vitamin A and lasalocid as the protein-supplemented cattle.

TABLE 1. INGREDIENT COMPOSITION OF FEEDLOT DIETS

Ingredients	Control	Urea	Golden Pro	Urea + Soybean meal	Urea + HTP soy blend meal	Golden Pro + HTP soy blend meal
			% of dry matter			
Corn silage	90	90	90	90	90	90
			Supplement[a]			
Ground corn	8.80	7.92	4.66	5.28	5.09	3.35
Soybean meal (44%)	--	--	--	3.01	--	--
Urea	--	.81	--	.40	.40	--
Golden Pro (60%)	--	--	4.07	--	--	2.00
HTP soy blend meal (40%)	--	--	--	--	3.36	3.39
Limestone	.29	.12	.12	.35	.20	.06
Dicalcium phosphate	.61	.63	.63	.55	.54	.79
Trace mineral salt	.30	.30	.30	.30	.30	.30
Calcium sulfate	--	.22	.22	.11	.11	.11
Avg protein content as analyzed (dry)	8.43	11.03	10.74	10.96	10.91	10.73

[a] Each diet contained 1000 IU vitamin A and 15 mg of lasalocid per pound.

The urea supplement was formulated to give diets with about 11.0% protein (dry basis) with urea as the only supplemental source. It provided .81% urea in the total dry diet. Calcium sulfate was included to provide 1 part sulfur to 10 parts of nitrogen from the urea in all supplements which contained urea. The urea diet served to measure the response from the high-protein ingredients and heat treatments of ingredients in the other diets.

The Golden Pro product (processed by Triple "F" Feeds, Des Moines, IA) consisted of ground yellow corn, urea (20%) and sodium bentonite subjected to heat treatment. This product which contains about 60% protein was used to formulate a diet

similar in composition to the urea supplemented one except for the heat treatment applied in the manufacturing process of the Golden Pro product.

The urea + soybean meal supplement provided a supplement in which soybean meal supplied about one-half of the supplemental protein. The purpose of this supplement was to combine a high-quality protein source (as measured by amino acid content) with a protein source devoid of amino acids. Not only is preformed protein substituted for nonprotein nitrogen, but the amount of urea is reduced. Each could have an influence on protein utilization and performance of the cattle.

The heat-treated protein soy blend meal product (Triple "F" Feeds) consisted of a mixture of 40% whole soybeans and 60% solvent processed soybean meal. It will be referred to as HTP soy blend meal in this report. The blend was extruded and heat treated at 320 F under pressure by the Instapro method, causing with this extra heat a reduction in the rate of ruminal degradation in comparison to soybean meal. This product was fed with the urea-corn mix and with the Golden Pro supplement to determine the benefits under each condition in substituting preformed protein for part of the nonprotein nitrogen and from a product more resistant to rumen degradation.

The corn silage (8.45% protein) from the 1982 crop was stored in two tower silos. Forage from one silo served as a control and the other was treated with a microbial additive. Data for microbial silage treatment are presented separately in this Cattle Feeders Day Report (84-2).

Protein contents of total diets on a dry basis for control, urea, Golden Pro, urea + soybean meal, urea + HTP soy blend meal and Golden Pro + HTP soy blend meal were 8.43, 11.03, 10.74, 10.96, 10.91 and 10.73%, respectively (table 1).

At the beginning of the experiment, supplements were offered for the first time on day 1. Total feed offered was about 8 lb (dry) per animal and was increased gradually to a full feed of about 12 lb (dry) per head daily in about 10 to 12 days. Rate of feeding after this was regulated to amounts that would be nearly consumed by the next feeding. Diets were batch mixed for each pen and fed once daily.

Prior to each weigh period during this experiment, the steers were left for an overnight stand of about 18 hr without feed and water. The experiment was terminated after 103 days when steers averaged about 841 lb. Data obtained for average daily gain, feed consumption and feed efficiency are presented cumulatively by weigh periods.

Results

Feedlot performance data for supplement treatments are presented averaged over corn silage microbial treatments.

Weight Gain:

Accumulated weight gain averages at periodic intervals are presented in table 2. Supplementing the control diet (8.43% protein) with the various sources of protein (about 11.0% protein) resulted in marked improvements in weight gains throughout the experiment. The advantage for the protein-supplemented groups was most pronounced during the first 2 months of the experiment.

TABLE 2. ACCUMULATED AVERAGE DAILY GAIN BY WEIGH PERIODS AS AFFECTED BY DIETARY TREATMENTS

Item	Control	Urea	Golden Pro	Urea + soybean meal	Urea + HTP soy blend meal	Golden Pro + HTP soy blend meal
No. of steers	28	27[a]	28	28	28	28
Initial shrunk wt, lb	582	581	581	582	582	579
Final shrunk wt, lb	807	854	844	859	862	853
Avg daily gain, lb						
29 days	1.76	2.97	2.89	2.78	3.28	3.18
58 days	1.91	2.66	2.82	2.73	2.77	2.71
85 days	2.15	2.73	2.71	2.70	2.76	2.70
103 days	2.19	2.65	2.56	2.69	2.72	2.66

[a] Initially 28 steers, one death loss from conditions unrelated to dietary treatment.

Among protein-supplemented groups, Golden Pro or urea with soybean meal appeared to offer no advantage over the urea supplement initially or during the course of the experiment. Faster rates of gain were obtained for steers with the HTP soy blend meal supplement combined with urea or with Golden Pro in comparison to the urea supplement during the first month of the experiment. Thereafter, the amount of gain at each weigh period showed no advantage over the urea supplement.

Feed Intake:

Accumulated average daily feed intake at periodic intervals is presented in table 3. Feed intake increased with increased weight and time on experiment. Steers fed protein-supplemented diets with corn silage consumed more feed than unsupplemented controls. Source of protein appeared to have only small effects on daily feed intake.

TABLE 3. ACCUMULATED AVERAGE FEED INTAKE BY WEIGH PERIODS AS AFFECTED BY DIETARY TREATMENTS

Item	Control	Urea	Golden Pro	Urea + soybean meal	Urea + HTP soy blend meal	Golden Pro + HTP soy blend meal
Avg feed intake (dry), lb.						
29 days	12.51	13.84	13.92	13.96	14.11	14.51
58 days	14.20	16.02	16.03	15.82	16.14	16.45
85 days	15.41	17.20	17.09	16.93	17.12	17.35
103 days	15.68	17.39	17.24	17.15	17.38	17.34

Feed Efficiency:

Data for feed efficiency accumulated by weigh periods are shown in table 4. As for feed consumed, feed required per unit of gain increased with weight and time on experiment. The increase was less for the controls than for protein-supplemented steers.

Protein-supplemented steers consuming more feed and making a faster rate of gain than controls had lower feed requirements. The apparent early advantage in weight gain for steers fed the HTP soy blend meal supplement was also accompanied by lower feed requirements. Otherwise, there appeared to be no major or consistent differences in feed requirements between protein-supplemented groups of steers.

TABLE 4. ACCUMULATED FEED EFFICIENCY BY WEIGH PERIODS AS AFFECTED BY DIETARY TREATMENTS

Item	Control	Urea	Golden Pro	Urea + soybean meal	Urea + HTP soy blend meal	Golden Pro + HTP soy blend meal
Avg feed/gain ratio (dry)						
29 days	711	466	482	502	430	456
58 days	743	602	568	579	583	607
85 days	716	630	626	627	620	643
103 days	716	656	651	638	639	652