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DEHYDRATED ALFALFA AND "KEDLOR" BIURET

IN RANGE SUPPLEMENTS

by

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INTRODUCTION

Mature winter range forage does not contain adequate protein, phosphorous and carotene to meet the nutritional requirements of most grazing livestock. This nutritional inadequacy is more critical for younger, growing animals than for maintenance of mature animals. Supplementation of protein, phosphorous, and vitamin A to cattle of all ages consuming low quality winter forages has become an established, recommended management practice.

Evaluation of different sources of non-protein nitrogen (NPN) that would substitute for plant protein in winter supplementation programs is necessary. Experiments conducted at the University of Nebraska, North Platte Station during the past six winters have evaluated urea and feed grade biuret as NPN sources. These experiments have shown that urea is not well utilized under range conditions, while biuret has shown promise as a source of NPN in winter range supplements.

This research has also demonstrated that biuret utilization is affected to some degree by the ingredients with which it is incorporated into range supplements. Supplements containing biuret together with soybean meal or dehydrated alfalfa have supported greater weight gains than supplements containing biuret in which corn was the major ingredient. The reason for greater gains when either natural protein source was incorporated into supplements with biuret is not well understood.

Differences are apparent in the chemical composition of soybean meal,dehydrated alfalfa, and corn. Dehydrated alfalfa and soybean meal are both superior to corn in protein quantity and quality. Soybean

meal and dehydrated alfalfa contain ten and fifty times, respectively, the amount of calcium, and six to seven times, respectively, the amount of potassium present in corn. Soybean meal and dehydrated alfalfa both contain more iron, magnesium, sodium, copper, chlorine, and manganese than corn.

The trace mineral premixes routinely used at the North Platte Station supply NRC recommended allowances of iron, copper, cobalt, iodine, zinc, and manganese. Sodium and chlorine are provided by salt, and sulfur is added to all NPN supplements fed at the Station. The basic difference between supplements containing dehydrated alfalfa or soybean meal (as opposed to largely corn) therefore, would be the quantity of calcium and potassium they contain. The use of NPN to replace protein from either dehydrated alfalfa or soybean meal would reduce the total quantity of plant protein, calcium, and potassium present in the supplements.

Experiments were designed to investigate some of the components of dehydrated alfalfa to determine the factors responsible for more effective biuret utilization when dehydrated alfalfa is included in protein supplements for growing steers.

REVIEW OF LITERATURE

Development of the Use of Non-Protein Nitrogen

Stangel (1967), in a history of the use of urea, noted that the discovery of nitrogen by Rutherford in 1772 marked the beginning of controlled experimentation with nitrogen. Rouelle, a year later, identified urea in urine. Forncroy and Vanquelin prepared a crystalline form of urea during the closing years of the 18th century, followed by the synthesis of urea from inorganic substances by Wholer in 1828.

Stangel further cited the work of Hagemann and Zuntz who, in 1891, independently recognized the unique role of the rumen microflora in the nutrition of the host ruminant. Zuntz pointed out that the protein-sparing action of asparagine and other amides was observed only with ruminants. Morgan and co-workers probably performed the first feeding experiments with NPN from 1907 to 1924. They showed that urea could supply 30% to 40% of the nitrogen in sheep diets. Voltz, from 1907 to 1920, showed that lambs would grow when fed a low-protein, semi-purified diet composed entirely of starch, alkali-washed straw, inorganic salts, and urea.

A comprehensive review of research on NPN utilization by ruminants was published by Armsby (1911). He deduced the role of microorganisms in converting NPN to microbial protein and their subsequent digestion and conversion to protein for growth and milk production. He further stated that the extent to which protein could be formed, rather than any inferior nutritive value, limited the utilization of protein formed from NPN.

The commercial success of direct synthesis of ammonia from atmospheric nitrogen, and the construction of a plant in Germany in 1913 to produce synthetic nitrogen products, stimulated research on the use of NPN compounds as nitrogen sources. Hart et al. (1938) reported the first intensive research in the United States on the use of urea and ammonium bicarbonate in ruminant rations, concluding that ruminants could use simple nitrogen compounds through the action of the rumen microorganisms.

Early in the 1950's research showed that urea could replace 25% to 33% of the total nitrogen in cattle feeds. Research conducted by Bell, Gallup and Whitehair (1953), Beeson, Mohler and Perry (1964), Beeson and Horn (1967) and Conrad and Hibbs (1968) contributed greatly to furthering the use of NPN in livestock feeding.

Biuret as a Source of NPN

Biuret, a condensation product of urea, has received considerable attention as a source of NPN because of improved palatibility, slower ammonia release, and relative lack of toxicity as compared to urea (Ioset, 1969).

Gaither et al. (1955) found biuret and urea nitrogen were retained equally well when each supplied 33% of the supplemental nitrogen in semi-purified lamb diets. Meiske et al. (1955) observed no difference in weight gains of growing and finishing lambs when fed either biuret, urea or soybean meal. Berry, Riggs and Kunkel (1956) reported that lambs and steers fed 1% biuret gained lass than lambs or steers fed urea or cottonseed meal. They concluded that biuret was not a dependable source of nitrogen.

Ewan, Hatfield and Garrigus (1958) found that biuret in the diet depressed *in vitro* dry matter digestibility when compared to urea, although the depression was not significant ($P > .05$). Anderson *et al.* (1959) fed lambs iso-nitrogenous, iso-caloric diets in which up to 67% of the total nitrogen was supplied by urea, uramite, biuret, or soybean meal. All levels of biuret reduced crude protein digestibility, although the depression was significant ($P < .05$) only when biuret supplied more than 50% of the total dietary nitrogen. Diets containing purified soybean protein were more digestible ($P < .05$) than diets containing biuret, urea or uramite. Hatfield *et al.* (1959) showed that biuret was not toxic and that growth, reproduction, and wool production were not adversely affected by feeding biuret. However, nitrogen digestibility was lower ($P < .01$) in diets containing biuret than in diets containing urea or soybean meal.

Clark, Barrett and Kellerman (1963), using low protein, high roughage diets, showed biuret to be as efficient as urea in promoting feed intake, nitrogen retention, and apparent nitrogen absorption. Karr *et al.* (1965) reported no differences ($P > .05$) in nitrogen and dry matter digestibility of diets containing 3% urea or 3.5% biuret. Verde *et al.* (1970) found that biuret stimulated voluntary intake of low quality forage by sheep almost as much as cottonseed meal. Cellulose and organic matter digestibility were higher, but nitrogen digestibility lower with biuret supplementation.

Slyter *et al.* (1970) showed no difference in nitrogen retention from either urea or biuret when steers were fed wood pulp with and without starch supplementation. Chicco *et al.* (1970) fed supplements containing biuret or urea to steers on a basal diet of green chop

elephant grass and observed slightly greater nitrogen retention and weight gains ($P > .05$) from biuret supplementation. Templeton, Bucek and Swart (1970), using a low protein basal diet, reported lower gains ($P < .05$) of steers supplemented with feed-grade biuret than of steers fed cottonseed meal supplements. Fick, Ammerman and Loggins (1971) demonstrated increased ($P < .01$) voluntary intake and nitrogen retention when biuret was fed as a nitrogen supplement to low quality pangolagrass hay.

Mies (1968) showed no difference ($P > .05$) in gains of steers wintered on high roughage rations in which half of the equivalent crude protein was supplied by urea, biuret or soybean meal. In a second study, cattle fed soybean meal gained more ($P < .05$) than steers fed urea or biuret. Heifers fed urea or biuret to supply two-thirds of the equivalent crude protein in finishing rations gained more ($P < .05$) than heifers fed a combination of 50% urea and 50% biuret.

Meiske, Goodrich and Owens (1968) compared urea and biuret when mixed with corn silage at feeding time or when added to the green chop at ensiling time. Both urea and biuret supplementation improved ($P < .05$) average daily gain and feed efficiency as compared to no supplemental nitrogen. However, calves fed silage supplemented with urea required less feed ($P < .05$) per unit gain than calves fed silage supplemented with biuret.

Biuret, urea, starea, and soybean meal were compared as sources of supplemental nitrogen for yearling steers fed finishing rations (Bucholtz and Henderson, 1971). Steers fed soybean meal gained faster and were more efficient than steers supplemented with NPN. Steers that received biuret supplements gained slightly faster than steers fed urea or

starea supplements, but steers fed urea were more efficient than those fed starea or biuret. However, none of these differences were significant ($P > .05$). Goodrich and Meiske (1970) reported better weight gains and feed efficiency from supplements containing urea as compared to those containing biuret.

Thomas et al. (1968) wintered steer calves on wheat straw and protein supplements in which 50% of the total nitrogen was supplied by soybean meal, urea or biuret. They indicated that steers fed soybean meal gained fastest and steers fed urea supplements gained the least. When the same supplements were fed in a finishing study, steers fed soybean meal gained faster than those fed NPN supplements, although the differences were not significant ($P > .05$).

Turner and Raleigh (1969) compared urea, biuret, and cottonseed meal alone, and in combination, in three studies with weaner calves fed iso-nitrogenous, iso-caloric diets. Weight gains favored the feeding of cottonseed meal supplements, although the differences were significant ($P < .05$) in only one trial. They suggested biuret was equal to, or superior to urea as a nitrogen source, and that biuret in combination with a natural protein source might enhance the utilization of both nitrogen sources.

Raleigh and Oldfield (1968) reported no difference in calf birth weights from range cows supplemented with barley alone or barley plus biuret when wintered on high energy levels. Turner and Raleigh (1968) reported range cows fed biuret or cottonseed meal supplements gained significantly more than cows fed urea or low protein control supplements.