SUGAR BEET YIELD PRODUCTION, DIGESTION AND POLARIZED SUGAR YIELD IN RELATION TO THE VARIETY AND LEAF BIOPREPARATIONS

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ABSTRACT

Field polyfactorial experiment was established at the experimental locality in Dolná Malanta. It was conducted in the years 2011 – 2012. The purpose of this experiments was to investigate the effect of foliar preparations containg bioactive substances (Biafit Gold and Ligno Super NPK) on the sugar beet yield, digestion and polarized sugar yield. In the field experiment was monitored two single germ sugar beet varieties: Antek and Fred. Experiment was established in three repetition by method of Split Plots. Sugar beet was treated with foliar preparations manually two times per year (sprayed on leaf). Foliar preparations Biafit Gold and Ligno Super NPK (in average of years 2011 – 2012) increased quantitative and qualitative parameters observed in the experiment comparing to control variant, but only polarized sugar yield was statistically significantly influenced by leaf preparations. There were found the highest values of root yield after treatment of Biaft Gold and Fred variety and the best value was found in Biafit Gold – Fred interaction. The variety statistically high significantly increased digestion and polarized sugar yield. Interaction Fred – Biafit Gold was the best on both of them. The highest values of digestion we obtained in variety Fred with Biafit Gold. The year 2011 and 2012 statistically high significantly influenced quantity and quality parameters. It was shown to be the strongest factor of root yield production and quality.

Key words: sugar beet, sugar beet yield, digestion, polarized sugar yield, leaf biopreparations

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INTRODUCTION

Climatic conditions during the vegetation period was significantly involved on the quantity and quality shaping of sugar beet, therefore it is necessary to pay attention to biology on crop production and agrotechnical or genetic characteristics of the variety. In Western and Central Europe, simulated average drought losses rise from 7 % (1961-1990) to 18 % (2021-2050).The annual variability of yield (measured by the coefficient of variation) will increase by half, from 10 % to 15 % compared to 1961-1990, again with potentially serious consequences for the European sugar industry. An important adaptation to climate change is through crop breeding for improved response to the altered climate and increasing extremes that are predicted. In particular breeding for drought tolerance should enable growers to continue to produce crops in areas that are already at risk of drought stress such (Jones, P.D. *et al*. 2003). With regard to climate change is beet sugar very adaptable plant that can tolerate drought, salty soil and heat. The highest impact on climate change is genetic variability between habitats beet (Ritz, C. *et al*. 2008). EU beet growers regularly adapt their management decisions and operations to changing local climate conditions. A key element of this adaptation process is the continuous research on new varieties and cultivation strategies, which is carried out by the EU beet and sugar sector with the intention of minimising the adverse effects of climate change and also maximising the opportunities given by the changing environment. EU beet growers are already adapting to climate change through: 1. To combat spreading diseases such as Rhizomania, Nematodes, Rhizoctonia and Cercospora, EU beet growers turn to varieties which are either tolerant or resistant to one or more of these diseases and which have a higher sugar content. 2. EU beet growers optimize their cropping management to produce more on less land to benefit from higher temperatures. As a result, in the last 10 years, the EU sugar yield has risen by over 40 %, while the sugar beet area has practically halved (FARMERS' SOLUTIONS). In the last 100 years in the development of climate trend growth was recorded average annual temperature of 1,1°C and a decrease in annual precipitation totals about 5,6 %. Particular southern Slovakia area, where is sugar beet grown, are gradually drying up, which is a result of the growth potential evapotranspiration and soil moisture decrease (Holúbek, I. 2011). To mitigate the negative impact of these adverse climate for the sugar beet production is necessary to use substances such as biostimulators supporting growth or fluid fertilizers containing micro-nutrients with antitranspiration effect to help quickly overcome stress (Bajči, V. *et al.* 1997).

MATERIAL AND METHODS

Field polyfactorial experiment was established in years 2011 and 2012 at experimental base of Slovak University of Agriculure in Nitra – Dolná Malanta. Locality belongs to corn production area with medium heavy luvisoil and warm and slightly dry climatic region with a continental type of weather. Experiment was established in three repetitions by method of split plots. The forecrop was winter wheat. Preparing and the plan fo experiment was in accordance with the principles of sugar beet growing with the final distance sowing.

Sugar beet was treated with foliar preparations manually (sprayed on leaf) twice during vegetation period with Biafit Gold (10 $l.ha^{-1}$) and Ligno Super NPK (5 $l.ha^{-1}$). In the experiment were observed effect of the preparations on sugar beet yield, digestion and polarized sugar yield on two single germ sugar beet varieties: Antek and Fred (STRUBE company). Monitored varieties Antek and Fred were N/C types varieties characterized two-tolernace against cercospora and rhizomania, good health and high sugar content.

RESULT AND DISCUSSION

We found a highly significant effect of year on all observed parameters. Influence of biological preparates was statistically significant only in polarized sugar yield. Variety statistically significantly influenced digestion and polarized sugar yield. Evaluating of the interaction year x variety we found a statistically significant effect on root yield and interaction year x biopreparation statistically significantly affect digestion (Table 1).

Tab. 1 The Analysis of Variation (ANOVA) with significance level α=0,05 – sugar beet yield, digestion and polarised sugar yield in years 2011 and 2012

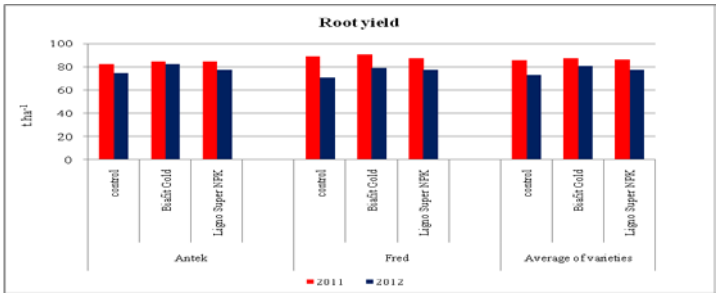
Source of variability	Observed parameter			Source of variability (interaction)	Observed parameter		
	Yield	Dg	PSY		Yield	DG	PSY
Year	**0,000****	**0,000****	**0,00****	Year x Variety	**0,069***	0,376	0,140
Variety	0,541	**0,000****	**0,028***	Year x Biopreparat	0,521	**0,034***	0,779
Biopreparat	0,193	0,110	**0,073***	Variety x biopreparat	0,996	0,877	0,627

*- statistically significant effect, ** - high statistically significant effect

In applications of Biafit Gold we achieved the highest average of root yield (84.28 t ha^{-1}), representing an increase of 4.99 t ha^{-1} compared to control, but without statistical support. Černý[1] reported that foliar fertilizers can increase the usability intake of essential nutrients by plant, which will be reflected during vegetation period by rapid regeneration of plants and in overall increase in yield and quality of crops (Černý, I.[1] *et al*. 2009). From evaluating varieties, better was Fred variety with an average root yield 82.47 t.ha^{-1}. It was about 1.31 t.ha^{-1} more than the variety Antek reached (81.16 t.ha^{-1}) . The highest root yield was found in the interaction Fred - Biaft Gold (84.97 t.ha^{-1}). Conversely, the lowest root yield was recorded in variety Antek in control treatment (78.74 t.ha^{-1}). When evaluating the year, we found it highly significant effect on root yield, which was higher in 2011 than in 2012 (Figure 1). Significant was the interaction year x variety on root yield.

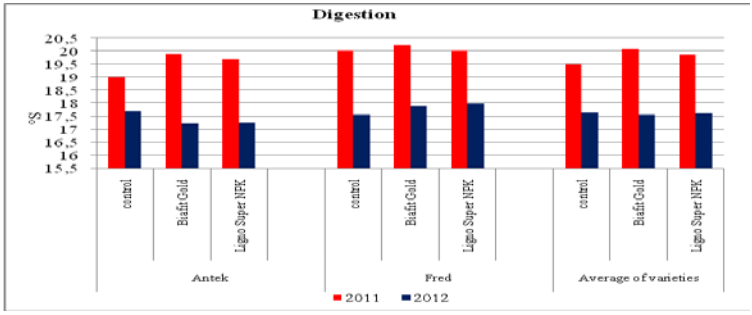
As reported Kovacova climatic conditions was significantly involved on shaping of sugar beet quantity and quality during vegetation period a much greater extent than agro-technical or genetic characteristics of the variety (Kovacova, M. 1999). These results is confirmed by the Pačuta, which in terms of the impact of growing years on sugar beet yield discovered a statistically significant impact of year on this quantitative parameter (Pačuta, V. *et al*. 2000).

Figure 1 Root yield (t.ha^{-1}) according to variety, years and biopreparations



Evaluating of the digestion, we found the highest average value with Biafit Gold using (18.81°S), it was statistically increased compared to the control (18.57°S). When evaluating varieties, we found a statistically significant influence on this quality parameter. Variety Fred reached a higher values of digestion (18.96°S) than variety Antek (18.45°S). The best interaction was showed Fred - Biaft Gold (19.08°S). Oršulová states that the sugar content is the most important indicator of technological quality of sugar beet and on formation of beet root quality are involved except genetically determined factors many also different influences with agro-technical nature (Oršulová, J. *et al*. 2003). Growing year was the strongest factor in our evaluating. We noticed a high statistically significant differences between 2011 and 2012, which resulted in a significant decrease digestion in 2012. Our results is confirmed by the Kráľovič, which states that except the terms of root yield crop, was growing year statistically highly significantly involved on the final digestion of sugar beet (Kráľovič, J. 1997). Discrepancy between the physiological requirements of sugar beet on temperature and moisture ensuring with their real state (especially at the end of vegetation period), leading to changes in metabolism of maturing sugar beet, which is then reflected on the depression of total sugar and reducing his amount at the sugar beet root (Černý, I.[2] *et al*. 2009). In the 2012, we recorded an uneven distribution of rainfall, leading to retro-vegetation of sugar beet. According to Záhradníček, for sugar beet, which starts again to vegetate (renew her rosettes), there is a sharp decline in the sugar content at the sugar beet root (Záhradníček, J. *et al*. 2007). (Figure 2).

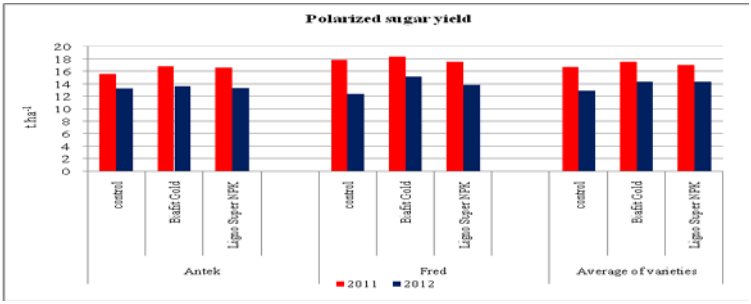
Figure 2 Digestion (°S) according to variety, years and biopreparations



Both of leaf biopreparation had a statistically significant effect on the polarized sugar yield, preparation Biaft Gold is showed as better (16.02 t ha^{-1}), it representing an increase about 1.22 t ha^{-1} compared to the control variant. Variety also had a statistical impact on crop yields, as reflectedby the variety Fred, which reached about 0.97 t ha^{-1} more than variety Antek (14.92 t ha^{-1}). Height of polarized sugar yield depends on root yield and digestion. The highest yields we achieved in 2011

and it was 18.41 t ha^{-1} (in Fred - Biaft Gold interaction), it was about 6.4 t ha^{-1} more than the weakest interaction Fred - control (Figure 3). Obtaining results confirmed Nádaský, who found increased of polarized sugar yield after application of Biafit Gold (Nádaský, R. 2013)

Figure 3 Polarized sugar yield (t.ha^{-1}) according to variety, years and biopreparations



CONCLUSIONS

- The weather condition influenced all monitored parameters statistically highly significant. Variety influenced only Dg and PSY and did not influence root yield. Biopreparations influenced only PSY.

- The highest average of sugar beet yield was found with applications of Biafit Gold and Fred variety.

- The highest values of digestion and PSY were achieved in interaction Fred - Biaft Gold and this interaction proved to be most optimal.

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