

QUALITY OF MAIZE STARCH AT HARVEST TIME

High-productive dairy cows nutrition requires an understanding of the needs of animals for a given performance and subsequent appropriate quality and quantity of feed for the utilitarian trend and production of animals. In this article we will consider the quality of maize starch and its degradability in the rumen of dairy cows, depending on the time of harvest and the degree of mechanical disruption of grains. Only a comprehensive solution can be used to effectively control the fermentation processes in the rumen and thereby contribute to the effective use of the manufactured feed, which, of course, is related to the economics of milk production.

By increasing milk production of dairy cows we are forced to increase the share of starch in the feed ration, coming out health problems. – Acidosis. Starch with different feed has varied in quality from the perspective of degradability in the rumen. Starch of cereals is degradable to glucose, almost at 100 % in the rumen of dairy cows. The glucose is used as a source of energy for microbial activity and production of volatile fatty acids. Volatile fatty acids (acetic acid, propionic acid, butyric acid, and valeric acid) are getting over the wall of the rumen into the blood of dairy cows, where serves as source of energy for the production of milk constituents. At high doses of pithy feed, high production of the volatile fatty acids causes a decrease of pH (potential of hydrogen) of the volatile fatty acids under physiological limit= pH 5.8, then subsequently appear an acute or chronic acidosis.

It occurs by reduced intake of dry matter with negative effects on the metabolism of dairy cows and even in the production of milk. It can be said that in the TMR (total mixed ration) is only the starch of cereals, which does not get in to the intestine. It was found out that in to the intestine should be brought approximately 1.2-2.1 kg of starch, considering a high production of milk, should be stored the energy metabolism of dairy cows. In the case of high quantities of starch in TMR, or insufficiently broken grains, especially high-yielding dairy cows we find an increased content of starch in feces.

For these reasons, feeding maize starch has a big importance, because of advantage of reduced degradability of the starch in the rumen, when its non-degradable ration passes into the small intestine, where, thanks to the enzymatic activity (enzyme - amylase) extends up into the glucose, which is absorbed into the blood supplying the organism. Increasing the

proportion of non-degradable starch in the feed ration with more starch, that getting into the intestines is the energy metabolism composed. Then, dairy cows have retained high dry matter and can increase milk production, because we achieve improved distribution of the energy in the body.

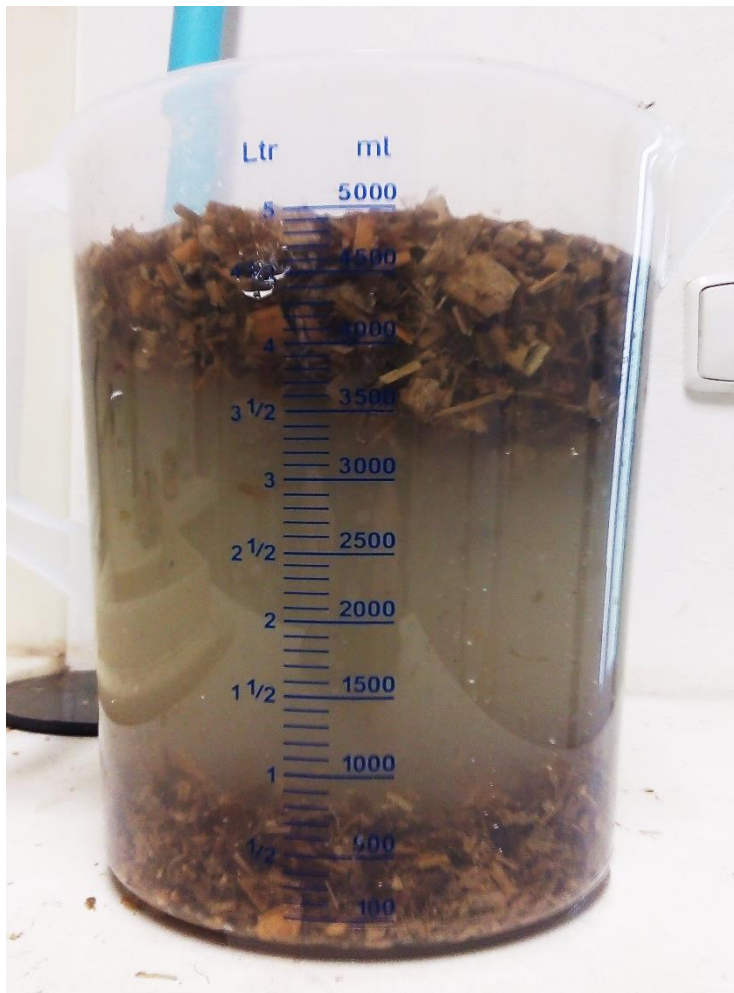
Depending on the ascertained facts, we can conclude the quality of the corn starch used in the nutrition of the dairy cows significantly affects their performance. Therefore, it is necessary to seek such ways to increase the proportion of non-degradable starch in the feed ration. For the reasons above, we observed two silage hybrids of company CEZEA breeding station, a. s. Incubation period in the rumen was given at 8 and 12 hours. In the experiment, we investigated an effect of the degree of mechanical disturbance, respectively, physical disturbance of maize grain. This factor was included in to the monitoring, because of rate of starch-degradability depending on the size of individual particles. We observed it at various stages in total dry matter of corn-cobs (7 variants).

Harvesting silage maize is a very important stage of mechanical disruption of the grain, due to the adjustment of the crushing rollers on the forage harvester – cutter. Recent discussions point out on technology Shredlage (crushing rolls under the name Corn Cracker) eventually on the cutters such as Claas, John Deere and KRONE, where are also disc-processors required to disrupt only fiber of the maize, but also the grain in whole maize silage. Therefore, is the increasing of the proportion of crushed grains in silage matter very important, especially for high-yielding dairy cows nutrition. Negative correlation was found between the utility and time of stay of the feed in the digestive tract. Simply put, the higher the milk yield, the shorter the time of feed stays in the digestive tract. If is the time of the feed-stay short, or the particle size too large, such amylolytic enzymes are not sufficient to decompose the starch into the glucose. In the feces of dairy cows we would find an increased percentage of the starch, which appears for milk production uneconomic. At the same time, therefore we recommend to observe starch content in the feces of individual groups of the cows, as we can avoid this fact.

In operating practice, in canned animal feed, including TMR, is commonly used as the assessment of the degree of mechanical disruption of silage biomass, per the system of three sieves. However, the assessment of the disruption of the grain in the maize silage is not too much common in our practice. Our company has developed a rating system for the

maize silage (**Pic. 1-3**). Silage has the ability to create the so-called - Mattress (**Pic. 1**) where green matter after fermentation floats on the water-surface and at the same time separates the grain and heavier particles of the rest of the plant, which settle to the bottom of container (**Pic. 2**). At the same time, this fraction visually assess the degree of the grain disruption. On **Pic. 3** you can see the effect at harvest (10 mm chopped straw and chopped straw technologies Shredlage 25 mm) per share in the first fraction (mattress). Calculating the proportion of individual fractions of 1, 2 and 3 and the degree of disruption not only the green matter, but also the grain, showing us well-cutted chopped straw, its length and how was the grain crushed at the harvest.

Pic. 1 Maize silage creates two fractions. The top layer, the so-called Mattress creating in the rumen, irritates mucous membrane and supports rumen motility



Pic. 2 Structure of the grain in maize silage after coming out by water. Can also see the grain which pass through the digestive tract unused



Pic. 3 On the left side is the container with maize silage of 10 mm chopped straw, on the right side is the container with maize silage harvested via technologies Shredlage of chopped straw 25 mm



In **Tables 1** and **2**, see the results investigating the degradability of starch in the rumen of dairy cows at 8 and 12 hours of incubation. It can be also compared the effect of particle size depending on the sieve, while milling samples (1 mm and 5 mm sieves).

Table 1 Effect of the harvest time and time of incubation on the degradability of the grain starch on 1 mm sieve

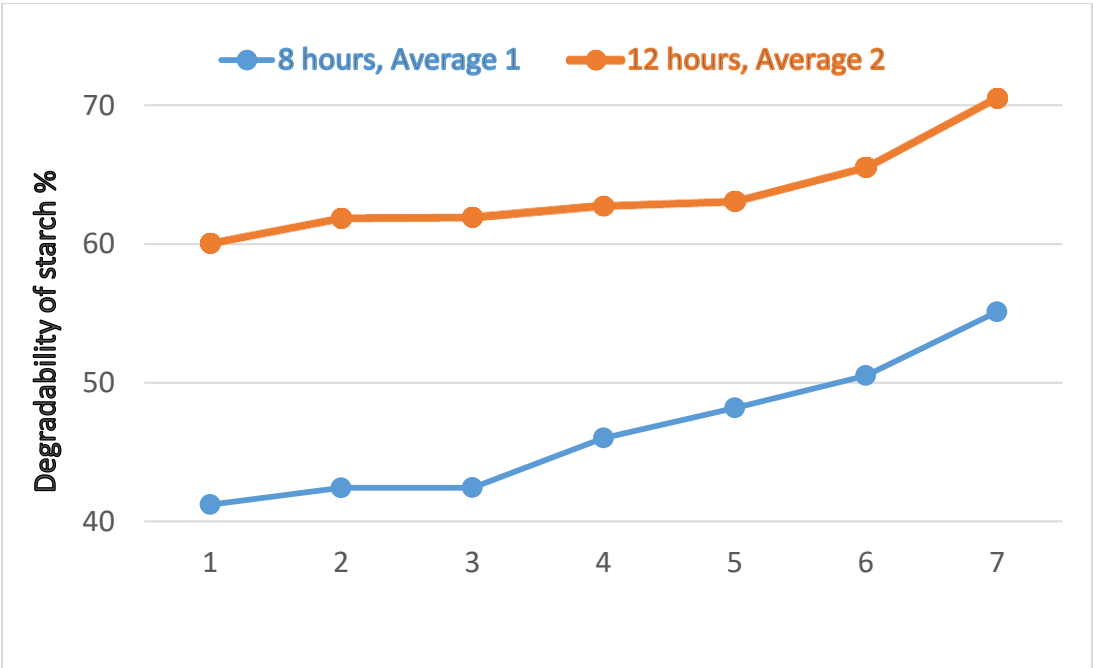
Date	1 mm				1 mm			
		8 hours	8 hours	8 hours		12 hours	12 hours	12 hours
	Dry matter %	Hybrid 1	Hybrid 2	Average 1	Dry matter %	Hybrid 1	Hybrid 2	Average 2
3.9.	55,57	41,01	41,43	41,22	51,38	56,94	63,16	60,05
9.9.	62,75	42,00	42,85	42,43	53,16	60,47	63,25	61,86
16.9.	63,81	41,49	43,38	42,44	56,88	61,37	62,50	61,94
23.9.	68,02	43,00	49,04	46,02	58,31	62,44	63,01	62,73
30.9.	67,22	45,60	50,78	48,19	64,90	62,00	64,13	63,07
7.10.	69,54	50,25	50,78	50,52	65,95	63,78	67,25	65,52
14.10.	72,03	59,23	50,98	55,11	65,94	72,82	68,19	70,51
Average	65,56	46,08	47,03	47,03	47,03	62,83	64,50	64,50

Table 2 Effect of the harvest time and time of incubation on the degradability of the grain starch on 5 mm sieve

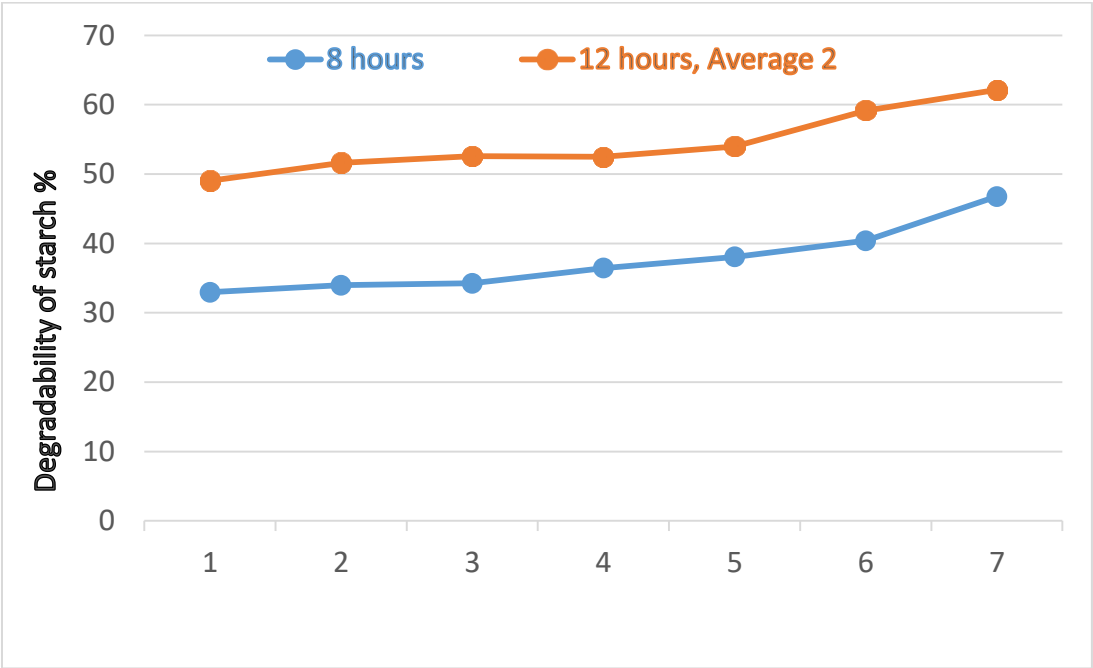
Date	5 mm				5 mm			
		8 hours	8 hours	8 hours		12 hours	12 hours	12 hours
	Dry matter %	Hybrid 1	Hybrid2	Average 1	Dry matter %	Hybrid 1	Hybrid 2	Average 2
3.9.	55,57	32,09	33,85	32,97	51,38	49,61	48,47	49,04
9.9.	62,75	33,29	34,68	33,98	53,16	51,84	51,44	51,64
16.9.	63,81	32,82	35,68	34,25	56,88	51,74	53,46	52,60
23.9.	68,02	33,51	39,37	36,44	58,31	51,98	52,99	52,49
30.9.	67,22	34,40	41,72	38,06	64,90	53,74	54,21	53,98
7.10.	69,54	38,27	42,52	40,40	65,95	58,06	60,25	59,16
14.10.	72,03	42,53	50,98	46,76	65,94	62,55	61,71	62,13
Average	65,56	35,27	39,83	37,55	37,55	54,22	54,65	54,43

In **Graph 1** can see changes of the degradability on the 1 mm sieve and incubation after 8 and 12 hours. The 8 hours incubation time has significantly lower values than the incubation time of 12 hours. It can be said that shortening of the fermentation in the rumen reduces the degradability of the starch and an increases the volume of the starch that passes via the rumen as undegraded, right into intestine. The graph presents the longer the time of harvest gradually increased the degradability, mainly for the incubation of 8 hours, but for 12 hours incubation is the degradability higher in the beginning. If happen increasing of the size of the individual particles to 5 mm (**Graph 2**), it will become slowing the degradability. Average values are determined in dependence on the incubation time and the particle size (1 mm / 5 mm) are stated in **Graph 3**.

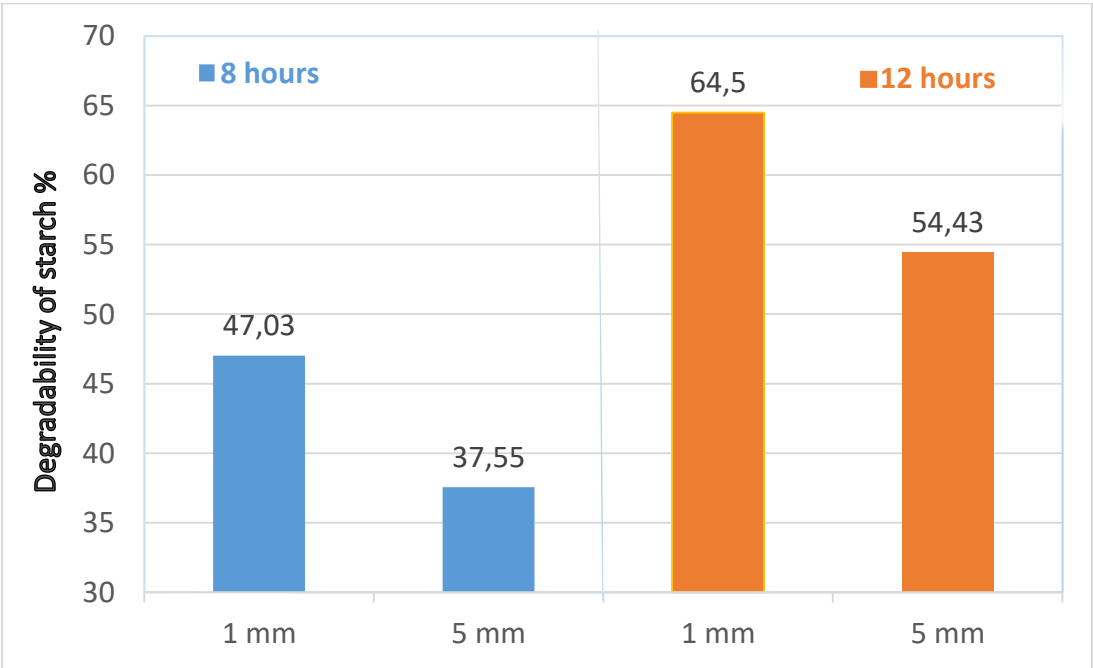
Graph 1 Effect of the harvest time and time of incubation on the degradability of the grain starch on 1 mm sieve



Graph 2 Effect of the harvest time and time of incubation on the degradability of the grain starch on 5 mm sieve



Graph 3 The average values of starch degradability according to the time of incubation of samples of grain in the rumen



Degradability of starch of maize grain affected decreasing of particle size from 47,03 % to 37,55 % at 8 hours incubation, and from 64,5 % to 54,43 % at 12 hours incubation. Due to enlargement of grain particles, is the degradability of the starch reduced by ca. 10 %.

the time of the incubation, the degradability is extended from 47,03 % to 64,5 % at 12 hours incubation for 1 mm particles mm and from 37,55 % to 54,43 % at 12 hours incubation, at particle size 5 mm.

In conclusion, the effect of grain disruption and incubation time on degradability of maize starch is a great on the degree of the degradability. Additionally, was also found the effect of harvest time on the degree of the degradability, which is dependent on the type of grain besides. The future is the subject of our interest. We would like to pay attention at different types of the grain when breeding, then on quality of maize hybrids for silage respectively for NDF digestibility, but also on the quality of the starch, its content in TMR and physical form. To be capable of capturing the individual conditions of the breeding, we recommend monitoring the volume and the content of the starch in silage as well as its mechanical disruption at separating of silage in a water bath, but also the content of the starch in the feces as a measure of the ability to use the volume of the starch in the TMR of dairy cows. This will result in improved health of the cows (lower occurrence of acidosis), increased efficiency, even more increased economics of farming in the form of saved volume of the starch which do not pass the intestinal tract of the cows, as unused.