DEVELOPMENT OF CRUDE PROTEIN IN MAIZE HARVESTED IN MOLDAVIA REGION IN LAST SEVEN YEARS

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Abstract

The impact which has climate change, the introduction of new hybrid, type of fertilizer or use of irrigation on quantitative and qualitative production of maize is a big challenge facing nutritionists, considering that maize is main raw material used in optimizing recepies. To support nutritionists it was accomplished a study of all chemical analysis conducted in the last seven years in a feed factory from Moldavia with an average consumption of 30000 tons of maize per year. It showed that the factors mentioned above, at this juncture, influence chemical composition and in particular the amount of crude protein of maize in a negative way. Thus the average amount of crude protein (PB) found in maize grown in Moldavia is 8.5% DM, lower by 2.0 percentage points compared to data from the literature, which leads to a higher consumption of protein concentrates and ultimately higher prices of complete feed.

Key words: maize, crude protein, complete feed

INTRODUCTION

Cereal grains are fruits of crop herbs and provide almost half of the energy needed for human consumption [8]. The origin of maize (Zea mays L.) is South America, archaeological evidence discovered in Mexico area today are dated from 7000 years ago, Europeans have met maize only after the discovery of America, this is introduced for the first time in Spain [3]. Now, because of the multitude of hybrids, maize is spread from 58 ° N in Canada and Russia to 40 ° S in Chile and Argentina, from sea level to 3800 m altitude [9]. In our country maize is mentioned in Muntenia during the reign of Serban Cantacuzino (1678-1688) and in Moldavia Duca's reign (1693-1695) [6].

Maize enjoy great popularity because it is used both in human and animal nutrition, alcohol industry or as bio-fuel. Maize presents agrophytotechnical importance because: leave the field clean of weeds and pests, allow intercropping with other crops and by early previous crops can grow as the second culture for green forage production [6]. Nutritional maize is a base cereal covering over a quarter of global production of grain (Fig. 1), it provides ~ 3860 kcal/ kg (due to its high carbohydrates content, in particular starch ~ 72 %), but low crude protein content 8-9% with an unbalanced amino acid profile (deficient in lysine and tryptophan), low crude fiber ~ 2.5%, B12 and C vitamins (the last one missing entirely), calcium, iodine and iron, and a high phytate content [7], [8]. Although it present nutritional disadvantages, maize is widely used in feed rations recipes and it is even indispensable in some cases [2]. Corn grains are very digestible (85-90% from organic substances) with a high palatability for all species of domestic animals compared to other grains [7].

Corn grain production provides about 15% of the global protein and 20% of the calories of entire global production [5]. In developed countries 78% of corn production is used for animal feeding and 6% to feed people, in less developed countries the proportion is changing in favor of food. About 50% of global corn grain production is used for animal feeding [8], [1]. World production of corn grain is about 900 million tonnes United States, China and Brazil are

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the main producers. Corn consumption per capita reached 300 kg per year and in countries where maize is the main food stock used in the daily ration, the world average being somewhere around 50 kg / head / year.

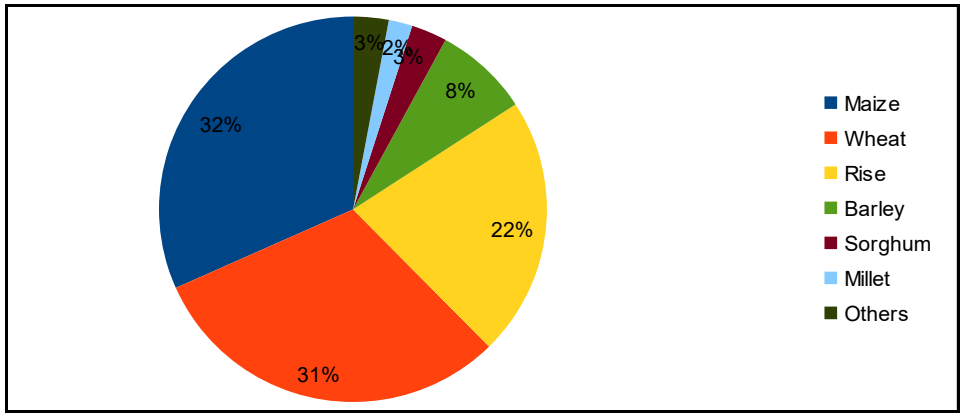

Fig. 1 Global cereal production %, 2010 [5]

Given the importance and spread, it is imperative for professionals in animal nutrition to know the nutritional value of this raw material, knowing that both hybrid and the technology used and the conditions for irrigation shows influences on the nutritional value of maize grains. According to online encyclopedia on forage globally used, feedipedia [9], the production of maize grain and its nutritional value in Romania should related to data provided by European countries (Tab. 1).

Table 1 Nutritional value of maize grain, crude protein [9]

Geographical area ↓	Average (% DM)	Standard deviation	Minimum (% DM)	Maximum (% DM)	No. of samples
Europe	9.4	0.8	7.2	12.4	11175
N Africa and Middle East	8.8	0.5	8.1	10.5	78
E Africa and Subsahara	8.0	3.1	2.0	12.9	618
N America	9.5	0.7	8.2	11.5	128
Central and S America	9.2	0.6	8.1	10.6	72
Asia and Australia	9.7	0.9	7.8	11.3	51

MATERIAL AND METHOD

For this paper were used data included in the entries Registry of raw materials from a Feed Factory in Moldavia. They were considering maize grain samples taken from all intern (national) suppliers for a total of 1445 samples over a period of seven years, from 2009 to 2015.

Sampling was conducted in accordance with "EN ISO 24333:2009 (SR EN ISO 24333:2010) - Cereals and cereal products. Sampling" [10]. The samples taken were analyzed for moisture under "SR EN ISO 6540:2010 - Maize. Moisture Determination (for ground beans and whole grains)", on samples taken before 2010 using "SR ISO 6540:2002 Maize. Moisture Determination (for ground beans and whole grains)" [11]. The method used to determine the crude protein content is the Kjeldahl method in accordance with "SR EN ISO 20483:2007 - Cereals and legumes. Determination of nitrogen content and calculation of crude

protein content - Kjeldahl method" [12]. Known humidity and crude protein was mathematically calculated crude protein content on dry weight basis.

To confirm chemical methods carried out in specialized laboratory of factory, samples were verified with the moisture analyzer specific Aqua TR II and a rapid analysis spectrophotometer Foss NIRSystem, appliances regularly checked, laboratory beeing authorized since 2010.

RESULTS AND DISCUSSIONS

Research has followed the evolution of the crude protein content in maize grain purchased by a Feed factory from Moldavia between 2009-2015. The processed data found that protein content of maize is in constant movement from year to year. Given that did not consider the technology, the hybrid, pedoclimatic factors or the type of fertilizer used and the protein content is highly influenced by them, it can be highlighted the nutritional value of maize grain sown in Moldavia.

From what is seen in table 2 crude protein varies between minimum 6.2% and maximum 12.4% of the dry matter (DM). The average for all seven years is 8.5% DM with a standard deviation of 0.7. The lowest annual average was recorded in 2014 amounting to 7.35% DM and highest in 2012 the average value of 8.89% DM, both values being located below average value declared by Europe, namely 9.4% DM.

Table 2 Nutritional value of maize grain, crude protein samples considered

Crop (samples from the period) ↓	Average (% DM)	Standard deviation	Minimum (% DM)	Maximum (% DM)	No of samples
2008 (2008-2009)	8.86	0.7	6.8	12.4	167
2009 (2009-2010)	7.95	0.5	6.2	9.5	231
2010 (2010-2011)	8.64	0.5	7.4	10.4	211
2011 (2011-2012)	8.78	0.8	6.2	12.0	231
2012 (2012-2013)	8.89	0.7	6.6	12.0	290
2013 (2013-2014)	8.73	0.7	6.4	10.8	262
2014 (2014-2015)	7.35	0.6	6.2	9.8	53

Comparing the results with the literature it can be seen that the results obtained in practice are lower (tab. 3) by up to 2 percentage points compared to data from the literature, which could mislead experts in animal nutrition who did not can perform chemical analyzes on the batches of maize grain they use in recipes structure. Given that the average production of maize grain in Romania according to the National Institute of Statistics is 4.5 t/ha and knowing crude protein value, the results can suggest only that both production and the quality of maize grain may be improved.

Of tab. 3 we see that when using a hybrid wich ripens earlier, drought resistant [6] results can be up to 8% better in terms of protein content. Although production quality lacking in Romania, nor quantitative production does not reach a satisfactory, with less than 5000 kg/ha compared to over 10,000 kg/ha in Spain, Austria, Germany or France, this placing Romania last in Europe on the production of maize grain per hectare with the largest acreage, nearly 50% of total grain cereals [13].

Analyzing data collected can easily conclude very low yield in production of maize for grain, which due to lack of irrigation and current technology is not found just at the level of this production (see soybean). A lower level of crude protein in the grain used universally in prescriptions and feed rations leads to higher consumption of feed proteins (ex. Soybean meal), feed that except that it does not produce enough in our

country they are expensive to, hence higher prices per kg forage. This vicious circle could be disrupted both for the welfare of customers and manufacturers and the only ones who can act are producers.

Tabel 3 Crude protein content from maize grain

Geographical area ↓	Average		Limits (% DM)	No of samples	Bibliographical sources
	(% DM)	%			
Europe	9.4	100	7.2-12.4	11175	INRA, 2015
Romania	10.5	111	-	-	Burlacu, 1983
Romania	10.3	110	-	-	Pop, 2006
Transilvania	9.2	98	8.72-9.72	9	Pandrea, 2012
Moldavia	*8.5*	*90*	*6.2-12.4*	*1445*	

CONCLUSIONS

It is clear that the production of corn for grain is not satisfactory in terms of quality or in terms of quantity as the level of crude protein that is found in corn grain is up to 3 percentage points lower than that reported in the specialized literature or European statistics. That leads to a higher consumption of protein forages as raw materials with a higher cost resulting feed with a higher price.

Production quantities of maize per hectare are well below the main producing countries leading to a low yield with repercussions on producer, price being given by EU market (Romania is a member of European Economic Area since 2007).

It would be advisable for both producers and specialized agencies responsible for the infrastructure of the industry to promote use of hybrids suitable both soil and climate, but also taking into account of certain genetically modified hybrids and practice irrigation system. With good management of this crop production, Romania could exceed 20 million tons of maize, reducing the import of raw materials for animal feed and thus reducing the cost of feed.

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