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The Importance of Nonprotein Nitrogen (NPN) in Feeding Ruminants

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INTRODUCTION

Despite the increasing population of the world, limited cultivable land shows the potential danger of big problems like famine for people and animals in the future. This situation indicates the necessity of saving for the future by using industrial by-products as nutritional materials and creating new and economical nutritional sources. Especially insecticides like flies, bugs and microorganisms created by poultry businesses and fruit juice factories near the residential areas have come to a point that threatens the environmental health of those areas.

The primary aspect distinguishing ruminants and non-ruminants is of course the difference in their digestive systems. Non-ruminants can digest only real proteins and use only them in their body, while ruminants can utilize all nitrogen compounds (Burgstaller, 1983). It is known that NPN compounds make, among many feeding materials, of 20-30% of the whole nitrogen in field grass, 50% of the nitrogen in silages and 40-50% of the whole nitrogen in the containing segments of especially things like roots, nodes, onions and the ratio decreases as the plants ripen (Ozgen, 1978; Burgstaller, 1983).

Rumen microorganisms synthesize protein from substances containing nitrogen to build up their cells and ruminants use this aspect of the microorganisms to satisfy some and sometimes all of their need for proteins from nonprotein nitrogen compounds (Kirchgessner, 1985). In a research with a purpose to use poultry manure for feeding ruminants, it is asserted that nutrition needs of the animals like protein, calcium, phosphor, copper, selenium and arsenic can be satisfied by feeding them with ensilaged poultry manure, as well as solving the problem of manure in poultry businesses by utilizing the manure in this area, additionally saving more of herbal protein resources (Hadjipanayiotou, 1984).

It is suggested that it compensates the oxygenic amino acids for the production of high value proteins, meat, milk and wool in the mixtures of food for beef cattle, 24.72% of the raw protein can be provided with the nitrogen from NPN compounds and it does not show any negative effects on the consumption of feeding materials (Colpan, 1977).

It is found that poultry manure can be used as a feeding material for ruminants by ensilaging it with nutrition substance containing easily digestible carbohydrates like crops, root materials from plants, molasses, fruit juice and left-overs from canned food industry; ensilaging is more economical compared to other methods, it has a lower rate of nutrition loss and additionally the unwanted smell of manure can be removed by ensilaging, making it no longer a problem for the animals to consume it (Ak, 1990; McClure and Fontenot, 1985).

In a research with the purpose of determining the effects of the ensilaging time of poultry manure on its composition, the changes occurring in the silage material were examined by taking samples from the ensilaged poultry manure in the 0, 14, 28 and 42nd days (Oliveria *et al.*, 1988). The researchers indicated that the dry substance and ether extract levels in the silage were not affected but raw protein level reached its maximum level of 17.4% in the 28th day and in the 14th day, raw cellulose level was 42.34% and its gross energy was 4020.73 Kcal g⁻¹ (KM).

USAGE OF NPN COMPOUNDS IN FEEDING BEEF CATTLE

With the ensilaging of poultry manure, the acidic nature of the environment rises and in ruminants fed with these silages, pathogenic microorganisms that can be harmful for animal health fall to a level where they cannot be effective or fall completely to zero (Ko *et al.*, 1991a; Hadjipanayiotou, 1984).

In a study to use poultry manure, which is an NPN resource, in beef cattle rations, poultry manure was ensilaged by adding corn in the amounts of 0, 20, 40 and 60%. It was found that the animals fed with these silages ate dry substance in amounts of 7.1, 7.7, 8.0 and 8.3 kg with respect to the groups; the live weight rise amounts were 1065, 1075, 1135 and 1070 with respect to the groups and the differences among the rising amount in the groups are not statistically significant (Vosseveld, 1988).

In a research conducted on 4 groups of male cattle to investigate the effects of different levels of dry poultry manure on carcass quality and live weight increases in beef cattle, three groups of cattle in the trial were given 15, 30 and 40% dry poultry manure and barley meal with barley straw and the other group was given rations of corn pulp with urea and mineral mixes.

It is indicated that the animal fed with dry poultry manure consumed daily amounts of 5.81, 5.97 and 5.96 kg of food with respect to the mentioned groups and the animals fed with food containing urea consumed a daily amount of 5.54 kg; all gaining daily amounts of live weight as of 1131, 1127, 1085 and 1041 g, respectively (Kraszewski and Wawrzynczak, 1983).

In another study to use poultry manure in beef cattle rations as a feeding material, it was suggested that the animals with average live weight of 212 kg were fed 2.45 kg of dry poultry manure, which made the 60-70% of the dry ration substance through 84 days, after this time, the trial group was observed to gain 6.1 kg more live weight compared to the control group (Abraham *et al.*, 1986).

To beef cattle rations, animals fed silage containing 40% broiler manure and prepared with corn meal containing 30% of dry substance did not show important differences in terms of daily live weight increase and food utilization when compared to the control group (Kirk and Fontenot, 1986).

It is declared that beef cattle can consume 3 kg of poultry manure daily (58), additionally, when fed 23.5 kg daily of corn silage prepared by adding 30% broiler manure, 1190 g of daily live weight gain can be achieved (McClure and Fontenot, 1988). In the research to understand the effects of the silages prepared with different feeding materials and different ratios of poultry manure on live weight gain and food consumption of beef cattle, poultry manure was ensilaged by adding it to sawdust by 33%, to sugar beet pulp by 27% and to wheat straw by 42%.

Researchers asserted that these silages contained 19.0, 18.0 and 19.3% raw protein respectively, they achieved 486, 581 and 508 live weight gain according to the groups of beef cattle and additionally they consumed 7.26, 6.27 and 6.77 kg KM^{-1} silage per kilogram of live weight gain respectively, while animals fed with these silages not showing a statistically significant difference when compared to the control group in terms of live weight gain (Parthasarathy and Pradhan, 1985).

In the research investigating possibilities to use food as additional to corn silage, according to dry substance base, by mixing 30% broiler or turkey manure to feed 1 year old castrated cattle, animals were fed 23.56 kg of corn silage and 1.45 kg of broiler manure daily, the consumption of dry substance daily was 6.95 kg and live weight gain was 1140 g daily (McClure and Fontenot, 1987).

In a study to utilize dried caged chicken manure as a protein source in beef cattle rations, 15 and 30% of dried caged chicken manure was added to the animals' concentrated food. At the end of the research, the daily live weight gains were found to be 774 g in the control group, 758 g in the group where 15% manure was used and 729 g in the group where 30% manure was used (Akkilic *et al.*, 1976).

USAGE OF NPN COMPOUNDS TO FEED SHEEP

Poultry manure can be fed to sheep as it can be fed to beef cattle and like it can be added to other mixed food in dry, flour form, it can also be pelleted to other food and provided to the animals for consumption (Qureshi, 1991). In intensive lamb feeding, lambs with rations supported with 40% dried poultry manure has shown 237 g of live weight gain and consumed 6.07 kg of food for a kg of live weight gain (Ak and Okuyan, 1991).

In a study conducted to increase the nutrition value of rice straw by adding broiler manure and molasses, broiler manure in the rates 20, 30, 40% and molasses 5% in every mix were silage with rice straw. In this study, where the prepared silages were fed to sheep and studied in terms of digestibility and taste, it was found that after the silages were given to sheep, there were no problems with dry substance ingestion and taste; however, the best results were achieved with 20% broiler manure (Ko *et al.*, 1991b).

USAGE OF NPN COMPOUNDS TO FEED DAIRY CATTLE

In a study conducted on cows that are fed silage containing added 30% poultry manure to increase the quality and nutrition of corn silage, the effects of the poultry manure added on the silage on the quality of the milk were investigated. According to the findings of the research, poultry manure added in the rate of 30% to corn silage increases the milk production and quality and additionally there is not a significant decrease in the fat ratio of the milk (Ko *et al.*, 1990).

At the end of a trial to investigate the effects of dried poultry manure added to the concentrated food of dairy cattle in different ratios like 20 and 30% on consumption of food, milk production and the content of the milk produced, like dry substance, fat and protein. It was found that poultry manure added to concentrated food by the ratio 30% does not create any negative effects on animals' consumption of food, nor does it significantly change dry substance, fat and protein contents of the produced milk (Kilic and Nalbant, 1991).

In a study to compare protein sources, when 20% dried poultry manure is added to dairy cattle rations instead of cotton seed pulp, milk production rises by 18%, additionally, when dried poultry manure containing 18% protein or corn, ensilaged with 0.5% urea is fed to dairy cattle, it does not create a significant difference in milk production and the composition of milk (Vilela *et al.*, 1986).

In another study conducted to use dried poultry manure in cow rations by mixing it with rice straw, while the rice straw was kept at 35%, poultry manure was used in different amount changing between 15 and 45%. According to the findings, there was an important increase in the yearly milk production in the cows and it is statistically significant (Trung *et al.*, 1986).

EFFECTS OF POULTRY MANURE SILAGE ON ANIMAL HEALTH

In the process of silage formation, as acidity rises and in the anaerobic part of the silage, oxygen content decreases dramatically, as a result of fermentation, pathogenic microorganisms that can threaten animal health cannot live in these circumstances and additionally, as the formed amino

acids naturally form in the normal rumen fermentation anyway, these silages do not create harmful effects on animal health when used to feed ruminants (Ak, 1990).

It is argued that fresh poultry manure can contain pathogenic microorganisms like *Salmonella* and *Proteus*, that can create drawbacks for animal health and therefore for it to be used in feeding animals, it is advised to be ensilaged or dried, especially pathogenic microorganisms that can harm animal health can be eliminated with these methods and additionally, these microorganisms should not be able to live in the rumen environment considering the microorganism population, rumen pH and enzyme effects in ruminants' digestive systems, or at least, their numbers will be reduced to a point where they will not be able to be harmful (Ak and Okuyan, 1991; Kilic, 1986; Hadjipanayiotou, 1984).

When dried poultry manure in the rates of 10 and 15% is added to ram rations to investigate the effects of poultry manure on fertility in rams, in not only trial groups, but also control groups, there were no differences regarding the average spermatologic values and there were no drawbacks in the states of the rams' health (Gokcen *et al.*, 1987). After the study, lasting 112 days, by mixing 15 and 30% dried poultry manure in concentrated food of beef cattle and lambs, there were no signs of diseases in the animals and poultry manure in these ratios are considered to be safe to mix in the animals' food (Akkilic *et al.*, 1976).

In a study concerning the bringing up of beef cattle to a desirable slaughter maturity, green corn was silage with broiler manure, fed to the animals and there were no negative effects found on the animals' carcass quality and health (McClure and Fontenot, 1987).

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