Influence of addition of non-protein nitrogen to maize silage on digestibility and content of protein and sugar fractions in silage

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Abstract- In order for food to be used as soon as possible and as well as possible, it is very important that the silage that feeds the animals is prepared in such a way that it contains as much degradable protein as possible in relation to non-degradable proteins. The paper analyzes the influence of the addition of non - protein nitrogen (NPN) to the silage of the whole maize plant on the content of individual protein fractions. Of the NPN compounds, urea (at a concentration of 0.5% and 1%) and Benural S (at a concentration of 1% and 2%) were used. The amount of insoluble proteins and non-protein nitrogen in the silage increased with the addition of NPN compounds. It was quite the opposite with real proteins, the content of which was reduced by their addition. Unavailable proteins (NDICP) and cell wall-bound nitrogen (ADICP) were also most prevalent in silage without additives, and their amount decreased with the addition of NPN compounds. The highest amount of soluble proteins (SolCP) was found in silage with 1% urea (746.73 gkg-1CP), and the lowest in control silage (490.2 gkg-1CP). The addition of NPN compounds to maize silage resulted in a significant increase in the PA fraction of degradable proteins as well as a decrease in PB (all three subfractions) and PC fraction. The addition of non-protein nitrogen (Benural S, urea) to the corn silage of the whole plant affected the content and fractions of carbohydrates in the silage. The amount of total and non-structural carbohydrates decreased, and the amount of lignin increased with the addition of non-protein nitrogen. The addition of urea (0.5% and 1%) had the greatest effect on the amount of NDF and ADF. Differences were statistically significant ($p > 0.05$)

Index Terms- CNCPS, corn silage, protein fractions, carbohydrate fractions, digestibility.

I. Introduction

The number of inhabitants in the world is constantly increasing, and at the same time natural resources are decreasing, which is a great challenge for society as a whole. The constant progress of science in the field of technology for growing fodder plants, canning fodder and nutrition contributes to more efficient production of domestic animals. Regular laboratory analyzes of nutrients in as many repetitions as possible reduce the variations in the information obtained and increase the reliability of existing models, and thus give us more accurate data on the nutritional value of the tested nutrients. In this way, variations in the nutritional value of nutrients caused by sampling error, then sample handling or errors caused by the application of the analysis model itself are reduced (Hall and Mertens, 2012). Jovanović (2006) states that knowledge of the nutritional value of various nutrients used in animal nutrition is extremely important. Based on the data on the chemical composition of nutrients, it is not possible to make a correct conclusion about their nutritional value. Namely, certain nutrients are incompletely or very little used in the digestive organs of animals. Although various criteria are used to assess the nutritional value of a nutrient - digestibility is certainly the most important parameter that exactly shows the difference between the potential and true nutritional value of a nutrient.

Under the action of microbial enzymes in the rumen, a significant part of the most important nutrients - carbohydrates and proteins - is degraded, and their degradability depends on numerous factors, primarily on the chemical and physical properties of the nutrient itself (Grubić and Adamović, 2003). Yari et al., (2012) indicate that the chemical nature of the protein of certain nutrients, that is the form in which nitrogenous substances are present, is the most important factor that determines the degree and speed of decomposition in the rumen. One of the most detailed models of crude protein and carbohydrate fractionation is the "Cornell Net Carbohydrate Protein System - CNCPS" model (Fox et al., 2004).

According to this model, proteins in nutrients can be divided into three basic fractions: non-protein nitrogen (A), true proteins (B) and unavailable proteins (C). It is considered that fraction A is immediately and completely decomposed in the rumen, while fraction C is completely non-degradable in the rumen and almost completely unusable in other parts of the digestive tract (Higgs et al., 2015). Unavailable or bound proteins (fraction C) contain proteins that are associated with lignin, tannins and Millard reaction products that are highly resistant to the action of microorganisms and enzymes (Lanzas et al., 2007a). Non-protein nitrogenous substances (NPN) should be added to maize biomass during ensiling in order to increase CP content, as well as inoculants based on homo and heterofermentative bacteria in order to increase lactic and acetic acid production, and thus improve aerobic stability and nutritional value of silage (Dinić and sar., 2013). The possibility of utilizing non-protein nitrogenous substances (NPN) in ruminant diets has led to the use of synthetic NPN substances to address protein deficiencies. For this purpose, urea or urea is most often used, which contains 42-46% N, whose content is about 2.6 times higher than in proteins. According to CNCPS (Cornell Net Protein and Carbohydrate

According to the CNCPS (Cornell Net Protein and Carbohydrate System) system, there are five protein fractions (Sniffen et al., 1992; Fox et al., 2003).
- PA fraction of crude proteins - easily soluble proteins
- PB crude protein fraction - a potentially degradable fraction that represents the difference between total crude protein and the sum of soluble and unavailable proteins: PB = CP - (NPN + ADICP)
- PC fraction of crude proteins - completely unavailable crude proteins represented by ADICP

The PB fraction of crude protein is further divided into:
- PB1 fraction that decomposes rapidly in rumen makes it NPN non-protein nitrogen in the feed: PB1 = SolP - NPN
- PB2 fraction of medium degradability in rumen: PB2 = PB - PB1 - PB3
- PB3 fraction that degrades slowly in rumen: PB3 = NDICP - ADICP

Carbohydrates (CHO) make up the largest part of the mass of nutrients in the rations of dairy cows - over 65% of dry matter (Varga et al. 1998). They are present in two basic forms: structural (FC - Fiber carbohydrates) and non-structural carbohydrates (NSC - Non structural carbohydrates). Inadequate content of these substances in the meal can cause serious metabolic disorders (acidosis, abomasum dislocation, ketosis) which can leave long-term consequences. Van Soest (1982) proposed a system for testing food by extraction with detergent solutions. The amount of NDF in food is the best single indicator of the potential consumption in ruminants and a useful and reliable criterion in formulating meals for high-yielding dairy cows. Van Soest (1982) points out that by extracting nutrients with an acidic detergent solution, acidic crude cellulose (ADF) is obtained. ADF consists of a large part of indigestible cellulose ingredients - cellulose, lignin and insoluble ash and is a much better indicator of digestibility of a given nutrient compared to NDF. The tree contains a larger amount of ADF compared to the leaves. As plants age, along with the amount of NDF, the amount of ADF also increases. In all tested perennial grasses, ADF increases with increasing temperature, regardless of the soil moisture level. The influence of light intensity was weaker and had the opposite effect from temperature (Marković, 2009). The proper structure of carbohydrates in the meal is of great importance for digestion in the blush and the provision of significant amounts of energy, for the synthesis of microbial proteins and for maintaining a stable level of fermentation. Balancing the content of carbohydrates, while maintaining maximum energy consumption and enabling the normal function of the blush, represents both art and science (Pejić, 2000).

The aim of this research is to analyze the influence of the addition of non - protein nitrogen on the content of individual fractions of proteins and sugars in the silage of the whole corn plant. Enrichment of silage with non-protein sources of nitrogen would improve the ratio of protein and energy in silage and thus increase the nutritional value of silage in the diet of ruminants. We believe that the addition of these substances would ultimately increase the digestibility of silage.

II. Material and Methods of Work

The experiment was performed during 2014, in Zleginje-Aleksandrovac (21010ь 01ъ E, 430 26ь 15ъ H). The plot from which corn was taken is located at an altitude of 297 m. The soil had 3.78% humus, 0.204% nitrogen, 4.9 mg P2O5 and 24.6 mg K2O per 100 mg / air dry soil. The average temperature and amount of precipitation per month in 2014 and for a period of 40 years are given in Table 1.

Table 1. Average temperatures and precipitation by months in 2014. and a multi-year (40-year) average for Aleksandrovac (Central Serbia)

		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Total
Temp.	74-13	0.6	2.4	7.2	12.6	16.8	20.4	22.2	22.3	18.6	11.2	7.8	3.2	12.1
	2014	3.5	6.6	9.4	11.9	15.9	19.7	21.7	21.2	16.8	11.7	8.4	2.3	12.4
Rain	74-13	37.7	63.4	49.4	44.0	55.9	90.8	62.0	34.8	27.8	71.9	34.4	72.1	644.2
	2014	25.1	9.3	63.5	188.8	126.6	115.3	92.4	42.8	127.6	56.8	39.4	99.6	986.4

The biomass of maize, whole plant (hybrid KWS Mikado), was ensiled in the phase of waxy maturity of the grain with the addition of non-protein nitrogen (NPN). Urea (46% N) and Benural S (manufacturer Petrokemija-Kutina, Croatia) were used as a source of NPN, which contains 42% urea, 56% bentonite and 2% sulfur. Unlike pure urea, this product contains bentonite, which enables slower release of ammonia in the rumen and more efficient utilization by rumen microorganisms, binds some gases and toxic substances and contains important alkaline elements (K, Na, Mg, etc.). The sulfur present in Benural S enables more efficient synthesis of essential amino acids that contain this macroelement (methionine, cystine). NPN substances were added to the ensiled biomass in various concentrations. The study included 5 treatments, namely: I-without the addition of NPN substances (control), with the addition of Benural S (II-treatment with 1.0% and III-treatment with 2.0%) and with the addition of urea (IV-treatment 0 , 5% and V-treatment 1.0%). Maize was ensiled with a Mengele forage harvester (Austrian production), and 200 l barrels were used for ensiling. NPN substances are added

NPN substances were added in the solid phase (urea-granules, Benural-powder). 150 kg of silo mass and the appropriate amount of NPN substances were added to each experimental vessel, and compaction was performed by trampling.

The silo mass is covered with nylon and pressed with 15-20 cm of gravel. All treatments were done in 3 repetitions, after the maturation of the silage, samples were taken for chemical analysis. Protein fractions in ensiled biomass, which were analyzed in these studies, were determined according to the method given in their studies by Licitra et al. (1996):

- The amount of total proteins was calculated indirectly, over the amount of total nitrogen determined by the Kjeldahl method on the TECATOR Kjeltec Auto Analyzer 1030 (AOAC, 984.13).
- True Proteins - TP (True Protein) were determined by protein precipitation with the addition of trichloroacetic acid, from which the amount of nitrogen was determined according to Kjeldahl and multiplied by a factor of 6.25.
- Non-Protein Nitrogen - NPN (Non Protein Nitrogen) was calculated as the difference between the total amount of protein and real protein.
- Insoluble Proteins - IP (Insoluble Protein) was determined as the amount of nitrogen in the residue that does not dissolve in a buffer solution whose pH value corresponds to the pH in the rumen, multiplied by a factor of 6.25.
- Nitrogen bound to the cell wall - NDICP (Neutral Detergent Insoluble Crude Protein) was determined as the amount of nitrogen in the rest of the sample insoluble in a solution of neutral detergent, multiplied by a factor of 6.25.
- Unavailable Proteins - ADICP (Acid Detergent Insoluble Crude Protein) was determined as the nitrogen in the rest of the sample that is insoluble in the acid detergent solution, multiplied by a factor of 6.25.
- Soluble Proteins - SolP (Soluble Protein) was calculated as the difference between total and insoluble proteins.
- NDF (Neutral Detergent Fiber) - fibers insoluble in a solution of neutral detergent was determined without the use of Na_2SO_3 according to the method of Van Soest and Robertson (1980).
- ADF (Acid Detergent Fiber) - was determined as the food fraction insoluble in the acid detergent solution, and the amount of lignin by treating this insoluble residue with 72% H_2SO_4 solution for 3 h (AOAC, 973.18).

Total carbohydrates (CHO) and non-fibrous carbohydrates (NFCs) were calculated according to equations NRC (2001):

$$CHO = 1000 - (CP + SMa + SPe)$$

$$NFC = 1000 - [(NDF - NDICP) + CP + SMa + SPe]$$

- the amount of lignin (ADL) was determined as a residue insoluble in 72% sulfuric acid (Van Soest and Robertson, 1980).
- In vitro digestibility of dry matter was determined by measuring the residue after successive hydrolysis using the enzymes pepsin and cellulase (De Boever et al., 1986).

The obtained data related to the share of individual protein and sugar fractions in the silage were processed by the method of analysis of variance according to a completely random plan. The data program STATISTICA - 7.1 was used for data processing (StatSoft, 2006). Differences between mean treatment values were tested by LSD test at a significance level of 95%.

III. Results and Discussion

The amount of dry matter had an average value of 340.7 gkg-1, the highest dry matter was treated with 1% Benural, and the least treated with the addition of urea. The results obtained in this way can also be interpreted in the way of work, because urea was previously dissolved in water and then added, which could have had an effect on the increased humidity of silage with urea. Slightly lower results in terms of dry matter content (313.4 - 325.6 gkg-1) were established by Jovanović (2006)

The addition of non-protein compounds (Benural, urea) to the corn silage of the whole plant affected the amount and fractions of proteins in the silage. The concentration of crude protein (CP) in silages increases with the addition of NPN compounds, going from control silage to silages with the highest dose of nitrogen compounds. The crude protein content ranged from 77.58 gkg-1DM in control silage to 158.5 gkg-1DM in silage with 1% urea, which is expected because urea has the highest concentration of nitrogen in it. The obtained results are significantly higher than the results of Stojanović and Grubić (2008) who state the value of 42.86 gkg-1DM and Dinić et al., (2013) in silages without additives and with the addition of inoculants (61.3-63.2 gkg-1DM). Fox et al., (2003) report crude protein content over 90 gkg-1DM. This value is higher than our control treatment, but is lower than the other four treatments in which non-protein compounds were added. The addition of Benural, in the amount of 1% of the biomass of the whole corn plant, provides an increase in crude protein close to 50% (Dinić et al., 2013). The amount of crude protein in corn silage largely depends on the climate and the amount of nitrogen fertilizers applied. Most whole-plant corn silages originating from the northern parts of Serbia have a higher crude protein content. Statistical significance was found between all 5 silage treatments.

The amount of true protein (TP) averaged 387.74 gkg-1CP, was highest in the control silage (558.8 g / kg-1CP) and decreased with the addition of NPN compounds. The least true protein was found in silage with 1% urea (262.13 g / kg-1SP), while the control had twice as much true protein. It is important to note that the amount of real protein was higher in the treatment with 0.5% urea compared to the treatment with 2% Benural. Of course, the situation is completely reversed with non-protein nitrogen (NPN - Non Protein Nitrogen) when it has the most in silage with the addition of 1% urea (737.87 g / kg-1SP), and the least in the control treatment (441.20 g / kg-1SP)). Differences between treatments for the amount of true protein and for the amount of nonprotein nitrogen were statistically significant (Table 2). The addition of non-protein nitrogen to corn silage significantly reduces the share of insoluble proteins (IP). The most insoluble proteins had control, and the least treatment with 1% urea. Treatments differed significantly from each other, $P < 0.01$ During the study, an average of 11.28 gkg-1 NDICP (Neutral Detergent Insoluble Crude Protein) was found to be highest in control silage and lowest in silage with 1% urea and 2% Benural (Table 2). Silage samples with Benural and 1% urea did not differ statistically significantly. The variation range for this trait is 9.5–15.8 gkg-1 similar values are reported by Fox et al. (2004), but with a slightly smaller interval of variation of 12-16 gkg-1. The unavailable protein for ruminants ADICP (Acid Detergent Insolube Crude Protein) was highest in control silage 9.82 gkg-1CP and lowest in silage with 1% urea 8.23 gkg-1CP. Fox et al. (2003) found values of 4.5 -7.0 gkg-1. Treatments with benural and 0.5% urea do not differ, and control and treatment with 1% urea differ significantly, $P > 0.01$.

The average amount of soluble proteins (SolP-soluble proteins) was 635.53 gkg-1SP and with the addition of NPN compounds it increased (Table 2). Differences between treatments ranged from 490.2 gkg-1SP in control silage to 746.73 gkg-1SP in silage with 1% urea. The differences are statistically significant P <0.05, all observed treatments differ from each other for this feature. Fox et al (2004) found, for whole plant corn silage, that the value of soluble protein (Sol.P) was 53% of the total amount of protein. The values in our research are from 49 to 74.7%.

Table 2. Primary protein fractions in whole plant corn silages

	Control	Benural 1%	Benural 2%	Urea 0.5 %	Urea 1 %	Average
DM, gkg^{-1}	345.8^{ab}	355.7^{a}	341.5^{b}	322.7^{c}	327.8^{c}	340.70
CP, gkg^{-1}DM	77.58^{e}	107.53^{d}	138.23^{b}	119.37^{c}	158.40^{a}	106.38
TP,gkg^{-1}CP	558.80^{a}	429.18^{b}	330.53^{d}	358.05^{c}	262.13^{e}	387.74
NPN,gkg^{-1}CP	441.20^{e}	570.82^{d}	669.47^{b}	641.95^{c}	737.87^{a}	612.26
IP,gkg^{-1}CP	509.80^{a}	403.88^{b}	310.05^{d}	345.33^{c}	253.27^{e}	364.47
NDICP,gkg^{-1}CP	15.78^{a}	10.17^{bc}	9.48^{c}	11.61^{b}	9.37^{c}	11.28
ADICP,gkg^{-1}CP	9.82^{a}	9.35^{b}	8.58^{bc}	8.45^{bc}	8.23^{c}	8.89
SolP,gkg^{-1}CP	490.20^{e}	596.12^{d}	689.95^{b}	654.67^{c}	746.73^{a}	635.53

a, b, c, d, e homogeneous groups within which there are no significant differences, and between which the differences are significant (P <0.05)

dm-dry matter, cp-crude proteins, ndicp-neutral spawning. cp in detergent
ip-insoluble prot, soip-soluble prot., adicp-insoluble raw detergent tp-true proteins, npn-non-protein nitrogen, pa, pb, pc-fractions of soluble proteins

During the analysis of crude protein degradation, it was found that during the addition of NPN compounds to the silage of the whole plant, it was dominated by the PA fraction (611.5 gkg-1SP), then the PB2 subfraction (259.24 gkg-1CP). The PC fraction, and especially the PB1 and PB3 subfractions, are significantly less represented. Table 3 shows the degradability results of crude proteins, with the highest degradability found in the PA fraction. The values of this fraction increase from control silage to silages with higher addition of NPN compounds and they range from 441.2 gkg-1SP (control) to 733.8 gkg-1CP (treatment with 1% urea). Fraction B (PB1, PB2, PB3) as well as the PC fraction are reduced with the addition of NPN compounds. The largest amount of protein fractions of PB and PC was determined in the control silage. In the PB1 subfraction, statistical significance was found between control silage and all other treatments. In the subfraction PB2 and PB3, three homogeneous groups are distinguished, while in the subfraction PA and PC, all treatments differ significantly from each other (P <0.05).

Table 3. Fractions of degradable crude proteins in whole plant corn silages

	Control	Benural 1%	Benural 2%	Urea 0.5 %	Urea 1 %	Average
PA gkg^{-1}CP	441.20^{e}	570.82^{d}	669.47^{b}	641.95^{c}	733.87^{a}	611.46
PB1 gkg^{-1}CP	48.97^{a}	25.35^{b}	20.47^{b}	12.73^{b}	12.87^{b}	24.08
PB_2 gkg^{-1}CP	305.75^{a}	309.30^{a}	241.48^{b}	247.90^{b}	191.75^{c}	259.24
PB_3 gkg^{-1}CP	77.48^{a}	7.73^{bc}	6.55^{c}	26.51^{b}	9.40^{bc}	25.53
PC, gkg^{-1}CP	126.60^{a}	86.80^{b}	62.03^{d}	70.91^{c}	52.11^{e}	79.70

- Carbohydrate content in silage

The addition of non-protein nitrogen (Benural, urea) to the corn silage of the whole plant affected the content and fractions of carbohydrates in the silage. Table 4 provides data on total (CHO) and non-structural carbohydrates (NFC). The highest values of total and unstructured carbohydrates were determined in the control, and the lowest in the treatment with the addition of 2% Benural. The addition of NPN additives to the corn silage silage significantly affected the reduction of CHO compared to the control. According to the amount of total carbohydrates, treatments with 1% Benural and 0.5% urea do not differ from each other. There is also no significant difference between treatments with 2% Benural and 1% urea, while control differs significantly from other treatments. When it comes to unstructured carbohydrates, treatments show different dependencies (Table 4).

Table 4. Carbohydrate content and digestibility in corn silage of the whole plant

	Control	Benural 1%	Benural 2%	Urea 0.5 %	Urea 1 %	Average
CHO gkg^{-1}	841.52^{a}	806.42^{b}	767.37^{c}	803.42^{b}	768.33^{c}	797.41

NFC gkg^{-1}	313.95^{a}	281.70^{ab}	206.73^{c}	241.38^{bc}	253.10^{b}	259.37
NDF gkg^{-1}	508.38^{ab}	504.83^{ab}	532.88^{a}	538.33^{a}	492.95^{b}	515.47
ADF gkg^{-1}	250.17^{b}	245.48^{b}	253.70^{b}	268.65^{a}	256.00^{b}	254.80
ADL gkg^{-1}	36.52^{c}	39.35^{abc}	38.53^{bc}	42.38^{ab}	44.83^{a}	40.32
Digestability (%)	59.88^{b}	62.75^{ab}	61.86^{ab}	59.81^{b}	63.18^{a}	61.50

The highest and lowest NDF content was determined in treatments with the addition of urea. Most NDF (538.33 gkg-1) had treatment with 0.5% urea, and the lowest content was found in treatments with 1% urea (492.95% gkg-1). From the obtained results, it can be concluded that there is no regular trend of changes in NDF depending on the change in the share of NPN additives in silage biomass. With the increase in the amount of added benural in the silage from 1% to 2%, there was a significant increase in NDF, while the increase in the amount of urea from 0.5% to 1% had the opposite effect on the same observed parameter. These results are within the limits of the results obtained by Jovanović (2006) in whose research the value of NDF ranges from 486.2-525.0 gkg-1 from SM. Slightly lower values are stated by Stojanović and Grubić (2008).
The addition of urea and benural significantly affected the ADF concentration, which is highest in silage with 0.5% urea (268.6 gkg-1SM) and lowest in silage with 1% benural (245.5 gkg-1SM). If we compare the trends of changes in ADF and NDF, we can see the similarity of the changes through treatment. Similar to NDF, an increase in the addition of urea in the silage led to an increase in ADF, while an increase in the share of benural had the opposite effect, ie. led to a decrease in ADF. Jovanović (2006) in his research states the values for ADF from 233.1 to 274.6 gkg-1 in ASM.

The lignin concentration ranged from 36.52 gkg-1SM in control silage to 44.83 gkg-1SM in silage with 1.0% urea (Table 4). Observed in relation to the control silage, all silages with NPN supplementation had a significantly higher level of ADL, where the increase in the concentration of benural, ie urea led to an increase in ADL. relative to benural. The concentration of lignin in the silages of 13 maize hybrids examined by Jovanović (2006) ranges from 29.3-47.9 gkg-1, which in relation to our results shows somewhat higher but also significantly lower values.
The digestibility in our tests is somewhat higher in relation to the results of Jovanović (2006) where the digestibility of 13 maize hybrids ranged from 55.39-61.70%. Such values in our tests (59.81-63.18%) are probably the result of favorable climatic conditions for the development of the corn plant in 2014, with an increased share of grains and non-structural carbohydrates. The results of the digestibility of organic and dry matter in the studies of O'Kiely and Moloney (1997), which ranged from 60.9 to 61.2% SM, are also within the limits of these tests.

IV. Conclusion

The addition of maize silage to the whole plant of non-protein nitrogen (Benural and urea) had an effect on the content of protein and sugar fractions in silage.
The amount of true protein (TP) and the amount of insoluble protein (IP) decrease with the addition of NPN compounds. The amount of non-protein nitrogen in the silage increases with the addition of NPN compounds.
Proteins that are determined from the residue after treatment with neutral detergent (NDICP), as well as proteins that are determined after treatment with acid detergent (ADICP) are in small quantities (about 10-15 gkg-1SM), which is desirable for silage. By adding NPN compounds, these proteins are reduced.
The soluble protein fraction (SolP) increased with the addition of non-protein compounds from 490.2 gkg-1SP in control to 746.73 gkg-1SP in silage with 1% urea.
It was found that within the crude proteins, the PA fraction (61.1%) dominates, followed by the PB2 subfraction (25.9%), while there are significantly fewer other fractions. The PA fraction, which has high degradability, tends to increase from silage without additives (control) to silage with the highest additives of NPN compounds (1% urea). Unlike the PA fraction, the other PB fractions (subfractions PB1, PB2 PB3), and especially the PC fraction are characterized by a decrease in value with the addition of NPN compounds.
Total and unstructured carbohydrates decreased with the addition of non-protein nitrogen. The addition of 0.5% urea had a positive effect on the amount of NDF, ADF and ADL, while the addition of 1% urea had a positive effect on the digestibility of silage.
The general conclusion is that the addition of NPN compounds to whole plant corn silage contributes to an increase in crude protein content and an increase in digestibility. The addition of these compounds does not negatively affect the fermentation process, on the contrary, it consumes the excess sugar left in the silage. In this way, lactic acid bacteria are influenced to produce more lactic acid, which increases the stability of the silage, by preventing subsequent fermentation caused by yeasts and molds, using that residual sugar in the silage.

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