

EXAMINATION OF SILAGE YIELDS AND CONTENT VALUES DIFFERENT TRITICALE VARIETIES

L. SAS, Z. FUTÓ

Szent István University, *Faculty Agriculture and Economics*
Hungary, 5540 Szarvas, Szabadság u. 1-3.
saslaci567@gmail.com, futo.zoltan@gk.szie.hu

Abstract: *As an impact of climate change the yield of non-irrigated silage maize harvested in the summer is increasingly threatened. Annual precipitation amount shows a declining tendency and its distribution also becomes uneven and hectic. Therefore, we shall base our coarse fodder production on plant species with higher yield security. Winter cereals, especially triticale may excellently fulfil all requirements. The growing season of this species starts in September and ends in the beginning of May. During this period sufficient amount of water is available for the plants. By applying adequate agro-technical solutions and selecting the best varieties triticale can provide high yields together with outstanding quality. All examined triticale varieties provided high yields in 2017 accompanied by good content values. Examinations conducted on the quality of yields showed that the Dimenzio variety contained remarkably high crude protein content that significantly exceeded that of all the other triticale varieties. Taking into account the easily digestible fibre content NDFd48 Dimenzio and GK Maros performed extremely well with proportions above 77 percent. 2018 proved to be an arid year with low amount of precipitation. Average per hectare yields were ten tons less than in 2017. However, content values of the samples were still very good. 2019 has started with an arid autumn that had some negative effect. However, the largest yields were measured in this year reaching 42.14 t/ha for the Hungaro variety in the fourth mowing. Proportion of easily digestible fibre content proved to be considerably high in all three years of the examination. At the time of first mowing the value of dNDF48h was always above 70%. This can be interpreted as very good, since this value is measured only around 50 to 55 percent in case of silage maize. It is important to choose the appropriate variety. Based on our experiment results GK Maros, Hungaro and Dimenzio are suitable for coarse fodder production as well.*

Keywords: *climate change, silage yield, biomass, triticale, fibre content*

INTRODUCTION

Due to climate change non-irrigated plant production has become increasingly threatened, since at least 3 out of the past 5 years were burdened by droughts or severe heat stress. Therefore, we shall base our fodder crop production on species with larger yield security. Silage produced by using winter cereal plants could be an excellent solution. This product can be utilised in feeding cattle. High quality coarse fodders are the key for economic and cost-effective dairy production as well as for providing the cows with long useful economic life. Winter fodder mixes can easily be inserted into the crop structure, because they are harvested early spring. Following their harvest other fodder plants such as silage maize or silage sorghum can be produced in the field. The use of rye and triticale as coarse fodder and forage will be of high importance in Hungary in the following decades. The use of these two cereals as coarse fodders has been increased dynamically in the past years and their significance has become indisputable. Triticale is the first man-made plant genus that has been involved in cultivation. The production area of this plant grows constantly. It can be considered as widespread in Hungary, too. "Originally triticale was recommended for areas with unfavourable conditions – mainly as a substitute for rye. By now it has been revealed that, by applying appropriate production technology, current up-to-date varieties can be produced everywhere and their yield can be utilised in animal husbandry. However, there are some

varieties the flour milling and bakery characteristics of which reach or even exceed that of autumn wheat.”. (RADICS AND PUSZTAI, 2011). Triticale and rye area bale to produce high yield even in early spring, around the second 10-day period of April. Moreover, autumn and winter precipitation generally covers the water demand of these plants. Based on these facts the production area of winter fodder mixes shows a steady increase in Hungary. (KRUPPA ET AL. 2018B)

Feeding animals with green cereals is ideal when the yield (t/ha) is the highest possible, but the spike is not yet visible. This stage can be reached in different time regarding the various plant species. (Kruppa et al. 2018b). Our first important cereal used for animal feeding purposes is the rye. According to the data of the Central Statistical Office (CSO) the production area of rye forage has been showing a decline in the past 20 years in Hungary. Currently it stagnates at around 30,000 hectares. I could not find any data about the production area of rye used as coarse fodder, however KRUPPA ET AL. (2018a) established that it could be approximately 20 to 25 thousand hectares.

In his article written about rye production KRUPPA (1995) emphasises the excellent adaptation abilities of medium-high and high Hungarian rye varieties. The productivity of these plants surpassed that of other (Polish and German) varieties during experiments conducted on sandy soil with poor fertility. The increased production and use of rye and triticale as green fodder (haylage) can be expected, since dairy farms can produce coarse fodder containing fibres and organic matter with high protein content (18 to 21%) and good digestibility (75 to 80%). (KRUPPA 2015). The importance of triticale – similar to rye – grows steadily. This trend is supported by the increase of arid years and the uneven distribution of precipitation. Szabó (2018) established that, beside rye, winter triticale has suffered the greatest blow out of all cereals due to the country’s accession to the EU. The seed crop area has been enlarged in the past 5 years as a result of increased demand. Out of the 19 varieties included in the National Catalogue of Varieties 13 varieties and a further 16 varieties from the Common Catalogue of Varieties were involved in seed production in 2017 altogether covering 2590.98 hectares.

Similar to rye, triticale is the cereal of poor fertility soils in Hungary and it is primarily used as animal fodder. In the past, triticale was considered as a fodder plant, but as it has been examined and used more frequently, it has become a cereal taken into account as of bread-making quality. A big advantage of using triticale – instead of rye – as green fodder is that the period for optimal quality harvest is longer. Under ideal circumstances it can be 12 to 14 days long. As for cereal silages it can be said that they are utilised as coarse fodder in feeding animals. In particular, ruminants are fed by these kinds of fodder. Generally it can be said that their energy and protein content is less concentrated than in case of forage plants. Due to their considerable filling effect the sense of satiety can be easily reached by using these plants. (KAKUK AND SCHMIDT, 1996; BOKORI ET AL., 2003). Fibre content of green cereal fodders increases before grain maturation while the digestibility of nutrients and fibres decreases. Closer to the time of maturation this process turns to its reverse. Starch content of grains in the spike goes up, therefore the overall relative fibre content is being reduced. Until a certain point the digestibility of nutrients increases whereas the breakdown of fibres in the rumen decreases dramatically. (OROSZ, 2019). According to BOKORI ET AL. (2003) lignin, by being built into the cell wall, creates ligno-cellulose bonds with cellulose, thus bacteria can not or hardly decompose it. The share of lignin within the overall crude fibre content grows constantly during the lifecycle of the plants. While only 1 to 2% lignin can be found in the dry matter of young green fodders, this value can reach 14 to 15% in the stalk of a mature plant specimen resulting the remarkable deterioration of crude fibre. (BOKORI ET AL. 2003)

OROSZ ET AL. (2018) declared that triticale silage provides excellent base for coarse fodder. Its great advantage as compared to rye is the elongated harvest period. The harvest window is wider that helps producing coarse fodder of outstanding quality.

MATERIAL AND METHODS

With the cooperation of Szent István University and Mezőmag Ltd. we have set up our experiment in which we examined the yields of four triticale varieties. All four varieties – GK Szemes, GK Maros, Hungaro and Dimenzio – were bred in Hungary.

Nutrient demand of parcels involved in the experiment was delivered first as a basal dressing prior to seedbed preparation. Its dosage was 45 kg/ha N, 45 kg/ha P₂O₅ and 45 kg/ha K₂O active agent per hectare. The second instalment was applied as topdressing containing further 52 kg/ha N active substance per hectare.

Varieties involved in the experiment received the same agro-technical treatments that made the exact comparison of performance possible. Samples were taken from four designated areas of one square metre regarding each mowing. A square metre frame was used to determine the sampling areas. Harvested samples were measured on site by using mobile scales. The samples were cut afterward. All samples were sealed airtight in order to prevent evaporation loss. These sealed samples were transported to the laboratory of Animal Husbandry and Performance Testing Ltd. in Gödöllő where the examinations of content values were implemented.

On-the-spot measured weights of green yields were – based on their checked dry matter content – uniformly converted into 30% dry matter content and they were compared to each other accordingly. The three years of the experiment brought far different results due to the amount of precipitation received during the growing seasons of the plants.

RESULTS AND DISCUSSION

2017 can be considered as a success from the aspect of the experiment, since all varieties produced high yields accompanied by good content values. GK Maros proved to be of exceptionally high performance: it has delivered 26.3 t/ha for the first mowing while its competitors could present only 22.43 t/ha of yield.

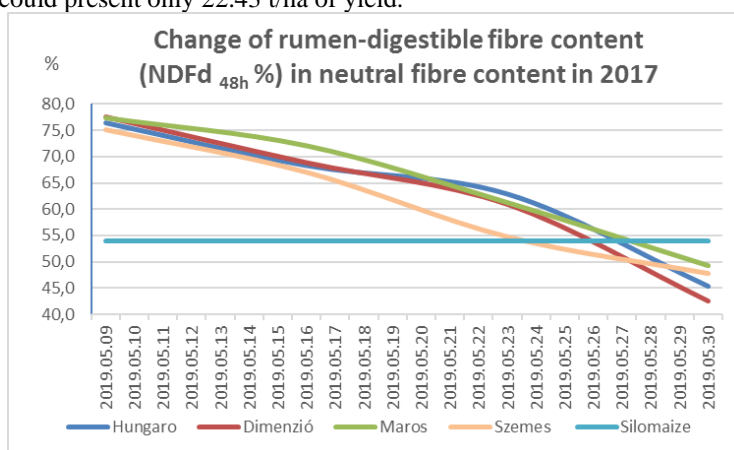


Fig. 1. Change of rumen-digestible fibre content (NDFd 48h) regarding triticale varieties 2017.

Examination of green fodder qualities showed that the Dimenzio variety possessed outstanding crude protein content significantly exceeding that of all other involved varieties.

From the aspect of easily digestible fibre content NDFd 48h Dimenzio and GK Maros varieties provided notable results with a value over 77%.

The 2018 growing season was characterised by low rainfall: precipitation was over 80 mm less compared to 2017. Yields fell behind the results of 2017 by an average of ten tons per hectare.

Table 1.

Silage yields of different triticale varieties in 2018

| Date | GK Szemes | GK Maros | Hungaro | Dimenzio | Average |
|-----------------|-----------|----------|---------|----------|---------|
| 2018.05.02. | 14.78 | 16.65 | 14.45 | 15.62 | 15.37 |
| 2018.05.09. | 22.67 | 23.95 | 22.31 | 22.57 | 22.88 |
| 2018.05.17. | 23.74 | 24.84 | 24.47 | 24.86 | 24.48 |
| 2018.05.23. | 26.45 | 25.92 | 24.47 | 24.06 | 25.23 |
| Variety average | 21.91 | 22.84 | 21.43 | 21.78 | |

In spite of this the content values of samples were extremely good. Both for the first and second mowing of 2018 GK Maros provided the highest yields with 15.65 t/ha and 23.95 t/ha. Yields of other varieties could also be considered good in case of the second mowing: they fell between 22.31 and 22.67 t/ha.

At the time of the first mowing protein content of the Hungaro variety produced 209 g/kg dry matter content that was significantly higher than the other varieties' values.

Table 2.

Crude protein content of samples in 2018.

| | | GK Szemes | GK Maros | Hungaro | Dimenzio | Average |
|---------------|-------------|-----------|----------|---------|----------|---------|
| Crude protein | 2018.05.02. | 124.00 | 176.00 | 209.00 | 177.00 | 171.50 |
| | 2018.05.09. | 128.00 | 139.00 | 144.00 | 145.00 | 139.00 |
| | 2018.05.17. | 101.00 | 125.00 | 130.00 | 120.00 | 119.00 |
| | 2018.05.23. | 108.00 | 108.00 | 116.00 | 110.00 | 110.50 |

GK Maros and Hungaro showed outstanding performance as regards of easily digestible fibre content that year with 76.6% and 74.9%, respectively.

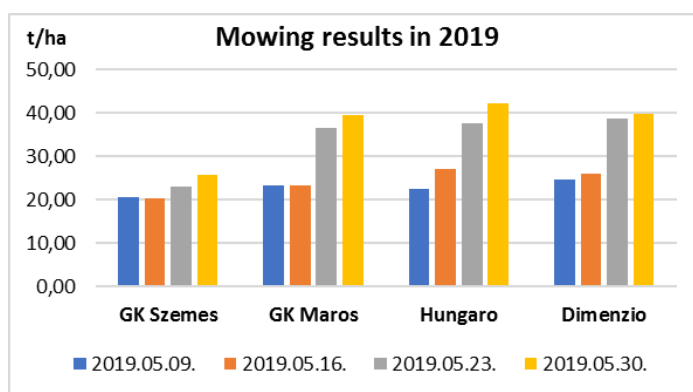


Fig.2. Silage yield of triticale varieties in 2019.

2019 has started with an arid autumn that had some negative effect. Emergence of the plants were uneven and slow. However, 2019 has become the year of records. The largest yields were measured reaching 42.14 t/ha for the Hungaro variety in the fourth mowing. Yields

of the first mowing representing the highest quality were also high. Dimenzio was in the first place with 24.51 t/ha, but the other triticale varieties also performed well with their yields between 20.50 and 23.21 t/ha.

From the aspect of content Dimenzio showed the highest protein in 2019 with 179 g/kg dry matter content. ADL value of GK Maros was 17 g/kg dry matter that is the lowest in the three examined years. GK Maros (73.3%) and Hungaro (71.4%) again provided outstanding values of easily digestible fibre content NDF_{d48h} in 2019. This result proves that these two varieties provide excellent fibre digestibility when harvested early.

Great differences were observed in the amount of precipitation during the three years, but the percentage of digestible fibre content was almost the same in case of first mowings nevertheless. Therefore, I concluded that there was no connection between water supply and easily digestible fibre content.

Change of fibre content showed increasing tendencies regarding the development of plants in each of the involved years, but its dynamics proved to be remarkably different.

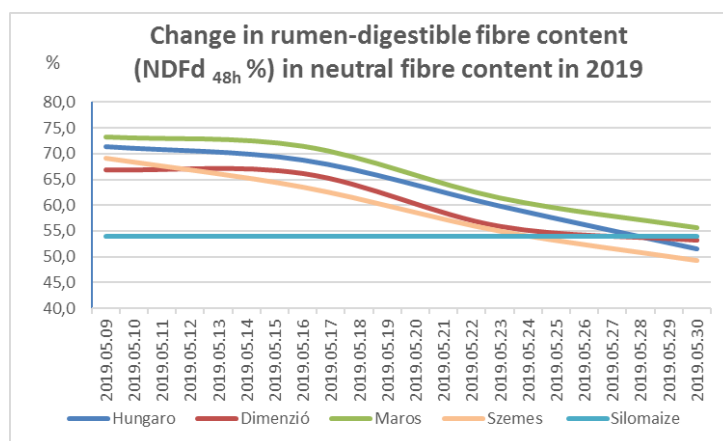


Fig. 3. Change of NDFd 48h in case of the triticale varieties

Proportion of easily digestible fibre content proved to be considerably high in all three years of the examination. At the time of first mowing the value of dNDF48h was always above 70%. This can be interpreted as very good, since this value is measured only around 50 to 55 percent in case of silage maize.

CONCLUSIONS

We have experienced in our experiment that in case of the first mowing when the spike was around 6 to 8 cm long and has not yet emerged it could provide acceptable yield accompanied by excellent feeding value. Coarse fodders produced in this mowing period can serve as an extra food for high-yield dairy cows involved in intensive animal farming.

During the experiment it was justified that triticale silage had future in Hungarian animal feeding practice. Results of the experiment showed that Hungarian triticale varieties selected for green consumption performed well.

It is important to choose the suitable variety. In our experiment GK Maros, Hungaro and Dimenzio produced competitive yields. Although the starch content of triticale silage falls behind that of maize silage, but its protein content is twice as high, while its rumen-digestible fibre content is 1.5 times higher compared to maize silage.

Triticale can be successfully produced in crop rotation with silage maize. Thus, the annual amount of coarse fodder harvested from an area unit can be increased. It is an aspect to be considered for economic reasons, too. Due to early harvest silage maize or other, short vegetation period plants can be grown afterward in the same area, because their rotation is clearly compatible.

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